ICONARCH II

INTERNATIONAL CONGRESS OF ARCHITECTURE
INNOVATIVE APPROACHES IN ARCHITECTURE AND PLANNING

INTERNATIONAL CONGRESS

PROCEEDINGS E-BOOK

20-22 November 2014

Selcuk University Süleyman Demirel Cultural Center, Konya

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Selcuk University Faculty of Architecture

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ICONARCH II INTERNATIONAL CONGRESS OF ARCHITECTURE INNOVATIVE APPROACHES IN ARCHITECTURE AND PLANNING

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FOREWORD

Dear Colleagues,

We are pleased to invite you to participate in ICONARCH II - International Congress of Architecture II, about "INNOVATIVE APPROACHES in ARCHITECTURE and PLANNING", which will be held in Konya, TURKEY, 20-22 November, 2014.

I am very honored and pleased to emphasize that we became Faculty of Architecture. The ICONARCH I, which was organized by Faculty of Engineering-Architecture, was about "Architecture and Technology". A total of 27 foreign scholars from the USA, Italy, Holland, Austria, England, Finland, Portugal, Germany, Poland, Lebanon, Iran and Cyprus, and 33 Turkish scholars attended the Congress. ICONARCH claims to be a brand name in Turkey and in the world as a platform where various issues in Architecture, Planning and, connected with them, various cultural, sector-related and intellectual topics are discussed. The congress event not only creates a scientific and academic surplus value but also becomes o field of synergy highlighting the historical, cultural, spatial and intellectual wealth of the city of Konya through trips organized within the scope of the congress. Details about ICONARCH I are given at (http://www.iconarch2012.org/). Our dream is to be able to organize ICONARCH III in our new campus area devoted specifically to our Faculty.

Innovation can be defined as developing new ideas in different fields and putting them into practice. New or significantly altered products, processes, methods, applications and organizations fall within the scope of innovation. According to the previously produced products and processes in Architecture and planning;

- To make better designs
- To eliminate problems observed in previous structures
- To increase functionality
- Sustainable, renewable and eco-technological approaches
- Globalization and social networks in processes and actors
- Digitalization in conservation and restoration
- To solve spatial problems through changes made in planning
- And smart systems in transportation and infrastructure are all innovation.

Researchers from all over the world are fully invited to present their papers and attend this congress to share their experiences with others about innovative approaches in Architecture and Planning. On behalf of the organizing committee, I hope you will join us for a symphony of outstanding science, and take a little extra time to discover the unique beauty of Konya. We look forward to welcoming you to Konya.

Yours Sincerely..

Prof. Dr. Ahmet ALKAN
Dean of the Faculty of Architecture

SESSION 1

20 November 2014 Thursday, 11.00-12.15

Chairperson: Prof. Godfried AUGENBROE

DETERMINATION OF COMFORTABLE OUTDOOR SPACES IN MASS-HOUSING SETTLEMENTS IN TERMS OF WIND AND NOISE CONTROL

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GÜLAY ZORER GEDİK[2]
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RAŞİDE ÇAÇAN[5]

ABSTRACT

In recent times, pre-analysis and necessary precautions and measures on wind and noises are ignored and cannot be reflected in design process of indoor and outdoor spaces. In mass housing apartments, the comfort and quality of living conditions decrease due to the wind and noise level especially in balconies, terraces, gardens and swimming pools etc. The quantitatively and empirically testing of building models according to the physical conditions in regard to the wind and noise parameters directly affect the formation of building blocks in design process. In Yıldız Technical University, a research project supported by TUBITAK has been completed in order to determine the most suitable settlement formations and to develop a methodology for a design guide to deal with the controlling of the wind and noise conditions. This paper aims to present spatial formation solutions to provide usage areas in maximum comfort level due to the conditions of different climate zones and different building orientations in terms of wind and noise in Istanbul case.

Key words : Mass-housing, noise, wind, optimum area

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1. INTRODUCTION

Wind and noise are both physical environment factors that cause serious problems in urban areas and should be considered in design and planning process. They also have many negative effects on human health and comfort. Nowadays, unhealthy structures and cities are ensued as a result of ignoring the importance of wind and noise and they directly influence the public and environmental health.
The number of mass-housing projects still increases day by day to meet the demand for housing quickly and economically that increase subject to rapid population growth and urbanisation. In recent mass-housing areas, some application samples ensue with different problems because an effective study is not realized for physical environmental factors apart from conformity of zoning laws.
As a result of not considering important sufficiently the wind characteristics of regions and interaction with noise sources results mass-housing areas are formed with uncomfortable conditions in terms of wind and noise.
Unavailable open, semi-open areas, balconies and terraces due to wind; not opened windows for natural ventilation; physical ailments and psychological disorders due to indoor and outdoor noise pollution are major problems originating from wind and noise in mass-housing areas. Depending on the placement of structures with increasing of wind speed or mass-housing areas exposed to the wind, uncomfortable wind conditions, occur in open-semi open public areas used especially in warm seasons. These areas cannot be used by reason of wrong design and applications. Allowing the wind into the structure is one of the effective and economical methods for natural ventilation. It cannot be possible to use this positive effect of the wind due to the windows and openings that cannot be opened because of the excessive speed and blowing number of wind.
One of the major sources of noise pollution is road noise. In mass-housing areas that designed without considering the position of the road according to settlement area and traffic density serious noise problems are occurred. Structures with negative influence on human health are built by reason of ignoring necessary precautions on design process of mass-housing, around roads, on layout plan works and directly in structure.
In Yıldız Technical University, a TUBITAK supported research project has been completed with the aim of developing a method that will guide the designer in determining stage of most suitable settlement formations in terms of wind and noise control (Zorer Gedik et al. 2014). Within the project, it is targeted to determine common uncomfortable open spaces that both wind and noise problems overlap and to design optimized barriers and to generate suitable settlement formations for mass-housing. Simulations are realized in five different climatic zones (cold, hot humid and hot dry, temperate humid and temperate dry). In this paper, it is aimed to determine maximum comfortable usage areas in different noise levels and settlement formations with using the wind data of Istanbul.

2. METHODOLOGY, DATA AND ACCEPTANCES

Methodology of this study consist of five stages as creating settlement scenarios for mass-housing, determining data and acceptances related with wind and noise, simulations in two different software, determining comfortable areas in terms of wind and noise and determining the common comfortable areas with overlapping for wind and noise.

2.1. Creating The Settlement Scenarios For Mass-Housing

Within this paper, the size of unit house that will be used in analyzes is taken as 150 sqm according to size of residential zone determined by TOKİ Housing Development Fund as an upper limit for credit support at housing and infrastructure (Anon 1997). Based on this, the width, length and height of house is specified as 10x15x3m, respectively.

The joining types of unit house are defined as point-type block and linear block, fig. 1. For point-type blocks, the quad-joining is selected due to being the most applied type by TOKİ mainly for economic reasons. In linear blocks, different joining types are created at least quad-joining according to specified land data. Analyzes are realized for four different number of floors (3, 5, 7 and 10) that effects the results directly.

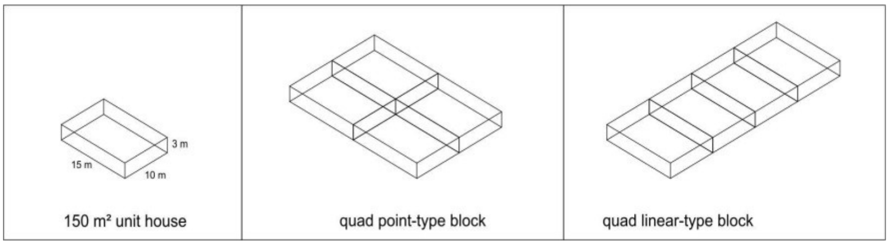

Figure 1 : The joining types of buildings

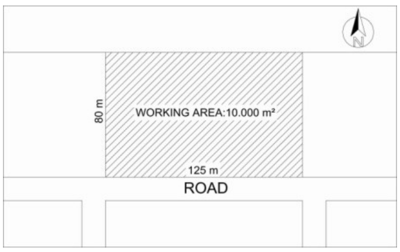

Figure 2 : The position and dimension of land

1 hectare (10.000sqm) land is assumed as working area, fig. 2. The width and length of the land is determined as 80x125m, respectively. The possible road alternatives are defined from one-way to four-way (parallel to short edge, parallel to long edge, at short and long edge). However, because it directly affects the wind and noise analysis and in order to limit the duration and number of analyzes, the road was selected on the south parallel edge of the land. “Planned Area Type Zoning Regulations” is used to determine the front, side and back yards of the houses (Anon. 1985). The 25 different mass-housing settlement scenarios are shown in fig. 3.

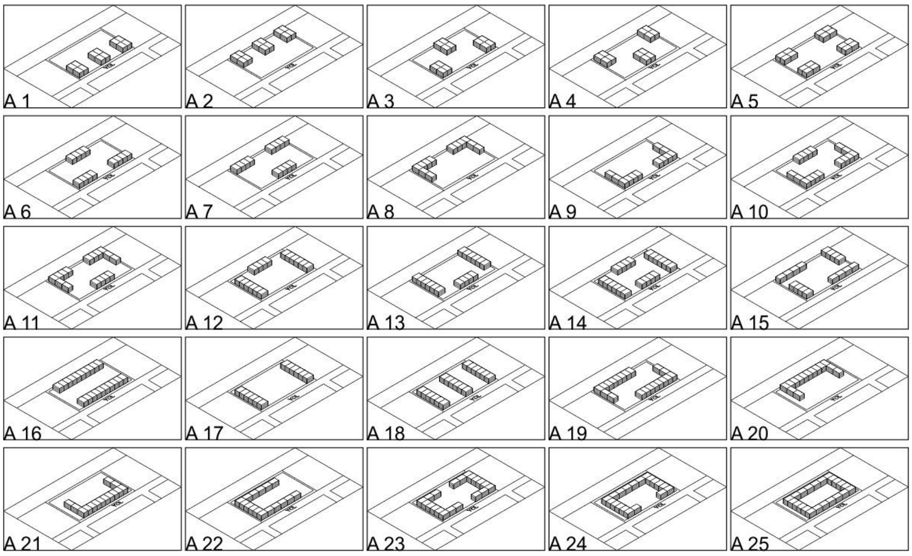

Figure 3: Mass-housing settlement scenarios (A1-A5: Point type blocks, A6-A25: Linear type blocks)

2.2. Data and acceptances related wind and noise

Within the project, used data and acceptances are explained below.

- The road noise level is taken as 55-65-75-85 dBA (1m distance), respectively.
- The road is assumed at the south side of the houses.
- Road width is 14m for 55-65 dBA sound levels and 21m for 75-85 dBA sound levels. Lane width is 3.5m, refuge and pavement widths are 2m.
- Sound absorption of ground is accepted as 0.6 (medium absorption).
- In simulations, NMPB-Routes-96 method is used for noise propagation (Braustain+Berndt GMBH. 2012).

- The wind data of İstanbul is transferred into the simulation software.
- In simulations, grid spacing is taken as 5m and the height from ground 1.5m.
- Acceptable noise level is 55 dBA for daytime (Anon. 2010, Anon. 1996).
- In this work, the wind data for Istanbul is used that obtained from daily and hourly measuring during 30 years by Turkish State Meteorological Service (Anon. 2013).
- Acceptable maximum wind speed is taken as 5m/sec for sitting and walking (Caniot et al. 2011).
- Percentage of annual hours of exceedance frequency of acceptable wind speed is accepted as $F(V>5) < \%5$ for sitting and $F(V>5) < \%10$ for walking. F states the percentage of annual hours of exceedance frequency (Caniot et al. 2011).
- Calculation height is 1.5m from ground.
- Because of the wind data used in the software ought to be in .tab file format, all data obtained from Turkish State Meteorological Service for 30 years was compiled and converted to related file format. Wind measurements are realized at 10m height in Turkey. Therefore, a reference point at 10m height was defined in software and calculations are realized according to this reference point (Urbawind 2013).

3. DETERMINATION OF COMFORTABLE OUTDOOR SPACES OF SETTLEMENT ALTERNATIVES IN REGARD TO WIND AND NOISE

3.1. Determination of comfortable spaces in terms of wind and noise

To determine the comfortable spaces in terms of wind and noise, the process steps were followed for each settlement alternatives, as shown below:

- “Urbawind” software for wind simulations and “Soundplan” software for noise simulations were used.
- Wind data for 30 years were transformed to proper format and entered to Urbawind and maps were obtained that shows comfortable areas in terms of wind.
- Noise maps were prepared based on road noise as 55-65,75-85 dBA, respectively.
- Tables were created for all results which show the percentage of comfortable areas in total open areas.
- The maps obtained for wind and noise were superposed to determine common suitable usage areas for both factors. Some examples of the comfort maps prepared for 25 settlement alternatives according to different number of floors, noise levels and activity type are shown in fig. 4.

Percentages of comfort calculated from common comfort maps in terms of wind and noise for 25 settlement type are presented in table 1. To create the table, ratio by percentage of common comfortable area to open area (calculated as difference of total land area and house area) was calculated.

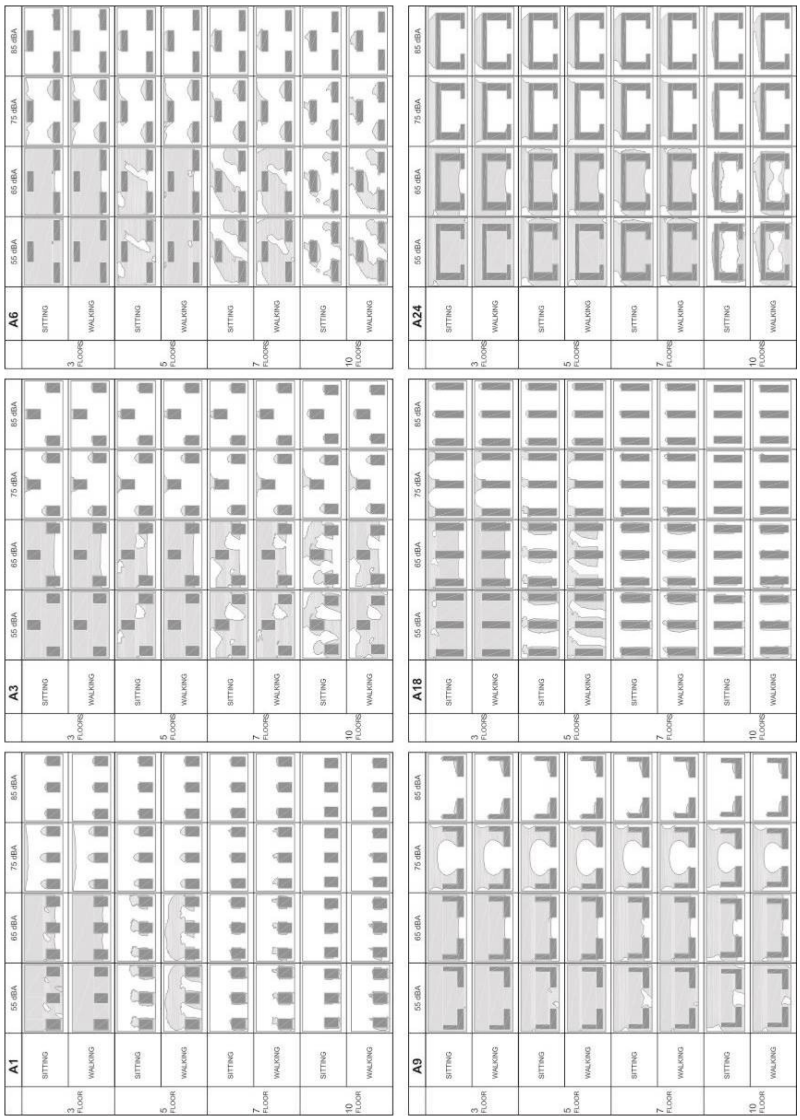

Figure 4: Common comfort maps for wind and noise

		WALKING				SITTING			
SETTLEMENT TYPE	NOISE LEVEL	3 FLOORS	5 FLOORS	7 FLOORS	10 FLOORS	3 FLOORS	5 FLOORS	7 FLOORS	10 FLOORS
A1	55 dBA	96	20	6	3	100	63	10	7
	65 dBA	81	14	2	1	83	55	6	3
	75 dBA	13	4	1	0	13	5	3	1
	85 dBA	1	1	1	0	1	1	1	0
A2	55 dBA	100	90	76	55	100	100	99	77
	65 dBA	71	62	49	33	71	71	71	49
	75 dBA	4	6	8	11	4	7	9	14
	85 dBA	3	3	2	2	3	3	2	3
A3	55 dBA	100	92	76	52	100	100	91	78
	65 dBA	79	70	57	37	79	79	72	59
	75 dBA	5	5	5	7	5	5	6	7
	85 dBA	1	2	2	1	1	2	2	1
A4	55 dBA	89	30	17	6	100	74	30	15
	65 dBA	65	25	14	4	76	53	23	11
	75 dBA	4	5	3	0	4	5	5	2
	85 dBA	2	2	1	0	2	2	2	1
A5	55 dBA	99	93	74	44	100	100	98	87
	65 dBA	81	77	59	36	82	81	80	71
	75 dBA	8	10	12	11	9	10	13	18
	85 dBA	3	4	5	4	3	4	5	5
A6	55 dBA	100	85	51	18	100	99	82	38
	65 dBA	86	73	42	12	86	85	69	29
	75 dBA	16	13	11	6	16	15	14	11
	85 dBA	2	3	3	2	2	3	4	3
A7	55 dBA	76	42	14	18	100	65	33	27
	65 dBA	64	38	11	14	79	54	29	22
	75 dBA	8	7	4	6	9	9	8	8
	85 dBA	4	5	3	4	4	6	6	5
A8	55 dBA	99	87	80	63	100	99	87	79
	65 dBA	70	58	80	41	72	70	58	52
	75 dBA	4	8	10	11	5	8	11	14
	85 dBA	4	6	7	6	4	6	7	7
A9	55 dBA	100	98	93	88	100	100	99	96
	65 dBA	86	85	84	80	86	85	85	85
	75 dBA	51	49	50	51	51	49	50	54
	85 dBA	3	2	2	2	3	2	2	2
A10	55 dBA	100	71	65	33	100	98	89	60
	65 dBA	84	58	55	26	84	83	72	50
	75 dBA	44	7	29	13	44	8	41	28
	85 dBA	3	3	5	1	3	3	6	6
A11	55 dBA	82	41	13	8	100	68	26	18
	65 dBA	62	28	9	0	77	48	27	11
	75 dBA	9	8	3	0	12	10	8	2
	85 dBA	4	5	2	0	4	6	6	1
A12	55 dBA	94	89	81	45	100	100	93	68
	65 dBA	70	64	67	29	76	75	75	45
	75 dBA	10	11	13	4	11	12	14	11
	85 dBA	3	4	5	3	3	4	5	5
A13	55 dBA	92	22	6	1	100	39	14	3
	65 dBA	64	14	3	0	79	29	8	2
	75 dBA	18	6	2	0	24	7	3	1
	85 dBA	2	2	0	0	2	2	1	0
A14	55 dBA	91	40	7	0	100	55	23	0
	65 dBA	75	34	4	0	82	47	16	0
	75 dBA	22	9	1	0	24	13	4	0
	85 dBA	4	4	0	0	4	5	3	0
A15	55 dBA	67	50	18	1	100	61	28	3
	65 dBA	58	43	13	0	84	53	21	2
	75 dBA	16	14	6	0	27	16	9	1
	85 dBA	3	5	2	0	4	6	4	0
A16	55 dBA	91	41	11	15	100	79	28	28
	65 dBA	80	34	7	9	87	69	20	21
	75 dBA	35	17	5	6	35	28	16	15
	85 dBA	6	9	5	6	6	10	11	12
A17	55 dBA	100	75	97	65	100	78	99	98
	65 dBA	78	78	74	51	78	78	77	75
	75 dBA	7	7	6	3	7	7	7	6
	85 dBA	1	1	1	1	1	1	1	1
A18	55 dBA	97	31	11	5	100	62	18	11
	65 dBA	73	24	8	2	78	48	13	7
	75 dBA	13	7	1	0	14	11	3	0
	85 dBA	2	2	0	0	2	2	1	0
A19	55 dBA	92	43	19	7	100	56	28	14
	65 dBA	75	30	12	4	100	41	19	9
	75 dBA	41	16	6	1	48	23	11	5
	85 dBA	6	8	3	0	6	8	5	2
A20	55 dBA	99	91	84	55	100	99	92	78
	65 dBA	69	63	58	36	70	69	64	53
	75 dBA	6	10	13	10	6	10	13	16
	85 dBA	6	9	12	10	6	9	12	14
A21	55 dBA	94	34	15	29	100	48	26	41
	65 dBA	84	28	12	24	89	41	21	34
	75 dBA	71	27	12	24	71	37	20	32
	85 dBA	53	26	12	24	53	34	20	32
A22	55 dBA	77	52	16	12	100	65	36	24
	65 dBA	71	45	12	8	86	59	30	19
	75 dBA	45	32	9	6	45	42	22	13
	85 dBA	14	13	6	1	14	14	11	4
A23	55 dBA	98	88	72	50	100	98	90	67
	65 dBA	84	76	63	43	85	84	76	58
	75 dBA	38	31	25	16	39	36	32	27
	85 dBA	14	15	13	3	14	15	15	11
A24	55 dBA	98	92	87	26	100	97	92	48
	65 dBA	80	74	69	13	81	78	74	32
	75 dBA	25	22	21	4	25	23	22	10
	85 dBA	19	19	17	3	19	19	19	9
A25	55 dBA	100	78	18	13	99	84	45	18
	65 dBA	84	70	13	9	87	75	38	12
	75 dBA	69	65	12	9	70	67	34	11
	85 dBA	65	63	12	9	65	65	34	11

Table 1: Percentage tables of common comfortable areas for wind and noise

3.2. Review of common comfortable outdoor spaces in terms of wind and noise
To review the results shown in table 1, for each settlement alternative, the results obtained according to number of floors were averaged for different noise levels. Results are presented as graphics and reviewed as follows.

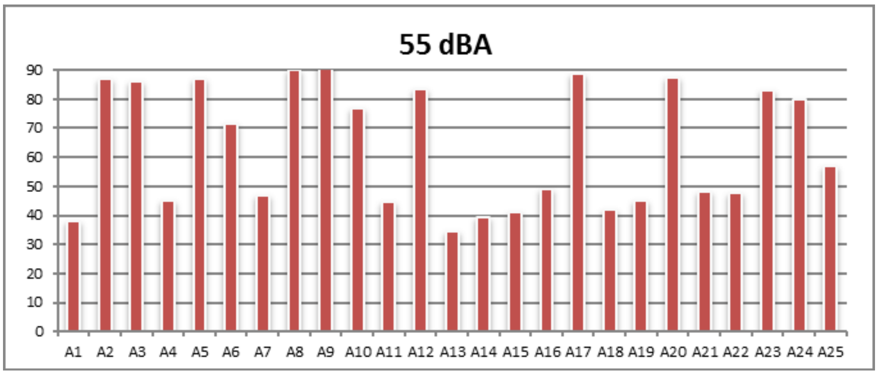

Figure 5: Average comfort percentages of wind and 55 dBA noise level results

- 55 dBA noise level is also the comfort limit value, so 100% comfortable results were obtained for all settlement alternatives. Therefore, the percentages shown in fig. 6 are values obtained depend on wind. As it can be seen from the figure, best results are provided by A9 and A8 settlements with L-shaped buildings (SW-SE and NE-NW corners of buildings are closed) and A17 settlement that the blocks vertical to road are arranged as wall along the short edge of the land (alternative which N and S directions are completely empty and not used block part that can create canal and strait effect). Additionally, alternative A20, that arranged to close N, NE and NW directions, the dominant wind directions of Istanbul, shaped like a continuous wall and S direction keeps opened, provides very high performance in terms of wind. The alternatives with lowest suitable area percentage are A13, that arranged as linear blocks vertical to road and block part at south that creates canal effect; and A1 that the point-type blocks are aligned at the south of land.

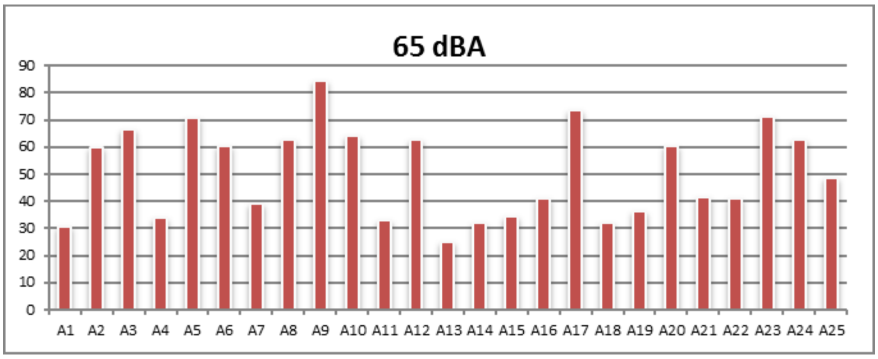

Figure 6: Average comfort percentages of wind and 65 dBA noise level results

- At 65 dBA noise level, the percentage of comfortable area changes between 70-88%. The most suitable settlement type is again A9 like 55 dBA level. A17 with blocks vertical to road provides high percentage of comfortable area. Conformably to 55 dBA level, at 65 dBA, percentage of comfortable area is mainly subjected to wind. But it can be seen that the percentages of comfort obtained from noise starts to effect the common comfortable areas percentages. For instance, while A20 type settlement with very high percentage of comfort at 55 dBA decrease to the lower level in comfort ranking, settlements shaped like linear walls and closed from the road side, like A23, come to the higher ranks. A1 and A13 types are again the settlements that have lowest suitable areas percentages.

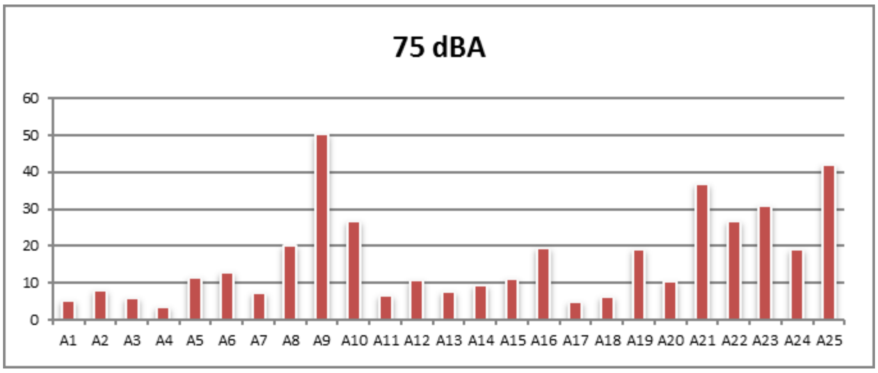

Figure 7: Average comfort percentages of wind and 75 dBA noise level results

- As can be seen from fig. 8, A9 type settlement provides again maximum comfort percentage with 50% at 75 dBA as that 55-65 dBA. A25 and A21 types with atriums are the settlements that provide higher percentages as 42% and 37% as against the other alternatives. With increasing the noise level, it can be seen that common suitable comfort percentages are considerably decrease especially in the settlements with point-type blocks. With the effect of comfort percentages obtained from noise, while the performance of the settlements that north side is closed like A20, decrease to the lower level; settlements with atriums that close the road side completely like A21 and A25 come to the higher ranks.

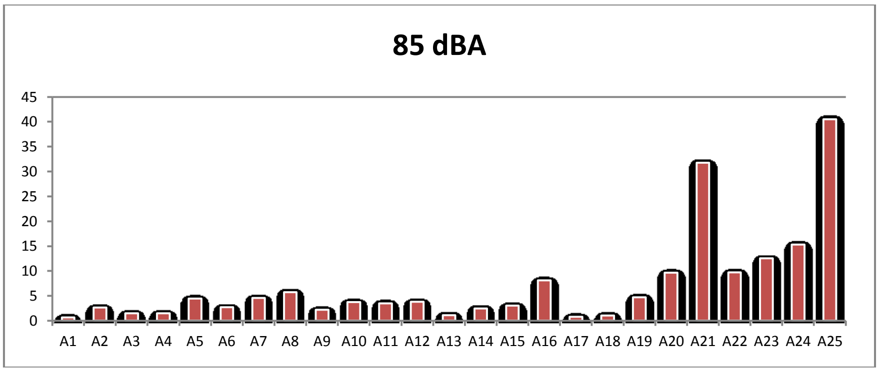

Figure 8: Average comfort percentages of wind and 85 dBA noise level results

- At 85 dBA noise level, high decrease occurs in all settlement alternatives. Comfort percentages show decrease till 1%. Except A21 and A25 types settlements with atrium that close the road side completely, comfort percentages decrease under the level of 20%. Comfort percentages obtained from noise effects the results significantly.

General review of the results is given below:

1. In the settlement options that the blocks arranged vertically to the road (north-south direction), the comfort ratio decrease. As a result of acting the blocks that are parallel to the road as noise barrier, comfortable areas increase behind the buildings. Therefore, improvements occur in comfort values for alternatives with blocks parallel to road.
2. Better comfort results appear in alternatives with L-C-U shaped buildings than point-type and linear block layouts. This situation is related with sheltered areas created by layout alternatives. For all noise levels under 85

dBA, A9 type settlement with L-shaped buildings shows the best performance in terms of wind and noise. But, at 85dBA noise level, C and U type settlements provide better results because of closed road side.

3. Increasing of number of floors causes decreasing of comfort level. The decrease on comfort level occurs as a result of reflections on building surfaces, dispersions and directions created by building forms. From the perspective of noise control, the main reasons of this situation are the distance of buildings to road, distance of one another and reflections from buildings surfaces. As for the perspective of wind, both increase of number of floors and structuring on the north or south side that creates canal or strait effect decrease the comfort level considerably.

4. CONCLUSION

Wind and noise, physical and environmental factors that directly affect user comfort. Due to both factors, outdoor and semi-outdoor spaces are not used efficiently. This situation is also valid modern-day mass-housing. Both wind and noise are important components of building physics in the field of specifying the area for structuring, orienting structures in terms of climatic factors, designing of structure shape and positioning according to other structures. In compliance with the analyze results of 25 settlement alternatives realized using climatic data of Istanbul, linear type layouts provides better results compared to point-type blocks. In block type settlements, layouts parallel to road continue along the south side have more comfortable areas than vertical settlement alternatives. Increase in the number of floors of buildings effect negatively both wind and noise comfort. Therefore, buildings with lower number of floors should be preferred. Position and configuration of buildings should be determined considering dominant wind direction and annual blowing distribution. As a result of the study, it was found that the performance of comfortable open spaces is not sufficient provided by components such as structure configuration, position and height. For this reason, additional precautions are needed to provide common comfortable areas in terms of wind and noise. Within the scope of an completed research project in Yıldız Technical University, several studies are carried out to determine optimum percentage of common area in terms of wind and noise comfort and the design of optimum wind and noise barrier that will be applied to settlement types that cannot provide requested percentage. In project, all simulations and calculations realized for different cities which have characteristic features of five climatic zones and it is only exemplified for Istanbul in this paper. By means of the data that will be presented as a result of the project, it will be possible to select suitable configuration in regard to wind and noise depends on wind data of current city, position of the design area according to road and the noise level of the road.

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THE EFFECT OF WIND VELOCITY AND NIGHT NATURAL VENTILATION ON THE INSIDE AIR TEMPERATURE IN PASSIVE COOLING IN ARID ZONES THE EFFECT OF WIND VELOCITY AND NIGHT NATURAL VENTILATION ON THE INSIDE AIR TEMPERATURE IN PASSIVE COOLING IN ARID ZONES

NHAMIDA BEN CHEIKH[1]

ABSTRACT

The effect of wind velocity and night natural ventilation in lowering the inside daytime air temperature in passive cooling in arid zones, were investigated by numerical calculations and experimental means for different values of air change flow rate due to infiltrations and natural ventilation and different wind speed. The numerical calculations based on the inside outside air temperature, wind speed, cracks and openings dimensions to determine the volume of air change per hour.
The experimental model was a test cell with door facing north and window in the opposite side facing south, the volume of the model was 9m³. The calculated and measured results show that 1.8 volume per hour of air change flow rate and 2m/s wind speed show a high concordance between calculated and measured inside air temperature, and can lower the inside air temperature by 3°c to 4°C compared to non ventilated test cell (Bencheikh & Bouchair 2004) .

Key words : Wind velocity, night natural ventilation, passive cooling, arid zones,

1. INTRODUCTION

Night natural ventilation potential for improving thermal comfort in buildings has been investigated by numerical and experimental means, (Santamouris and al. 1996 1997) introduced an interested method to calculate the energy contribution of night ventilation technique to the cooling load of a building. Many researchers investigate the improvement of space cooling by night natural ventilation such as: (Kolokotroni and al. 1998) used temperature and humidity charts to generate a pre-design tool for summer cooling evaluation of night ventilation. (Geros et al. 1999) carried out an experimental evolution of night ventilation effect on the inside air temperature for four buildings and simulations investigation to determine the effect of air change rate on night natural ventilation. (Givoni 1998) carried out experiment work to investigate the effectiveness of night ventilation in lowering the indoor day time temperature and many other researchers' worked on the same subject. This paper

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focuses on numerical calculation and experiment work to validate the theoretical results, on night natural ventilation effect in lowering the daytime inside air temperature.

2. NUMERICAL MODEL

2.1. Air flow rates calculation

Air flow into buildings is either by infiltration of outside air through cracks around exterior openings, or by natural ventilation through opened exterior openings. Any outdoor air that enters by way of infiltration or ventilation is assumed to be immediately mixed with inside air.

2 .1. 1 Infiltration

The determination of the amount of infiltration air is quite complicated and subject to significant uncertainty. The infiltration quantity is converted from a number of air change by hour (ACH) and unclouded in the inside air heat balance using the outside air current simulation time step.
There are three models for estimating the infiltration flow rate. The first is the design flow rate, the second is the effective leakages area base on (Sherman and Grimsrud 1980) , and the third is the flow coefficient model based on (Walker and Wilson 1998).

Infiltration design flow rate

The flow of air from the outside environment directly into the inside one is generally caused by cracks around exterior openings, temperature differences and wind speed. The basic equation (Coblens and Achenbach 1963) used to calculate infiltration.

$$Infiltration=(Inf_{design})(F_{schedule})(A+B)(T_{ai}-T_{ae})[CV+DV^2)] \quad (1)$$

Infiltration effective leakage area

Infiltration leakage area model is based on Sherman and Grimsrud [7]

$$Infiltration=(F_{schedule})\,\frac{A_i}{1000}\,\sqrt{C_s\Delta T+C_wV} \quad (2)$$

Where

$F_{schedule}$ is a value from the user-difined scheduls.

A_i is the effective air leakage area in cm² that corresponds to a 4Pa pressure differential.

C_s is the coefficient from stack-induced infiltration in $(\frac{L}{S})^2(\frac{1}{cm^4K})$.

ΔT is the absolute difference between inside and outside air temperature.

C_w is the coefficient for wind-induced infiltration in $(\frac{L}{S})^2(\frac{1}{cm^4K})$.

V is the local wind speed in m/s.

Infiltration by flow coefficient

The flow coefficient model is based on (Walker and Wilson 1998) equation.

$$Infiltration= F_{schedule}\sqrt{(cC_s\Delta T)^2 + [cC_w(sV)^{2n}]^2} \qquad (3)$$

c is the flow coefficient in m²/(s.Pa^n)

C_s is the coefficient from stack-induced infiltration in $(\frac{Pa}{k})^n$

n is the pressure exponent.

C_w is the coefficient for wind-induced infiltration in $(Pa.\frac{s^2}{m^2})^2$.

s is the shelter factor.

2 .1 .2 Natural ventilation

Natural ventilation is a controlled air change with the exterior environment through openings due to temperature differences, wind speed, and the opening area. The controlled natural ventilation calculation is based on three models.

Design flow rate

Design flow rate is based on the outside inside temperature difference, wind speed and openings area, the basic equation to calculate the design flow rate is;

$$Ventilation= (v_{design})(F_{schedule})(A + B)(T_{ai} - T_{ae})[CV+DV^2)] \qquad (4)$$

Ventilation by wind and stack with open area

The ventilation air flow rate is function of wind speed and thermal stack effect, along with the area of the opening, the equation used to calculate the ventilation rate is (ASHRAE 2006) .

$$Q_w = C_w A_{open} f_{schedule} V \qquad (5)$$

Where

Q_w = Volumerique air flow rate driven by wind $(\frac{\mathrm{m}^3}{\mathrm{s}})$

C_w = Opening effectiveness dimensionless

A_{open} = Opening area m²

$$C_w = 0.55 - \frac{(Effective\ angle - wind\ direction)}{180} * 0.25$$

If $(Effective\ angle - wind\ direction) > 180°$ the difference= -180°

The equation used calculates the ventilation rate due to stack effect is given by ASHRAE 2009 handbook;

$$Q_s = C_D\ A_{open} F_{schedule}\sqrt{2g\Delta H_{NPL}(|\ T_{ai} - T_{ae}|)/T_{ai}}$$

(6)

Q_s = Volumetric air flow rate due to stack effect m³/s.

C_D = discharge coefficient for opening dimensionless.

ΔH_{NPL}=Height from midpoint of lower opening to the neutral pressure level (m).

$\boldsymbol{T_{ai}}$, $\boldsymbol{T_{ae}}$ The inside and outside air temperature in degree (k).

The discharge coefficient for opening dimensionless C_D is given by (ASHRAE 2009) handbook;

$$C_D = 0.40 + 0.0045|T_{ai} - T_{ae}|$$

The total ventilation rate by wind and stack air flow;

$$Q_{vt} = \sqrt{Q_s^2 - Q_w^2}$$

3. EXPERIMENTAL WORK

The experimental set-up consisted of two identical test cells (a) and (b), a cubic room with 3m high and 3m wide as shown in figure (1). South wall is provided with a window and the North one is provided with a door, the window and door were closed during day time and opned during night to allow night natural ventilation . The experimental cell (b) was the basic reference unit. The roof was constructed of simple aluminum sheet painted white. The model situated in Laghouat Algeria (latitude +33.46°, longitude +2.56° and elevation 767 m).

Figure 1. (a) Room with cooling roof (b) Room without cooling roof.

An experimental study of the effect of night natural ventilation on day time inside air temperature was carried out for a typical summer day of June for Laghouat in Algeria. The first experimental work was done under clear sky and 0.25m/s wind speed during night time, the second day under cloudy sky and 0.81m/s wind speed, after three days of experiment the night natural ventilation had a good effect on in lowering the inside air temperature. The effect of air change flow rate and wind speed were studied and simulated for an average wind speed of 3m/s and a variable air change flow rate (1.8, 2.7,and 3.6 V/h). Figure (2) shows the variations of inside air temperature for constant wind speed 3m/s and variable air change flow rate , the inside air temperature decreases with the increase of air change flow rate. When the air change flow rate taken to its maximum for variable wind velocities, for velocity ≥3m/s the inside air temperature had the almost the same values as shown in figure (3).

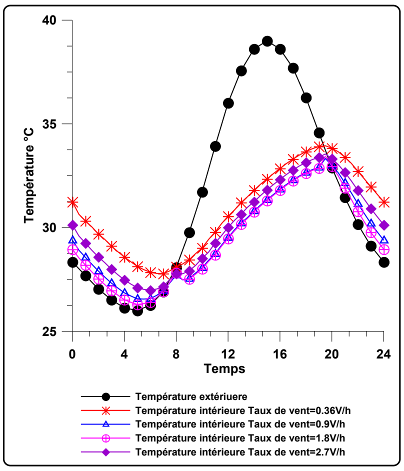

Figure 2: inside air temperature for 3m/s wind speed and variable air change flow rate

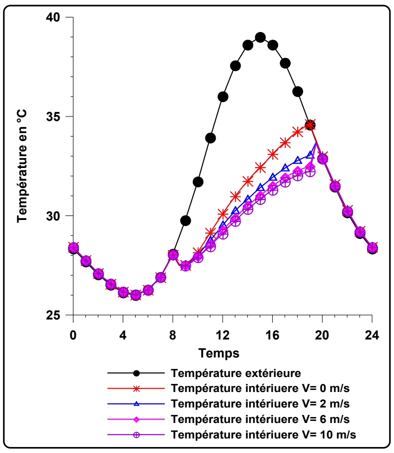

Figure 3 : inside air temperature for 7.2 V/h air change flow rate and variable wind spe

4. TEMPERATURE MEASUREMENTS

Air temperatures outside the room were measured using weather stations installed near the laboratory, far from the test cell by 150m. The temperature at different positions under the roof level has been measured by copper constant thermocouples connected to digital thermometer. Thermocouples fixed under the roof surface the end of the thermocouples were enveloped in thin aluminum paper to reflect the radiation from the surrounding interior surfaces. The readings of all thermocouples have been averaged to give the average temperature

5. RESULTS AND DISCUSSIONS

Figure (4, 5, 6 and 7) show the inside air temperatures variations for variable air change flow rate (0.9, 1.8, 3.6, and 7.2V/h) and variable wind speed (from 0 to 10m/s). After analyzing the results obtained by experimental and simulation, by comparing the results, the values of 1.8V/h of air change flow rate and 2m/s wind speed give the smaller error between measured and simulated inside air temperature as shown in figure (7).

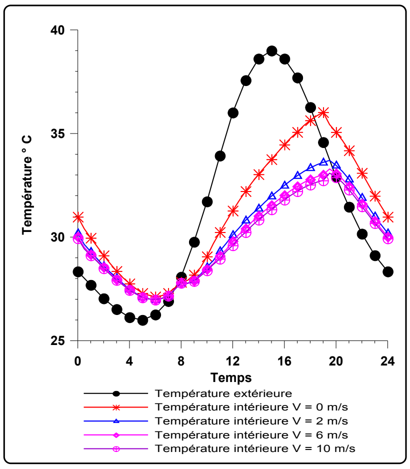

Figure 4: inside air temperature for 0.9 V/h air change flow rate and variable wind speed

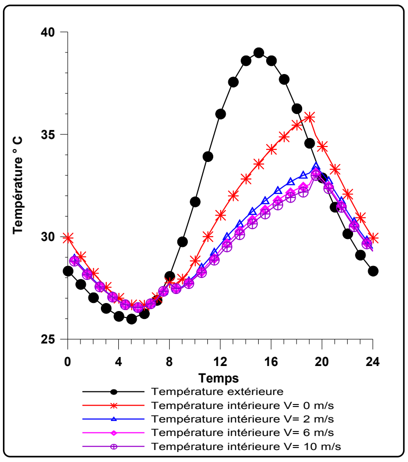

Figure 5: inside air temperature for 1.8 V/h air change flow rate and variable wind speed

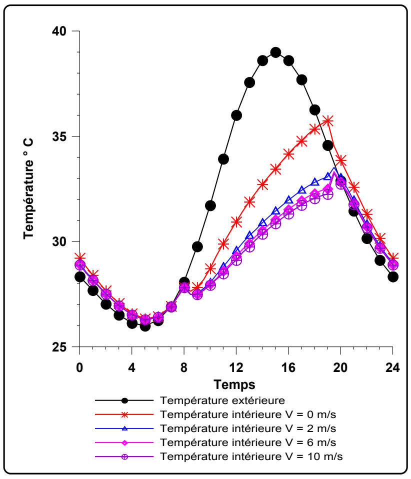

Figure 6: inside air temperature for 3.6 V/h air change flow rate and variable wind speed

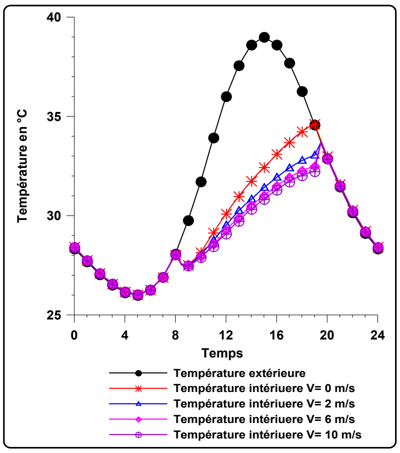

Figure 7: inside air temperature variation for 7.2 V/h air change flow rate and variable wind speed

Figure (8) presents the measured and simulated inside air temperature for non ventilated space, the two curves have almost the same values which mean the simulations are accurate. Figure (10) present the measured and simulated inside air temperature for night ventilated space for 1.8V/h air change flow rate and 2m/s wind speed, the two inside air temperature curves show a smaller error, these error were due to, wind speed was considered in simulation a constant value during simulation period, which is different to the reality, the wind speed was very variable from time to time and sometimes present a big differences which effect directly the air change flow rate which effect the inside day time air temperature. In the space without night natural ventilation and when the wind speed was assumed null for space with night ventilation the two curves of the inside air temperature measured and simulated have almost the same values as shown in figure 8. Figure 9 shows the inside air temperature for the space with and without night natural ventilation , so the night natural ventilation for space in arid zone participate in lowering the day time inside air temperature from 3to 6°C.

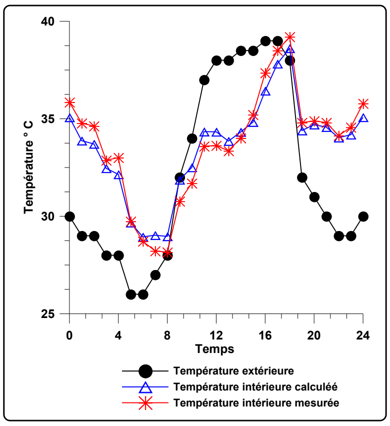

Figure8: measured and simulated inside air temperature without night natural ventilation (Bencheikh 2013).

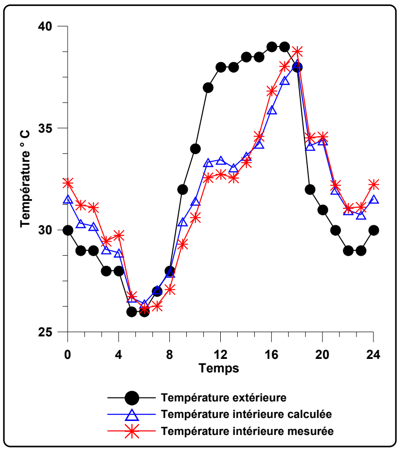

Figure 9: measured and simulated inside air temperature with night natural ventilation (Bencheikh 2013).

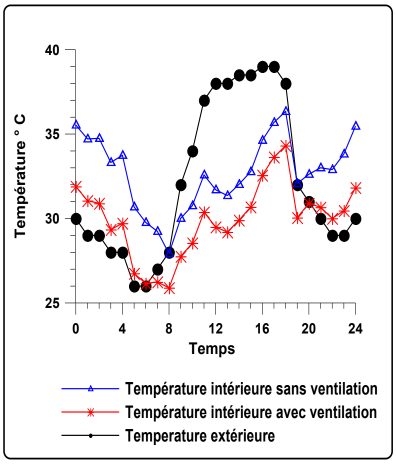

Figure 10: measured inside air temperature with and without night natural ventilation for space with cooling roof (Bencheikh 2013

6. CONCLUSION

In comparison between calculated and measured inside air temperatures in cell (b) without cooling system, without nocturnal natural ventilation, the two temperatures have almost the same values , however the calculated and measured ones in the same cell with nocturnal natural ventilation, present a small difference between calculated and measured temperatures during ventilation period as shown in figure 9, that due to wind speed variations during night time, which was in calculations usually considered constant value. Measured and calculated temperature in cell (a) with cooling system, with and without nocturnal natural ventilation, presents a small differences in two periods time, from 6.00 Am till 15.00Pm and form midnight till 4.00 Am which correspond to the evaporations and condensations periods. The differences were due to that the quantities of water vapor and condensate water were not exactly well known. Under hot arid conditions a full scale test cell for an evaporative reflective roof used to improve space cooling in buildings has been tested. The experimental results examined the effectiveness of such a roof cooling system in comparison to a bare roof. The results showed that cooling inside buildings can be improved by the application of such a cooling design. It was also seen that combining evaporative reflective roof with night ventilation increases such cooling more significantly

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AN APPROACH FOR EVALUATING EXTERNAL WALL-ROOF COUPLING DETAIL'S PERFORMANCE

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ABSTRACT

Designing a coupling detail is a complicated job since coupling details are areas where building elements and other sub-systems come together and performances of single building elements come into a complex interaction. Mistakes in the design stage can lead to building failures after construction, which on the other hand are causing unhealthy environments and high repair or retrofitting costs. The intersection areas in the external envelope, exposed to environmental conditions, are even more vulnerable to building failures. Building element systems of the external envelope do have several functions. Some of them are in common, but some functions are differing. These common and/or varying functions are coupled at the intersection area, working independently, cooperatively or opposing. This is why a complex interaction is born in a coupling detail. The coupling area of the exterior wall system with the roof system is one of those intersection areas of the external envelope. It is obvious that a way to avoid building failures is proper detailing.
In this paper, an approach to evaluate external wall-roof coupling detail's performance is presented. The evaluation approach consists of two modules. The first module is a "performance requirements checklist" separately generated for each building element, namely; the exterior wall systems and the roof systems. The second module is a step-by-step evaluation tool for coupling details. The tool and the checklists are prepared by taking into consideration of sole functional continuity at coupling details, supported by material continuity and geometric precautions. The evaluation tool can be used either in the detail design process or before the tendering process for finalized details.
The usability of the proposed approach is demonstrated through its application on a real world problem and pros and cons of the approach are discussed in conclusion.

Key words: Detail, Evaluation, Exterior Wall, Roof, Performance

1. INTRODUCTION

In some buildings failures occur a while after construction, affecting users' comfort and health and also causing high repair or retrofitting costs. The intersection areas in the external envelope, exposed to environmental conditions, are the most vulnerable

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parts of a building to failures. A remarkable reason for building failures are faulty designed details (Schild, 1984).
Intersection areas in the external envelope are coupling details where at least two building elements and/or other sub-systems such as the structural system come together (Rush, 1986). Each individual building element of the external envelope has to fulfill several functions. Some of them are in common, but some functions are differing. These common and/or varying functions are coupled at the intersection area, working independently, cooperatively or opposing (Emmitt, 2004). This is why a complex interaction is born in a coupling detail. The main goal has to be here the accurate integration of the systems and providing the continuity of performances at coupling details (Olie, 2011).Moreover, there is a great variety of building materials and a substantial amount of construction techniques, today. Due to this richness, it might be easier to prevent the building failures (Knaack, 2007). But at the same time, countless alternatives are causing a complex decision process. All those factors are leading to a complicated design process of the coupling detail which on the other hand also increases the risk of faulty design. Design errors should be detected at the design stage, to avoid carrying those mistakes to the construction stage. Although design review procedures at different scales to preclude those failures do exist, they rarely form a methodical approach for evaluating details.
In this paper, an approach to evaluate external wall-roof coupling detail's performance is presented. The evaluation tool can be used either in the detail design process or before the tendering process for finalized details. The proposed tool is to be used in the context of the building envelope, consisting of the exterior wall and roof systems.

2. METHODOLOGY

The evaluation approach consists of two modules. The first module is a "performance requirements check list" separately generated for each building element, namely; the exterior wall systems and the roof systems. The second module is a step-by-step evaluation tool for the exterior wall- roof coupling details.

2.1. Checklists for Performance Requirements for External Walls and Roofs

To propose a systematical approach in the context of building details, checklists were drawn up for building element systems as the first module of the analyzing approach. Checklists can be used as design or analysis tool in order to avoid overlooking any requirement which should be met by any product (Jones, 1992). These checklists were generated by determining all performance requirements for each building element through an extensive literature review. As the study is focusing on the intersection area of the exterior wall system and the roof system, firstly, performance requirements for exterior wall and roof systems were compiled in form of tables. Reliable resources, such as text books, guidelines and standards from years between 1970's and 2010's about building construction and details were used to identify performance requirements. Secondly, a frequency analysis was conducted to determine the most important requirements. Then, the performance requirements were transformed into checklists for the exterior wall and the roof systems. Finally, checklists were tested on a great amount of typical building element details to control their accuracy and extensity. In this regard, a large number of roof and external wall details (Lückmann, 2011), (Beinhauer, 2013) were studied by using those checklists.

2.2. An Approach for the Evaluation of External Wall-Roof Coupling Detail's Performance

The second module of the proposed approach is a step-by-step evaluation tool for coupling details (Table 1).

Table 1: Flowchart of the support tool for analyzing coupling detail's performance

Step 1	Disassemble the coupling detail into building element details.
Step 2	Identify layers, materials, material properties and layer composition in building elements 1 and 2.
Step 3	Identify generic layer composition in building elements 1 and 2 separately.
Step 4	Identify functions which are fulfilled by each layer in building elements 1 and 2 separately.
Step 5	Determine if a functional layer has multiple functions for building elements 1 and 2 separately.
Step 6	Prepare a list for required performances for the intersection area "3".
Step 7	Check the continuity of functional layers from building elements 1 and 2 at intersection area 3. They can be either continuous, or discontinuous, or interrupted
Step 8	Check the continuity of functions at intersection area 3. They can be either continuous, or discontinuous, or interrupted.
Step 9	Check the geometric solutions by using the "geometric solutions table."
Step 10	Fill the intersection area evaluation table according to obtained data and evaluate the performances of intersection area if the number of precautions is enough and if they are correctly executed. Grading as +/o/-.

The evaluation tool is roughly developed by upgrading, adapting and reversing Emmitt's architectural detailing procedure which is a morphological method to develop new joint solutions (Emmitt, 2004). The evaluation tool comprises two aspects in analyzing the performance of coupling details. The first aspect is the layer composition of both building elements intersecting at the coupling detail and their continuity or discontinuity. The second aspect is the geometric characteristics leading to the form of the coupling detail. Layers of building elements and geometric solutions, both, might be used to fulfill the required performances. In the performance analysis of coupling details, firstly, building element systems composing the coupling detail are disassembled and defined namely "1" and "2". Functional layers in the building element system sections are examined. Secondly, physical properties of building elements 1 and 2 are identified such as materials, layer composition and functional layers. Then functions for building elements 1 and 2 are defined and checked according to performance requirement tables as stated in section 2.1. The common performance requirements of the two building elements are considered to be the performance requirements of the coupling detail (Table 2). Then, physical properties of the intersection area are identified and it is controlled if the coupling detail is in continuity with building elements 1 and 2. After examining the material continuity, the continuity of functions is defined.

Table 2: An example for generating a table in terms of performance requirements related to water, water vapor and thermal performance for a coupling detail of the roof and the exterior wall

main performances	sub-performances	fulfilled performances by		
		roof	ext. wall	both roof & ext. wall
… RELATED TO WATER	impermeability to precipitation	X	X	X
	impermeability to splash water		X	
	impermeability to ground water		X	
	impermeability to domestic water (damage/ accident)		X	
	impermeability to wind-driven rain			X
	keeping water away in a controlled manner	X		
… RELATED TO WATER VAPOR	prevention of surface condensation	X	X	X
	prevention of interstitial condensation	X	X	X
	condensation control through ventilation	X		
THERMAL PERFORMANCE	low thermal conductivity	X	X	X
	heat storage	X	X	X
	durability against high temperatures	X	X	X
	durability against low temperatures	X	X	X
	avoid thermal bridges	X	X	X
	warmth to touch		X	
	prevention of heat gain	X		
	prevention of heat loss	X		

Geometric solution fulfilling performance requirements were also compiled by a literature review (Allen, 1993), (Knaack, 2007) and were expressed in form of a table. In the analysis of coupling details, geometric characteristics fulfilling performance requirements are defined and checked according to the "geometric solutions table" (Table 3). Finally, an evaluation table is generated in order to see all the design solutions that affect coupling detail's performance. Results of all steps in the evaluation module come in this table together and according to quantity and quality of solutions, the required performances are graded through a three-level ordinal scale with scores assigned as; “good”(+), “moderate”(o) and “poor”(-). In this way, it is obtained which performance requirements are fulfilled by the coupling detail and how “successful” they are.

Table 3: “Geometric solutions” table (Allen, 1993), (Knaack, 2007)

performance	geometric solutions
… related to water	wash
	overlap
	overhang and drip
	drain and weep
	capillary break
	labyrinth
	rainscreen
	upstand

performance	geometric solutions
…related towater vapour	condensate drainage

3. THE USABILITY OF THE PROPOSED APPROACH IN ANALYZING EXTERIOR WALL-ROOF COUPLING DETAILS

Two coupling details are analyzed with the evaluation tool in order to demonstrate its usability. Thermal performance, performance related to water and water vapor of the coupling details are taken into consideration.

3.1.Aflat roof-exterior wall coupling detail

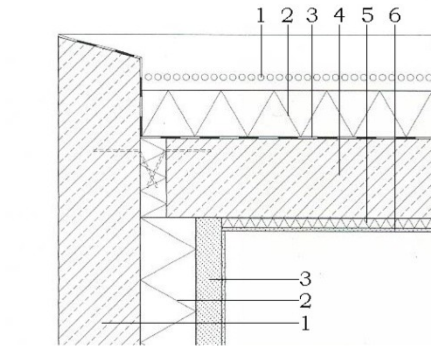


*Figure*1: Ext. wall-flat roof coupling detail, “House in Zurich, Switzerland” (Detail, 2008, 1/2, p. 35.)

Step 1: Disassemble the coupling detail into typical building element details.(Fig.1)
building element 1: roof system

building element 2: exterior wall system

Step 2& 3: Identify layers, materials, material properties and layer composition in building elements 1 and 2. (Table 4, 5)
Identify generic layer composition in building elements 1 and 2 separately.

Table 4: building element 1; roof system

no	materials	generic layer
1	gravel, 50 mm	ext. finishing layer
2	XPS, 140 mm	thermal insulation l.
3	liquid-plastic sealant	waterproofing layer
4	R.C., 240 mm	core
5	mineral based acoustic board, 30 mm	acoustic board
6	mineral based coat, 10 mm	internal finishing layer

*Table*5: building element 2; exterior wall system

no	materials	generic la.
1	concrete, 250 mm, mortar (with gravel and black pigments)	core
2	foamed glass, 160 mm	thermal insulation l.
3	plasterboard, 80 mm + plaster, 3 mm	internal finishing l.

Step 4: Identify functions which are fulfilled by each layer in building elements 1 and 2 separately. (Table 6, 7)

Table 6: building element 1; roof system, layer-function table

Generic layer	Function
ext. finishing l.	+ preventing heat gain
thermal insulation layer	low thermal conductivity
waterproofing l.	water impermeability + vapor barrier
core	
acoustic board	
int. finishing l.	

*Table*7: building element 2; exterior wall system, layer-function table

Generic layer	Function
core	+water impermeability + heat storage
ther. insulation layer	low thermal conductivity
int. finishing l.	

Step 5: Determine if a functional layer has multiple functions for building elements 1 and 2 separately.

b.e. 1: roof system
1 External finishing layer
3 Waterproofing layer

b.e. 2: exterior wall system
1 Core

Step 6: Prepare a list for required performances for the intersection area “3”.

<u>Performance related to water:</u>
Water impermeability
Impermeability to wind-driven rain

<u>Thermal performance:</u>
Low thermal conductivity
Heat storage

Avoid thermal bridges (required only from the coupling detail)
Preventing heat gain

Performance related to water vapor:
Prevention of interstitial cond.
Prevention of surface condensation

Step 7: Check the continuity of functional layers from building elements 1 and 2 at intersection area 3.They can be either continuous, or discontinuous, or interrupted. (Table 8)

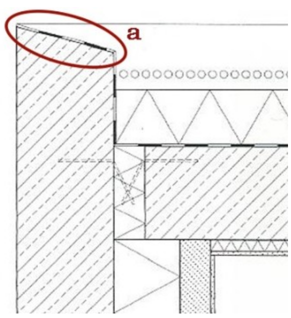
Table 8: Functional layer continuity table

1, roof system	**2, exterior wall system**	**3, intersection area**
External finishing layer		- discontinuous
Thermal insulation layer	Thermal insulation layer	✓ continuous
Waterproofing layer		- discontinuous
Core	Core	✗ interrupted
Acoustic board		- discontinuous
Internal finishing layer	Internal finishing layer	✓ continuous

Step 8: Check the continuity of functions at intersection area 3.
They can be either continuous, or discontinuous, or interrupted. (Table 9)

Table 9: Performance continuity table

1, roof system	**2, exterior wall system**	**3, intersection area**
Perf. related to water	Perf. related to water	✓ continuous
Thermal performance	Thermal performance	✓ continuous
Performancerel. to water vapor	Performance rel. to water vapor	-



Step 9: Check the geometric solutions by using "geometric solutions table." (Tab. 2)
("✓" is used as "existing"; "✗" is used as "non-existing".)

aWash ✓
bOverlap ✗
cOverhang and drip ✗
dDrain and weep ✗
eCapillary break ✗
fLabyrinth ✗
gRainscreen✗
hUpstand✗

*Figure*2: geometric solutions in coupling detail

Step 10: Fill the intersection area evaluation table according to obtained data and evaluate the performances of the intersection area if the number of precautions are enough and if they are correctly executed. Grading should be as +/o/-. (Table 10)

Table 10: intersection area evaluation table

Performance	**Geometric solutions**	**Insulation & sealing layers**	**Performance continuity**	**Functional layer continuity**	**Evaluation**
Performance related to water	wash	waterproofing layer (liquid)	(+)	(o)	(o)
Ther.performance	-	ther.insulation	(+)	(+)	(+)
Perf. related to water vapor	-	-	(-)	(-)	(-)

According to the evaluation, the thermal performance and performance related to water of the coupling detail can be classified as acceptable, whereas the performance related to water vapor is at an insufficient level. Some revisions of the detail are needed to upgrade it to obtain an acceptable overall performance.

3.2. A pitched roof-exterior wall coupling detail

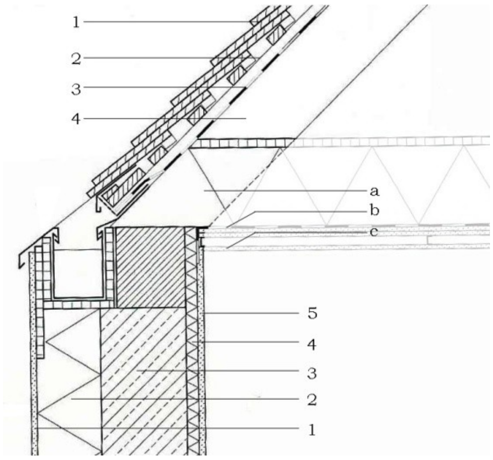


Figure 3: Analyzed exterior wall-roof coupling detail "Parish Hall, Hailfingen, Germany" (Detail, 2011, 10, p.1188)

Step 1: Disassemble the coupling detail into typical building element details. (Fig. 3)

building element 1: roof system
building element 2: exterior wall system

Step 2 & 3: Identify layers, materials, material properties and layer composition in building elements 1 and 2. (Table 11, 12)
Identify generic layer composition in building elements 1 and 2 separately.

Table 11: b. e. 1; roof system

no	materials	generic layer
1	natural tiling, 180/380 mm	external finishing layer
2	battens, 50/40 mm + rear ventilated layer	complimentary components + air gap
3	moisture-diffusing membrane	waterproofing layer
4	rafters, 100/180 mm	core

Table 12: b. e. 2; exterior wall system

no	materials	generic layer
1	fabric-reinforced rendering, 16 mm	external finishing layer
2	mineral wool insulation, 160 mm	ther. insulation layer (1)
3	reinforced concrete wall, 250 mm	core
4	XPS, 20 mm	ther. insul. l. (2)
5	plaster, 15 mm	int. finishing l.

Step 4: Identify functions which are fulfilled by each layer in building elements 1 and 2 separately. (Table 13, 14)

Albeit the coupling detail is considered to be consisted of two building element systems, components from the ceiling construction (in Fig. 11 a, b, c) which intersect with this detail and share the volume of the roof system also has to be taken into consideration to conduct an accurate performance analysis. e.g., partial thermal insulation from the ceiling construction adjacent to the intersection area is counted as a part of the roof system.

Table 13: building element 1, roof system, layer-function table

Generic layer	Function
1 External finishing layer	+ water impermeability
2 Rear ventilated layer	condensation control through ventilation
3 Waterproofing layer	water impermeability + condensation control through ventilation
4 Core	
athermal insulation	preventing heat gain/loss

Table 14: building element 2, exterior wall system, layer-function table

Generic layer	Function
1 External finishing layer	+ water impermeability

2 Ther.insulation layer (1)	preventing heat gain/loss
3 Core	+ heat storage
4 Thermal insulation layer (2)	preventing heat gain/loss + avoid thermal bridges + preventing surface condensation
5 Internal finishing layer	

Step 5: Determine if a functional layer has multiple functions for building elements 1 and 2 separately.

b. e. 1: roof system
1 External finishing layer
3 Waterproofing layer

b. e. 2: exterior wall system
1 External finishing layer
3 Core
4 Thermal insulation layer (2)

Step 6: Prepare a list for required performances for the intersection area “3”.

Performance related to water:
Impermeability to precipitation
Impermeabilityto wind-driven rain

Thermal performance:
Low thermal conductivity
Heat storage
Avoid thermal bridges

Performance related to water vapor:
Prevention of interstitial cond.
Prevention of surface condensation

Step 7: Check the continuity of functional layers from building elements 1 and 2 at intersection area 3.They can be either continuous, or discontinuous, or interrupted. (Table 15)

Table 15: Functional layer continuity table

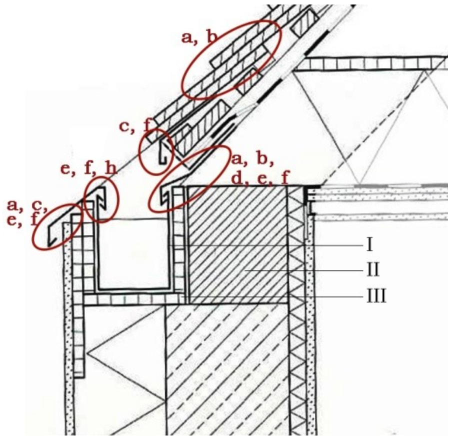
1, roof system	**2, exterior wall sys.**	**3 intersection area**
1 External finishing layer	1 Ext. finishing layer	× interrupted
2 Rear ventilated layer		- discontinuous
3 Waterproofing layer		- discontinuous
4 Core	3 Core	✓ continuous
a- Thermal insulation layer (from the ceiling construction)	2, 4 Ther. insulation layer (1&2)	✓ continuous
b- Vapor-retarding layer (from the ceiling construction)		- discontinuous
c- Internal finishing layer (from the ceiling construction)	5 Internal finishing layer	✓ continuous

Step 8: Check the continuity of functions at intersection area 3.
They can be either continuous, or discontinuous, or interrupted. (Table 16)

Table 16: Performance continuity table

1, roof system	**2, exterior wall system**	**3, intersection area**
Performance rel. to water	Performance rel. to water	✓ continuous
Thermal performance	Thermal performance	✓ continuous
Perf. rel. to water vapor	Perf. rel. to water vapor	- discontinuous

Step 9: Check the geometric solutions by using "geometric solutions table."(Tab. 2)
("✓" is used as "existing"; "×" is used as "non-existing".)



a Wash ✓
b Overlap ✓
c Overhang and drip ✓
d Drain and weep ✓
e Capillary break ✓
f Labyrinth ✓
g Rainscreen×
h Upstand

Figure 4: geometric solutions in coupling detail

Step 10: Fill the intersection area evaluation table according to obtained data and evaluate the performances of the intersection area if the number of precautions is enough and if they are correctly executed. Grading should be as: +/o/-. (Table17)

Table 17: intersection area evaluation table

Perf.	**Geometric solutions**	**Insulation & sealing layers**	**Compl. components**	**Perf. cont.**	**Func. layer cont.**	**Eval.**
Perf. related to water	Overhang and drip		Sheet zinc gutter -I	(+)	(-)	(+)
	Wash					
	Overlap					
	Drain and weep					
	Capillary break					
	Labyrinth					
Thermal perf.	-	Thermal insulation layers	wood purlin -II + plywood gutter boards -III	(+)	(+)	(+)
Perf. related to water vapor	-	Vapor retarder + Thermal insulation layer (2)		(o)	(-)	(o)

According to the evaluation, thermal performance, performance related to water and performance related to water vapor of the coupling detail can be classified as acceptable. As the performance related to water vapor is slightly lower than other performances, upgrading should be considered.

4. DISCUSSION AND CONCLUSION

An approach to evaluate external wall-roof coupling detail's performance is presented. The evaluation approach consists of two modules. The first module is a "performance requirements check list" separately generated for each building element, namely; the external wall systems and the roof systems. The second module is a step-by-step evaluation tool for coupling details. The usability of the proposed approach is demonstrated through its application on two real world problems. The evaluation approach is to be used in the design process as a design review tool to avoid building failures caused by faulty design.

Futures of the evaluation tool are as follows:

- The tool is established upon investigating existing details, so it is also a means to analyze how an architect works on a detail and what he/she thinks while designing. In other words, the proposed tool reveals the “nature” of design and helps to understand how a detail is “born”.
- The tool provides an explicitly organized, rationalized method that complicated detailing process becomes clear for the architect at design stage.
- The tool does not only evaluate a coupling detail of two building elements, it also evaluates the typical building element details.
- It shows that fulfillment of performances at intersection area depends on the performances existing in typical building element details and their continuity at intersection areas.
- If a coupling detail is regarded as not sufficient according to the evaluation, hints can be found in the evaluation table, for feed-back and redesigning the detail.
- Since the module is based on ranking and scaling methods, self-evaluation is easy for designers.

Still, there are some flaws or some points to fulfill:

- In the grading step of the evaluation tool, a certain level of expertise on related areas is required.
- The analyzing module, if necessary, should be quantitative for more precise evaluation.
- The evaluation tool should also be extended to cover all types of building elements and sub-systems and their combinations in creating coupling details.

The development of the tool continues with respect to the findings from the applications.

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IMPACT OF ENERGY ORIENTED MEASURES OVER CO_2 EMISSIONS OF A THERMALLY INSULATED LOW-RISE APARTMENT BUILDING IN IZMIR, TURKEY

MÜMİNE GERÇEK[1]
ZEYNEP DURMUŞ ARSAN[2]

ABSTRACT

Climate change has drawn the attention of many researchers and practitioners to focus on the methods to address the challenges in achieving low-carbon buildings and cities and in future developments. Nevertheless, few studies have explored the impacts of thermal mass applications for the lowest carbon emissions of building operational energy consumption. A comparative study of CO_2 emissions due to different wall and floor compositions is presented in accordance with their lifespans for a hot-humid climate site. Aim of this study is to examine the relation between the energy oriented operations and carbon emissions of the building. Firstly, an existing low-rise building in İzmir is selected, then modelled in the dynamic simulation model software DesignBuilder v4 by synchronizing drawings with basic operational principles of the program. Furthermore, various influence factors of building envelope thermal characteristics are selected as follows: type, location, thickness and thermal specifications of materials used by keeping thermal conductivity value constant. Selection of optimal CO_2 emission case would be investigated based on the simulation results. The research would provide further information about variable CO_2 emission levels depending on the changes in building envelope of a thermally insulated building.

Keywords: Housing, CO_2 emission, Thermal mass, Energy efficiency

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1. INTRODUCTION

In many countries, energy consumption of buildings is 25–40% of the total energy consumption, in which most of the energy is used for space heating or cooling (i.e., air-conditioning) of buildings (Zeng et al. 2011). The huge energy consumption for heating or cooling buildings not only demands valuable fossil fuel resources, but also emits a huge amount of CO_2 and other pollutants into the atmosphere. In fact, studies related to energy efficient buildings are of great importance all around the world. For example, Turkey paid \$60.1 billion for energy exports and the dependence on foreign energy sources reached 72% in 2012, based on data from the Ministry of Energy and Natural Resources (MENR) and Turkish Statistical Institute (TUIK). Annual average energy demand saw an increase as 4.6%, while remaining at 1.6% in EU member states after the 1990s (Düzgün and Kömürgöz 2014). This creates the energy oriented approach where minimization of energy consumption is the main target. When the amount of CO_2 released in building is the main indicator for reaching sustainability, the energy measures taken for achieving required heat transmittance coefficient (U) value may contradict with the targets for minimization of CO_2 emissions.

There are different ways to reduce mechanical energy needs of buildings, which are shading, control of daytime ventilation, and use of better thermal mass qualities (CIBSE TM 36 2005). This paper focuses on thermal mass which is related with the heat gain of a building.

Thermal capacitance is the amount of heat required for a unit temperature change in material's temperature. It is also necessary to examine the time required for materials response to heat gain. Hence, thermal mass is associated with the building time constant $t_c = m \times c/(U \times A)$, which explains the speed of building reaction to incoming heat as well as its thermal capacitance. In other words, transformation of mass into volume and density $(m = \rho \times V)$, time constant formula is defined as:

$$t_c = \frac{\sum_{i=l}^{i=n} \rho_i \times V_i \times c_i}{\sum_{i=l}^{i=n} (U_i \times A_i)} \qquad \text{Eq(1)}$$

So that, increasing density, volume, specific heat, and reducing overall conductance-area product of the building (UA) will also increase time constant and thermal mass. Decisions about placement of thermal mass is also considered in order to increase its exposure to solar heat gains. In this content, primary and secondary thermal mass issues take place where exposure to solar heat input straightforward describes primary, while exposure to internal heat input is observed as well as heat transfer with air conditioning system in secondary thermal mass.

In buildings, thermal mass is typically provided by heavyweight materials such as brick, stone or earth-based materials. Although inclusion of thermal mass in this way has thermal benefits, it is important to compare them in order to investigate better options. For example, the impact of thermal mass on the thermal performance of several types of Australian residential construction was examined numerically using the AccuRate energy rating tool. The performance of each construction type was evaluated using four different hypothetical building envelopes, referred to here as building modules. It was found that the thermal mass had a dramatic impact on the thermal behaviour of the modules studied, particularly in those where the thermal mass was within a protective envelope of insulation. The RBV and CB constructions were found to be the most effective walling systems in this regard (Gregory et al. 2008). Then, analysis of the effect of several wall and building design features on the energy savings is seen owing to thermal mass in exterior walls of residential buildings. Thermal mass effects on annual heating and cooling loads were analysed in 12 climates for three types of exterior walls including insulation placement and U value variations. The study highlights the heating and cooling load decreases due to various interactions between parameters affecting thermal mass (Byrne and Ritschard 1985). Later on, construction materials studies with regard to life-cycle assessment and CO_2 emissions as energy efficiency criteria are also included into researches. The actual building was being constructed in concrete, and two further versions were designed with steel or timber structures and finishes. Besides, large quantities of finish materials were common to all three buildings. Both energy use and CO_2 emissions have been assessed over three main stages in the life of a building: initial production of the building materials; operation of the building; and the refurbishment and maintenance of the building materials over the building's effective life. DesignBuilder software was used to estimate whole life-cycle energy used and CO_2 emitted in the operation of the buildings over a period of 60 years. The results showed that operating CO_2 emissions were majority of life-cycle CO_2 emissions, instead of total embodied emissions. The findings were of significance, in the assessment and weighting of the embodied energy and embodied CO_2 components of building sustainable rating tools (Fernandez 2008).

However, these kind of researches do not fulfil the need for focusing on the relation between thermal specifications of building and carbon emissions of residential buildings in Turkey. In this context, the specific objective of the present study is to investigate how thermal mass influences building behaviour and CO_2 emissions. Furthermore, this investigation allows determining the effects of low carbon building design on heat absorption capabilities of building envelope.

A flat located in thermally insulated low-rise apartment building in Izmir, created in DesingBuilder v4. is used to investigate how different materials influence building thermal behaviour and environmental performance. Eighteen scenarios are developed over the modifications of thermal mass characteristics through which insulation layer placement, material type, location and thickness are combined for floor, partitions and exterior walls. In order to compare like with like, the overall conductance-area product UA is kept the same for different comparison scenarios. At the end, this paper presents the influence of material types on reducing energy demands and improving energy rating. Besides, it shows the important impact of the lifespans of materials on embodied and operational CO_2 emissions on residential buildings.

2. PHYSICAL IDENTIFICATION

2.1. Weather Data

The study has been carried out in İzmir, west coast of Turkey (38.5°N latitude and 27.02°E longitude). The climate for studied area (İzmir) is hot-humid climate, labelled with Csa (Cs-for dry summer, a- for hot summer) in Köppen climate classification, referring to Mediterranean climate. Thus, the proximity to the Aegean Sea makes summer and winter temperatures relatively temperate, while summers are hot and dry in contrast to mild and rainy winters. July and august are the hottest months of summer, as well as January and february are the coldest of winter. Average maximum temperature is around 38°C during summer period, whereas the average minimum in winter may vary between 0°C and -3°C, which does not last longer than 10 days. Monthly rain level changes between 700-1000 mm depending on the region.

2.2. Location and Description of The House

This study analyses low-rise residential buildings. Thus, an existing low-rise apartment building is selected to represent the general plan schema and architectural features commonly applied in Izmir. Fig. 1,a shows that the case study is a detached apartment, located in Çamdibi region of İzmir with 38.43°N latitude, 27.20°E longitude, and 13 m elevation above sea level, as well as 14° direction to north. In addition, it can be seen from Fig.1,b that close placement of dwellings, and existence of Atatürk Park affects surrounding area texture.

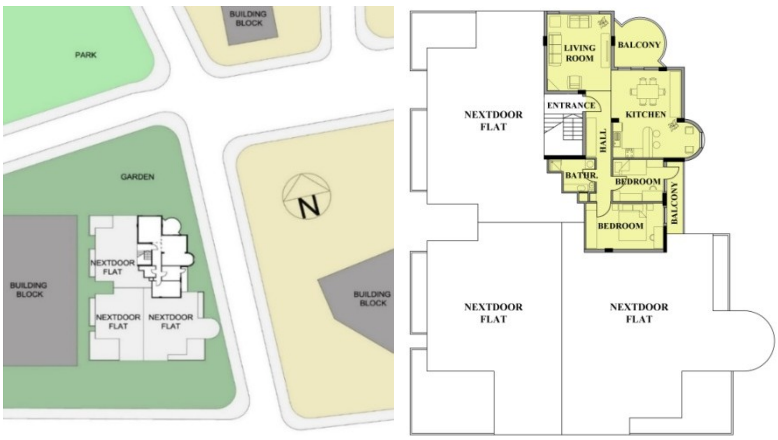

Figure 9 a) Site plan of the building b) Floor plan including selected flat

The selected apartment is a four-storey, multi-family dwelling, consisting of an entrance from north direction. Besides, it is a second floor flat, attached to others on south and west sides. Fig.1, b also presents that the flat has two bedrooms, and a closed balcony facing east, while balcony, kitchen and living room are located towards north-east direction. On the other hand, entrance hole and bathroom are

other spaces having blind facades. Balcony is surrounded by living and dining rooms, while large openings are used to take advantage of daylight. Although apertures are wide enough to provide sufficient natural lighting, they increase thermal transmission. In fact, living room and kitchen are the places that cause solar gain most, since glazing units cover larger areas. However, summer is critical because of excessive heat in west coast of Turkey, so curtains are used as a precaution to passive solar gain. In addition, total floor area of the flat is approximately 100 m² with floor-to-ceiling height of 2.80 m.
The thermal properties of the building materials match with the requirements for energy performance rules of TS 825 Energy Standard for low-rise residential buildings. The construction technique of the building is reinforced concrete skeleton system, hollow brick internal partitions, and a composite floor (concrete strengthen with steel framing) covered with parquet, ceramic tile for wet cores. Furthermore, inner partition walls have 0,015 m gypsum plaster, 0,085 m brick, 0,015 m gypsum plaster layers with U value of 2,1 W/ m².K. The flat has floor materials as 0,05 m cement screed, 0,03 m EPS, 0,04 m cement screed, 0,012 m flooring layer; as well as 0,65 W/ m².K U value. Besides, exterior walls have U value of 0,41 W/ m².K with 0,015 m gypsum plaster, 0,03 m EPS, 0,085 m brick, 0,03 m EPS, 0,135 m brick and 0,025 m plastering layers. These existing material conditions of the flat are determined as original scenario for further studies in paper.
Occupancy and lighting patterns of the house are also investigated to analyse further daily energy usage. The house was occupied by a family of two adults and a daughter. The house was in continuous occupancy except working hours in weekdays, so that most of the occupancy occurs between 17:00 and 08:00. Occupancy for the living room was also seen between 19:00 and 23:00.

3. MEASUREMENTS

Test house was equipped with diagnostics equipment for short term external and internal climate monitoring to execute site measurements with collecting data every 10 minutes. Fig.2 indicates installation of a Temp-RH-Light Hobo Data logger (HOBO U12-012) to the balcony to monitor outdoor air temperature and relative humidity. Its resolution is 0.03°C for 25°C temperature, and 0.03% for relative humidity, and its accuracy is ± 0.35°C from 0° to 50°C and ±2.5% from 10% to 90% relative humidity, respectively while another one recording rel. humidity and indoor air temperature was installed to the living room.

Figure 10 Placement of Hobo data loggers in living room and balcony

In addition, environmental data collection in test house started in April 1, 2014 at 00:00 a.m. and it was completed in April 24, 2014 at 11:59 p.m. The windows of the living room had constant conditions such as always closed windows and doors, semi-closed curtains and no mechanical/natural heating or cooling during data collection.

4. SIMULATION

This study used DesignBuilder v4, an energy simulation program developed by DesignBuilder Software Ltd., UK, for building energy modelling and simulation. It offers simple and convenient functions to model building components. Its calculation method is based on EnergyPlus, a building energy simulation program of the United States Department of Energy (USDOE).

The model geometry was created from architectural drawings which were available in DWG format, and converted into DXF format with the right proportions. These scaled drawings were imported into DSM software, and internal spaces were created by tracing the DXF outline of each floor and subdividing the floors with partitions.

Construction types were then created using the specifications obtained from collected data about the building. Input data for living room, kitchen, bedrooms and bathrooms were entered, including its operating occupation, lighting and opening schedules and system description.

In all scenarios, mechanical heating was assumed to be provided by fan-coil unit using coal as heat input. The heating set point was 22◦C in all rooms. The heating system was controlled to keep the set points in all rooms, except for the period of June-September, when the heating was shut down. In addition, mode of operation for mechanical cooling was provided by electricity from grid with cooling set point of 26◦C. It was also shut down for the period of November-February.

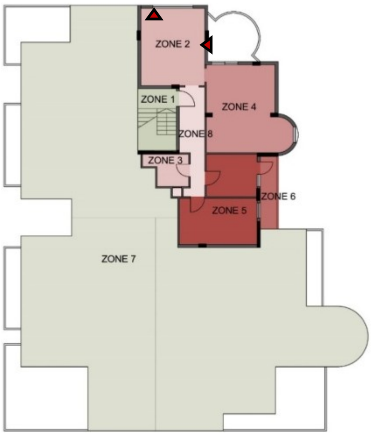

Figure 11 Zonings of the flat including location of indoor & outdoor Hobo data loggers

Fig.3 also points out that the flat has been separated into zones depending on the activities held out. Seven zones are created, while remaining spaces are considered as another zone as well as merging two bedrooms into one. In fact, living room, kitchen and hall form different zones because of having variable activities that would represent reality more accurate which will also reduce errors in the calculation results. On the other hand, open balcony is left aside from these zone categorizations unlike closed balcony. Furthermore, surrounded obstructions such as ground, buildings and trees are also modelled as different components. Green objects are assumed to be solid objects in order to include them into simulation process. Thermal properties of each element has importance for final thermal, energy and carbon emission measurements, so that material properties and surface reflection coefficients are also considered as input data. For example, adiabatic zone and other building materials assigned to be concrete with 0.25 surface reflection coefficient, while trees are accepted as deciduous having 0.3 as well as grass (garden) with 0.2.

4.1. Model Calibration Process

Residential building is used as a base for conducting parametric study. Considering availability of measurement cycle, the calibration with hourly data approach is employed in this paper. Measurements are only made for living room from April 1, 2014 to April 24, 2014, while energy demand and CO_2 emission results are obtained for whole floor during the study. The current hourly thermal performance of the flat is calibrated with measured inner and outer air temperatures. So that, these guidelines define two statistical indices: hourly mean bias error (MBE) and the root mean squared error (RMSE). Lower values of the latter informs us about better prediction by digital model.

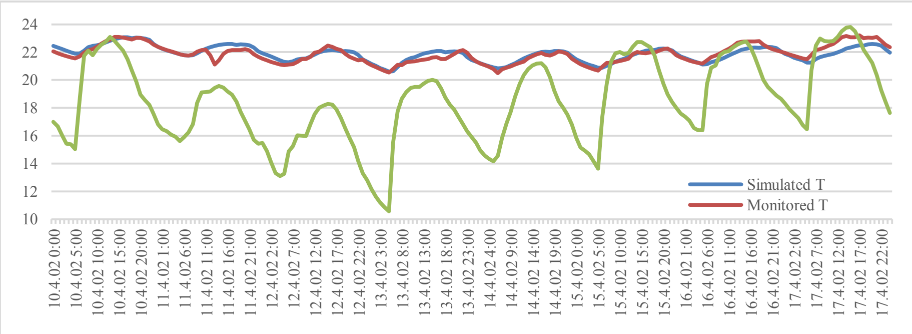

Figure 12 Calibration results of the simulation

Firstly, the calibration in terms of energy consumption is executed in order to decrease heat gains originating from lighting elements. The lighting elements used for living room were selected to be energy efficient in existing conditions. So that, automatically assigned 6 W/m² lighting template for material and energy are arranged to 1 W/m² as well as additional lighting schedule in order to specify differing occupancy ratios. Secondly, 0.4 ac/h air tightness rates of the zones is increased 0.7 ac/h in order to have lower inner temperature than initial conditions. Finally, arrangements about the simulation process options in terms of shading calculations are revised and all buildings are included in shading calculations during the simulation as well as model reflection shading of ground reflected solar. In addition, shadowing interval switched from 20 to 7 days in order to have more accurate results which also contributed closer temperatures to measured ones. In this way the calibration of the model in terms of internal temperature adjustment is completed, and the calibration results can be seen from Fig. 4. Also, the tolerances of hourly calibration indices and the final values of the simulation are specified in Table 1.

STATISTICAL INDICE		ASHRAE 14-2002	IPMVP	MVFEM P	Calibrated Model
hourly	MBE	±10	±20	±10	-1,3
	RMSE	30	20	30	2,81

Table 2 Error ratios for indoor air temperature

4.2. Simulation of Construction Scenarios

A comparative analysis is performed for a wide variety of mass configurations to determine how several complex interactions could change heating, cooling loads and environmental impacts of residential buildings in hot humid climate. Variable parameters are created such as density, thickness, conductivity, and specific heat of the mass layer as well as the location of the insulation layer within the range found in common residential constructions. This set of simulations are investigated in terms of summer and winter temperatures, energy demands, and environmental impacts in accordance with material's lifespans. Four different floors, three internal partitions, ten exterior walls including inner and outer insulation placement configurations are created with regard to previous parameters.

Firstly, initial floor scenario differs from original case by 0,025 m ceramic tile layer on top. Then, ceramic tile is changed with 0,015 m clay tile as second scenario, while turning 0,04 m cement screed into 0,08 m thickness in both, creates another two scenarios.

Secondly, three inner partition wall scenarios are included into experiments. Thus, 0,085 m AAC block between two layers of 0,015 m gypsum plastering creates 1,48 W/ m².K U value of AAC inner partition wall scenario. Besides, 0,09 m glass wool placed between 0,0125 m gypsum board layers and 0,085 m solid brick covered from both sides with 0,015 gypsum plastering having 0,36 W/ m².K and 2,2 W/ m².K U values respectively are two other scenarios.

Thirdly, five exterior wall combinations are produced by changing major wall material as well as keeping 0,08 m EPS, 0,015 m gypsum plastering layers and 0,41 W/ m².K U values constant. Thus, 0,16 m solid brick, 0,06 m AAC block, 0,55 m reinforced concrete, 0,5 m limestone, 0,07 m aerated brick layers are placed towards outermost faces of walls to form exterior wall with inner insulation scenarios. Lastly, these previous five scenarios' layers are mirrored in a way that innermost part of the walls have major construction materials with different thicknesses followed by EPS and gypsum plastering layers as inner to outer arrangement. So that, they provide varieties in exterior wall configurations with outer insulation properties.

5. RESULTS

5.1. Thermal Conditions

The only factor influencing the temperature change is the variations made to specific components of the building like floor, exterior wall or internal partitions according to scenarios. The summer and winter indoor temperature variations for all scenarios are shown in Fig.5 and Fig.6. There is around 1,5 ºC difference between peak temperatures both in winter and summer weeks. In winter time, limestone exterior wall with inner insulation and reinforced concrete wall with outer insulation showed same temperature pattern which is the highest between all scenarios. In addition, same configurations also show the lowest temperature patterns in summer design week. In fact, it can be seen that, they have the maximum time lag in winter and summer design weeks because of having higher thermal mass properties than others. On the other hand, the gypsum board partition wall scenario which has lower thermal mass quality, indicates the lowest temperature for winter time, while limestone exterior wall with outer insulation has the highest temperature for summer time independently from thermal mass properties of materials.

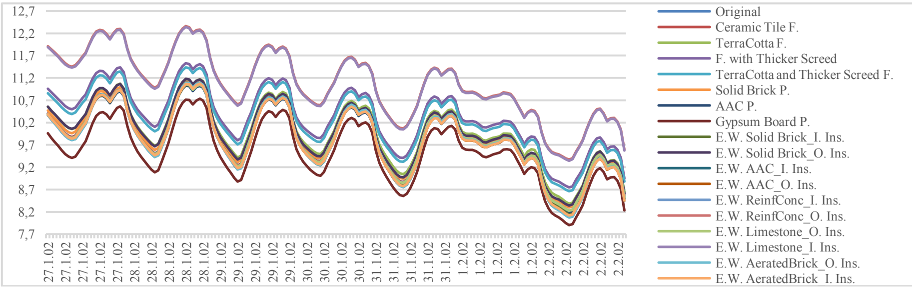

Figure 13 Winter design week indoor air temperatures of scenarios

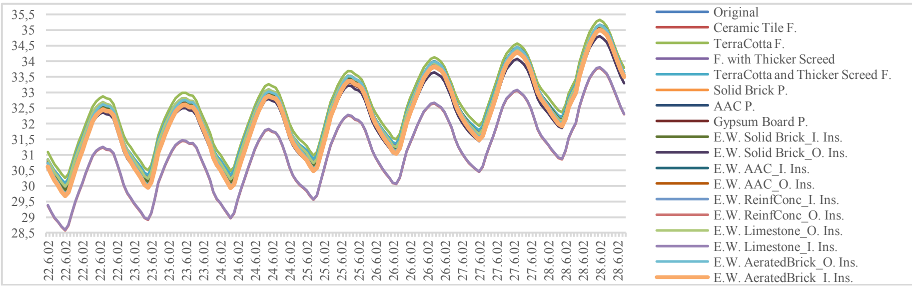

Figure 14 Summer design week indoor air temperatures of scenarios

5.2. Heating and Cooling Loads

Fig.7 shows total mechanical air conditioning energy consumptions of different scenarios for all year. It presents that all scenarios have similar cooling energy demands, while heating creates the difference. In fact, floor scenarios have the biggest impact on reduction of energy loads. The results also present that, combination of thicker screed usage for floor, AAC internal partitions, and reinforced concrete exterior wall with external insulation would establish the lowest energy consuming scenario for the flat. Besides heating and cooling loads are not affected by thermal mass qualities of materials unlike inner temperature values.

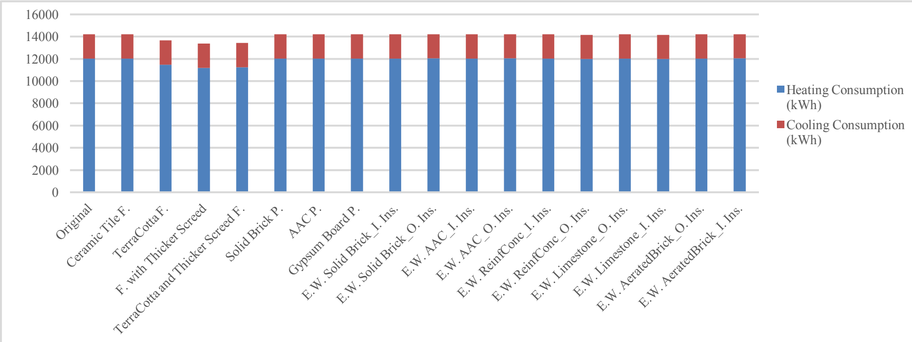

Figure 15 Heating and cooling consumptions of scenarios

5.3. CO_2 Emissions

a. Embodied and Operational CO_2 Emissions

Fig.8 indicates embodied and operational CO_2 emissions released to atmosphere in different scenarios, as a consequence of the energy demands. Operational emissions are almost the same for all of them which is around 8000kg. On the contrary, emissions due to embodied CO_2 makes the difference. AAC partition wall and aerated brick exterior wall options are better than others with 50280kg release regardless thermal mass qualities. Floor with thicker screed has 67650 kg CO_2 emission followed by reinforced concrete exterior walls whereas this type of exterior wall showed the best features for thermal conditions. Consequently, it can be seen that investigations particularly about thermal mass quality is not sufficient in order to decide construction materials of the building. It is also noted that the differences in carbon emissions from one material to another one are not influenced by insulation layer placement.

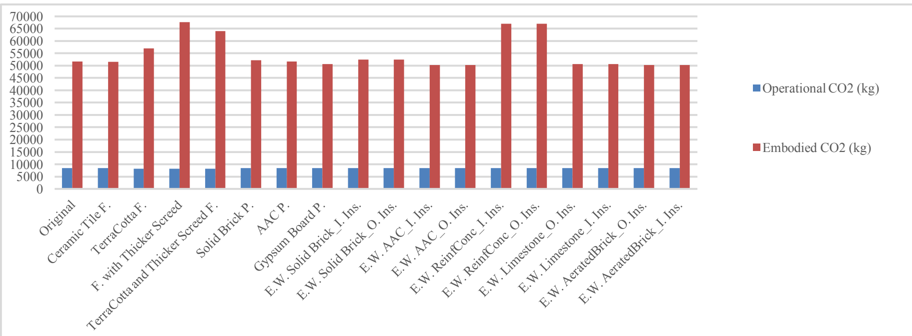

Figure 16 Embodied and operation carbon emissions of scenarios

b. Lifecycle CO_2 Emissions

Lifecycle carbon emissions are studied in accordance with a lifespan of 50 years for three main structure components with different scenarios. Reinforced concrete exterior wall with inner insulation followed by its outer insulation scenario reaches the peak point with around 490.000 kg CO_2 emission, whereas terracotta floor has the least amount as represented in Fig.9. Also, the minimum emission for inner partitions is seen by gypsum board releasing 472.000kg, while solid brick partition reaches the maximum amount. As a result, there are important impacts of lifespans of both the materials and the building itself on CO_2 emissions. Thus, common usage of reinforced concrete is obvious in Turkey, but the sharp difference between other materials in terms of environmental effects cannot be neglected.

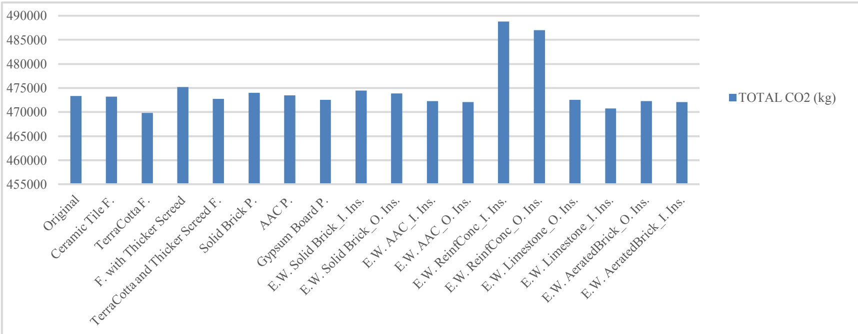

Figure 17 Carbon emissions according to lifespans of scenarios

6. CONCLUSION

The heating and cooling load reduction due to thermal mass are the results of a complex set of interactions between the amount and physical properties of the mass, the location and amount of insulation in the exterior wall, inner partitions and floors that effect solar gain. On the other hand, it is a fact that energy performance assessments do not involve the type of fuel used for mechanic air conditioning. However, one of the major parameters, effecting operational CO_2 emissions of environmental performance is the fuel type (Dombaya, 2012). Besides, not only energy efficiency, but also CO_2 production should also be considered as an evaluation criteria for energy oriented studies in buildings. In this context, this study examined how thermal mass changes building behaviour and CO_2 emissions. Furthermore, this investigation allows determining the effects of low carbon building design on heat absorption capabilities of building envelope.

A thermally insulated low-rise apartment building flat, situated in hot humid climate, is used to analyse how different materials affect building's thermal response and environmental performance. Besides, coal for mechanical heating and electricity for cooling are specified for this study in order to compare energy demands of different materials. There are also eighteen scenarios over the modifications of thermal mass characteristics through which insulation layer placement, material type, location and thickness are combined for floor, partitions and exterior walls. Comparison is made between same construction element with different configurations by keeping conductance area product constant in order to compare like with like

The result of this study reveals that thermal mass has a noticeable affect on thermal behaviour and CO_2 production considering outer walls, inner partitions and floors together. Besides, it shows the important impact of lifespans of materials on embodied and operational CO_2 emissions on residential buildings.

For further studies, additional mechanical air conditioning or natural ventilation in order to compare inner temperature results and keeping mass layer thickness while varying U values of the construction components are also important points to have more developed results.

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KEYNOTE SPEECH

(20 November 2012 Thursday, 13.30-14.00)

Prof. MARCO SALA

"Architecture: The Art of Integration"

ARCHITECTURE: THE ART OF INTEGRATION

MARCO SALA[1]

ABSTRACT

Bioclimatic Technologies and sustainable design approach can be applied in the transformation of the natural and built environment at any operational scale.

The application of bioclimatic technologies must complete with the conditions of the environment, in relation to the prevalent objectives to be achieved, such reduction of energy consumption, improving both winter and summer comfort, improving visual comfort and natural lighting, indoor comfort and indoor air quality, as well the sustainable use of water resources and the integration of Renewable Energies in buildings.

Appropriate building envelope remains the main strategy for sustainable design, but in the mild temperate/mesothermal climates, the rapid changing of outdoor conditions push toward a dynamic response of envelope parameters to allow the maintenance of interior good adaptive comfort.

To achieve the reduction of energy consumption both in new and existing buildings, we need the integration among mechanical, architectural and structural approach for a sustainable design approach.

Sustainable architecture in Mediterranean area meets its roots in traditional culture and the education of architects and engineers in this part of the world should be aimed to develop a sustainable approach to design, through the understanding of the evolution of the architectural technology and local cultural influences with new models (systems approach, holistic view of the project).

Key words: Sustainability, Technology, Energy, Retrofitting, Integration

[1] Prof. Marco Sala, University of Florence, Department of Architecture, Firenze, Italy

1. INTRODUCTION

Building components, construction tools and know how did not change a lot during many centuries while architects and craftsmen shared similar knowledge how to rise buildings and the local society identified itself in the same architectural culture.
With the beginning of last century the rapid growing of new materials, competencies and energy sources, brought industrial revolution, markets globalization and the rapid spreading and contamination of different cultures through the world.
The new scenario deeply modified traditional design approach and local building technology and now architects and engineers have at their disposal a large number of construction systems, building materials and energy choices that allow them to overcome nearly any problems, with the dangerous feeling that only economical issue and aesthetic inspiration are the criteria to achieve success.
But in the last two decade, a new general concern developed and soon has became a great ethic approach in every field, up to be recognized as the international global paradigm that will mark our century: the need to pursue a sustainable future as strategy that can be applied in every activity aimed to modifies and transform our world.
The growing of construction market, the rapid transformation of our cities and villages, need new rules and limits, benchmarks and certification to evaluate the results, guide lines to address planning and design activities.
The holistic approach in architecture means the art of integration different competencies, technologies and materials, to meet project requirements with a sustainable strategy.

2. "BIOCLIMATIC TECHNOLOGIES"

They are the set of strategies of design and construction, through which it seeks to achieve the realization of a sustainable architecture, an architecture that using its formal configuration, technologies, components, materials and equipment, try to establish an optimal relationship with the surrounding environment so as to reduce energy consumption and provide the best comfort to the occupants, using as far as possible natural systems and reducing the use of mechanical systems of the building.

This design approach can applied in the transformation of the natural and built environment at different operational scales: from the size of regional and urban planning to town and district design, architectural concept, building detailed design, mechanical plant, up to the choice of building component and to sustainable building materials and even applied to rules setting and post realization management.

Definition of "bioclimatic technologies" can be misleading because it does not constitute an independent category of technologies applied to construction, but are the result of a more comprehensive, holistic approach that involves all issues related to sustainability, and in this meaning includes both the reduction of impacts on the

environment, the amount of energy contained in the components (embodied energy), the evaluation of their active role in the life of the building, until the final disposal (life cycle analysis).
However, there is a tendency to define "bioclimatic technologies" some applications where the aims to pursue bioclimatic architecture is more relevant, and these technologies are mainly related to the building envelope, such as ventilated roof or façade, winter garden, solar shading systems, light chimneys, ventilation towers, and so on, but the concept of "bioclimatic technology" must always be compared and validated by the analysis of its appropriateness with respect to the local context in which it is used, ie the climatic context and the specific environmental design intervention and not as a model or a fashion design.
For this reason, a bioclimatic technology that is properly applied in Berlin is certainly not very appropriate when applied in Dubai and vice versa.
The choice of appropriate technology may rise from the needs of the specific building under the current climatic condition.
A possible articulation of bioclimatic technologies in line with the conditions of the environment, could be made in relation to the prevalent objectives to be achieved.

2.1 Improving winter comfort and the reduction of energy consumption

1. use of solar energy and other renewable energy sources that may be available through use of the greenhouse effect: form of buildings, optimal orientation of the building, atriums, conservatories, windows to gain direct, skylights, solar panels,
2. reduction of heat loss through the thermal insulation of the building, dynamic insulation, controlled ventilation, heat recovery, thermal mass, phase change materials
3. optimization of heating systems through the selection of heat source (boiler, heat pump) and the supply network, choice and optimization of heat transfer to the environment (radiation systems, mixed with air) monitoring systems and optimized management of all systems (BEMS Building Energy Management System)

2.2 Improving summer comfort and the reduction of energy consumption

1. shielding of solar radiation, shading the building through the form, shading with vegetation, exterior screening fixed and mobile, pergolas, marquees, green roof
2. natural ventilation and internal exploitation of the prevailing winds, shape and arrangement of buildings, cross ventilation, chimneys and towers of ventilation, ventilation openings, design of fixtures, underground pipes, night ventilation (night cooling), mechanical ventilation inside
3. evaporative cooling: the use of vegetation, evaporative systems internal and external, capillary evaporation, fountains, ponds,
4. choice, color and exterior finish materials, reflective surfaces and non-absorbent wall panels and flooring
5. thermal mass and phase shift of the thermal wave, position of the thermal insulation, roof pond, ventilated roof, green roof

2.3 Improving visual comfort and natural lighting

1. shape and size of the windows, characteristics of the glasses, special glasses,

skylights in the roof, chimneys, light reflection systems, heliostats,
2. mobile screens, inner and outer reflective screens, shape of the ceilings and screens included in the IG,
3. choice, color and external finishing of materials, reflective surfaces and non-absorbent materials for internal and external
4. rational use of artificial lighting systems with the use of high output lamps, sensors and controls, use of LEDs, integration of artificial and natural light.

2.4 Improve indoor comfort and indoor air quality
1. natural ventilation and internal exploitation of the prevailing winds, shape and arrangement of buildings, cross ventilation, chimneys and towers of ventilation, ventilation openings, design of fixtures, internal mechanical ventilation, automatic controls for the management of various ventilation devices.

2.5 Improving the sustainable use of water resources
1. collect and use of rainwater for non-drinking use, indoor and outdoor
2. local management and treatment of wastewater with possible reuse, constructed wetlands, environmental accommodations neighborhood, controlled flow of water, rolling the surplus rainfall, use of vegetation to reduce the flow velocity.

Many of the technologies and strategies that can be applied to the building are potentially contradictory with each other, especially in temperate climates where we have opposite demands in winter and summer conditions, which may be overcame with compromise or compensatory strategies or better with the introduction of dynamic components able to modifies the performance of the building in relation to external conditions, with manual controls or equipped with sensors and automatic controls like BEMS (Building Energy Management System).

2.6 Integrating Renewable Energies in buildings
This aspect cannot be as additional strategy to apply in the building, but is an important issue to be considered from the very starting of the design process, not only for the relevant visual aspect that can badly impact with architecture, but also for the constrain and limit of integrating such technologies in the building.
Elements like thermal solar panels, photovoltaic elements (crystalline or amorphous) integrated into glazing, thin photostatic cladding integrated into building components, small wind mills, geothermal wheel, heat pumps, biomass boilers, fuel cells, and also the rationalization of combined energy use such cogeneration and trigeneration, which can make a contribution significant energy needs of a building, up to more recent effort to introduce small hydrogen fuel cells at building scale.

3. DYNAMIC BUILDING ENVELOPE

Appropriate building envelope remains the main strategy for sustainable design, but in the mild temperate/mesothermal climates, the rapid changing of outdoor conditions push toward a dynamic response of envelope parameters to allow the maintenance of interior good adaptive comfort.
Dynamic envelope of buildings, such "kinetic" facades that respond to outside conditions according to the needs of the people inside or the use of mechanical louvers is an ancient technology (IE. all the systems to control the window performances) has been applied in modern iconic architecture with the Arab Institute in Paris by Jean Nouvel where the southern façade is realized with hundreds of light-sensitive diaphragms that automatically regulated the amount of light entering the building and since that project in many other buildings, until the recent realization through the world such as:
Al Bahr Towers in Abu Dhabi
http://www.youtube.com/watch?v=RU7kXOR94qg
Design Hub, Melbourne
http://www.smh.com.au/entertainment/art-and-design/hub-has-designs-on-rmits-creative-types-20120921-26ceo.html
Center for Architecture, Science and Ecology, New York
http://www.case.rpi.edu/index.php

The traditional response of the windows components that characterizes the Mediterranean architecture has recently developed by the ABITA Centre to a new range of innovative facade modules and new materials able to play different roles and dynamic response to climate.

Building components refers to more familiar elements such as operable windows, controllable blinds, flexible furniture layout and spatial freedom. Due to the variation in personal requirements, it is easier to satisfy occupants in cellular buildings than open-plan office, but it is also found that people are much more tolerant of variation in environmental conditions (for example temperature), if they are close to a window. There is also growing evidence that the provision of good outdoor views affects the overall well-being of occupants which in turn influences their response to internal conditions in a positive way: this are the basic principles of "adaptive comfort" , that produced the "green building" fashion in UK and around the world. These issues are more familiar territory for the architect and can effect the design of the building from its first planning, to the detailed specification of elements and components.

A crucial point when integrating dynamic component systems in buildings is to define a control strategy that allows the use of solar gains during the heating period and provides acceptable thermal comfort conditions during the whole year. The risk of overheating the offices during the summer months is high when the design is not coupled properly with the strategy of the HVAC system.

Efficient control system needs to be applied to manage rapidly changing outside conditions. A successful application can only be achieved when the contributions of all the devices can be synchronized by an integral control system.

The control system of the “Passive climate system” of the building should be done according to the following principles:

The dynamic building components must be controlled by automatic systems, but the occupants must be able to influence everything, even if their intervention spoils energy, and in order to save energy, the control system must take the maximum advantage from the outside conditions before switches over to the air conditioning system. (A.H.C. van Paassen, 1995).

All the control system must be focused on the realization of the comfort with the lowest energy consumption and during the unoccupied period the control system is focused only on the energy saving, while during the occupied period must be focused on the comfort as well.

The control system has three tasks to fulfill with the use of the passive and active components: keep the right level of the temperature inside the building, supply sufficient amount of the ventilation air to the building and ensure the right amount of light inside the building.

The ABITA Research Centre of University of Florence has a long experience in the field and presents here a series of prototypes and new component able to modify their performances according occupants needs and outdoor conditions, but trying to integrate them into the contemporary architecture.The design approach focuses the goals of:

-Controls solar radiation (redirect, diffuse or reflect direct radiation)
-Controls air changes (natural and forced ventilation, heat exchangers)
-Reduces energy losses and recover the heat in ventilation
-Increases security and control in windows frame
-Integrates RE in facade components
-Increases the thermal mass of industrialized building envelope (PCM)
-Increases the overall prefabrication in buildings.

The development of new facade system has been developed under current project research ABITARE MEDITERRANEO and will be soon tested under a Test Cell realized in Engineering Campus of University of Florence.

The system guarantees a considerable energy saving in office building and high standardization. With the cooperation of local window assembler company has been

possible the realization of prototypes, and a real building integration with direct monitoring of the performances.
In the attach schemes, we present three innovative facade systems: a double skin dynamic facade; a facade whit heat exchanger and a facade with integration of TIM material and internal lighting shed.
http://www.centroabita.unifi.it/mdswitch.html
http://www.msaassociati.it/

integration of TIM materials (left) and heat exchanger (right).

Dynamic building envelope in the building of Technological Park in Lucca, 2013

PV integration in the south facade (above)

4. INTEGRATION OF MECHANICAL AND ARCHITECTURAL DESIGN

When two different interacting technologies are not homogeneous for scientific content, level of innovation and industrialization, generally the more evolved one tends to prevail in interaction and the decision-making.

But this does not apply in the building sector, in the relationship between the construction technology that is traditionally "conservative", and and the mechanical technology, that has developed to high level of innovation and industialization.
This diversity of technological level, led to a strict separation of competence and professional roles, which in fact has limited the interaction and reduced the area of dialogue between engineers and architects.
Often the architectural designer is only interested in the shape of the building and believes that its proper functioning from the point of view of comfort is delegated in full to the mechanical engineer, except for dicussing about the size of space where allocate the machinery.

If this picture of relations was certainly the prevailing until recently, today we are facing a renewed interest in looking for the better integration between architectural inputs and comfort of occupants that always existed in the history of architecture until the beginning the last century.
Interest in environmental issues, the spread of ecological awareness, and the need to achieve real energy savings, are bringing more and more architects to focus thir interest also in heating and cooling mechanical systems and several engineers to look for a better interaction with the architect to optimize the mechanical choices.

From a theoretical point of view, we can say that the building, if properly constructed, should play a primary role to achieve internal conditions of well-being (at least in the temperate climatic zones) and that the mechanical equipment should be designed to achieve its goals with the minimum energy consumption.
If we consider the different durability of the two technologies, we notice that traditional masonry construction system, and the culture of conservation and maintenance (most common in Europe) compared to the logic of the demolition and rebuilding (mainly in US), leads to a remarkable durability of building envelope compared to the rapid obsolescence of the mechanical components.

This different durability should make reflect that wrong decisions in design phase of the building affect a much longer period, while appropriate design solutions and investments in higher quality of construction are lasting in a longer period, allowing to spread the higher costs in more annuity.

In heating and cooling technology, the rapid growing of new components and materials brings more dynamism and innovation, while the lower durability of components leads to more frequent replacement during the life time of the building, with lower payback time.

The integration that today we are seeking between architectural and mechanical approach, is enhanced by "bioclimatic" architecture, the holistic concept where all components of the project are seen in relation to each other and in relation to the external environment including of course the mechanical components.
Better performance can be achieved in new buildings, where the integration between building components and mechanical systems brings maximum benefits, both in terms of cost and environmental comfort, but even in refurbishment and retrofitting of existing building there are interesting opportunity.

Retrofitting the existing building stock is a crucial challenge in Europe, where this sector is responsible for the highest energy consumption, and this market is rapidly increasing and stands at about 40% of the all construction work of European Union (source: DAEI Euroconstruct), while in Italy and France exceeded the new building market.
Residential construction absorb the largest part of retrofitting and if ten years ago, the building recovery weighed to 30% on demand for materials and construction products, today the figure stands at 50% and the trend is mainly represented by the urban construction realized from '50s and' 70s, (post war reconstruction).

The theme of the recovery of "modern architecture" in suburban areas is therefore one of the most topical issues at European level, also from economical point of view, since demolition and reconstruction of new buildings is a much more costly strategy than retrofitting.and restoring the quality of buildings according to the logic of environmentally friendly .
Rehabilitating energetically a building involves considerations, evaluations and different choices depending on many variables that characterize the specificity of the building: the age, the degree of conservation, the structural characteristics, the typology, the internal distribution, the different activities carried out in the building.
The analysis of the artifact in all its characteristics is thus the basis of any type of intervention; the designer will be faced with the constraints of various kinds (structural, regulatory, distributive, cultural) that limit the ability to change and adapt to the changing needs of the building both from the architectural point of view and from the mechanical one.
The maintenance operations are dues to normal deterioration of the different parts of the building, its technological systems in addition to the general aging process of the construction. There are also circumstances that pushe to intervent, such changes in the needs of users, progress and technological innovations that offer increasingly high standards of quality of life and work, and pushing for a continuous update.

In most cases, the intervention of renoval of existing buildings, is not directly related to the energy sector and any maintenance, rehabilitation or renovation of the building, offers a significant opportunity to operate also for the energy rehabilitation.

Intervents for energy retrofitting or improving energy efficiency, as part of a wider project of renewal or maintenance of the building, is a way to reduce the cost of individual measures and the time of return of the investment is lower, both for the normal maintenance operations and for those related to the energy efficiency, with increase in the convenience of the interventions.

In conclusion, the reduction of energy consumption, sustainable socio-economic development and the improvement of facilities in existing buildings, is strongly linked to the general process of urban renoval and maintenance of buildings and that these policies must be realized with the integration among mechanical, architectural and structural approach: the art of integration for a sustainable development of our cities and villages.

5. SUSTAINABLE ARCHITECTURE IN MEDITERRANEAN REGION

The Mediterranean area is today a central focus from the strategic viewpoint as union rather than competition bridge between Europe, Africa and Middle East, and needs a commun thinking about existing constructions and new construction policies in the different countries facing this sea. The reflection about present trends focus on the need of a cultural consciousness about the importance of safeguarding the built as well as the natural heritage, by means of sustainable development strategies.

There is a number of common architectural lines and engineering techniques in settlement organisation, established in the roots of Mediterranean traditional culture, and a number of similar principles in line with the sustainable development and ecological concern. Now we have the opportunity to deeply investigate so as to define a common strategy for the future of cities and villages.

As it is very well known, the amount of resources on our planet are going to be depleted very soon, and a large number of conferences, worldly summit and meetings in the high areas of government and management have been held during the last two decades around the themes of sustainable development, pointing out the need of moving our society towards a different economy and a different way of reflecting on the possible transformation of land and city. Such terms as “green economy”, “smart cities”, “emerging technologies” and others have been created so as to clarify the various opinions and movements which can help during the establishment of this new society.

Abitare Mediterraneo is an applied research project, sponsored by the Tuscany Region EU program FESR 2007-2013, developed by the University of Florence in synergy with some construction companies.

Project aim’s to realize an “Open System” to promote technological innovation and architectural quality in the construction process in order to encourage the development of building initiatives focused on high energy efficacy; the catalog of the “Open System” is a flexible tool dedicated to enterprises to promote innovative products in the Mediterranean Areas.

The research propose a formula to create a synergy between the research and production in the building sector and also involves a «construction model» to adopt for architecture in these kind of climates and it is dedicated to draftsmen and enterprises as a promotion tools supporting design and planning in the Mediterranean climate.

The purpose is to transform Tuscany into an International Laboratory for Research of high quality living in the Mediterranean area; develop analysis of Case Studies in order to promote the future of Environmental Sustainable Buildings, designed in the context of history, culture and Mediterranean climate. Key objective fosters the creation of a “Centre for Technological Competence” as a benchmark point for research, innovation and implementation of environmental sustainability, eco-efficiency, quality of life. Innovative results from Abitare Mediterraneo up to now has been the realization of:

• Test Cell - outdoor Laboratory for Thermal Dynamic behavior of façade components realized in Florence University , Engineering Department.

Prototypes of building components such:

• MIA - Temporary Living Module specific for Mediterranean climate

• Domino - Façade System that guarantees significant energy savings

• AIW - Facade System with an integrated heat exchanger

• Shading Screen -Innovative Ventilated Wall

6. CONCLUSION

6.1 University education and ABITA Master course

The education of the architect and the engineer should aim to develop a sustainable approach to design, through the understanding of the evolution of the architectural technology and cultural influences that new models (systems approach, holistic view of the project) resulted in the design synthesis. Energy issues and the concept of sustainability applied to the design changes at different scales require new tools for understanding and analysis that will be integrated with the traditional skills of the architect. In the universities the curricula of students should be aimed to achieve

the means of ensuring the effective coherence between the cognitive phase and the project, to develop a sustainable design that manages to integrate the needs of the environment and the fulfillment of the objectives of the client.
The post graduate Master ABITA has been developed twelve years ago in University of Florence as a second level of training and as a response to the high interest expressed by administration and private developers for experts in management of natural resources and sustainable design.
As part of the general transformation process as implementation of the Kyoto Protocol, and the new legislation such as the European Directive on energy conservation in buildings, ministerial decrees on green certificates and licenses to energy saving, skills of the Master Bio-ecological Architecture and Technology Innovation for the Environment refer to the objective urgency to solve the energy problem in the field of architecture, in order to define a new professional with more specialized training and in all aspects of the building process, which integrates knowledge and the basic skills of planning and design acquired in university college courses.
The need for greater environmental sustainability and proper energy management requires a high quality of the planning process and land management and execution of the works on the basis of eco-friendly environment. The Master responds to the increasing need for new professionals with specific expertise in the field of innovative strategies for the deployment of renewable energy sources and their integration into the urban space.
The goal is to provide a high-level training than would generally be offered in the current context of teaching faculty of architecture and engineering, and to provide new inputs to stimulate the creativity of the designers of the City of Tomorrow: methods and operational tools for design of the built environment in a sustainable perspective. The training objective is therefore to define a cultural base capable of formulating and managing eco-design criteria through the identification of procedures and tools to determine methods of intervention and economic viability for both the new building and for the retrofit of existing stock, in terms of quality, environmental and energy performances.

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SESSION 2

20 November 2014 Thursday, 14.00-15.15

Chairperson: Prof.Dr. İ.Sevil SARIYILDIZ

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SUSTAINABILITY AND BIOCLIMATIC DESIGN PRINCIPALS IN HOT-DRY AREA OF IRAN

MAHSHID MIKAEILI[1], FARUK SARIHAN[2]

ABSTRACT

Today, buildings worldwide account for up to 40% of total end-use energy. Sustainable architecture is a general term that described environmentally conscious design techniques in architecture and landscape design. The aims of sustainable architecture at producing buildings that adapted to climate, local, cultural and environmental contexts. Sustainable architecture also referred as Green Architecture, Energy Conscious, Eco friendly, Energy Efficient is a design that uses natural building materials that are energy efficient and that make little or no impact on the nature of a site and its resources. Climate has a major effect on the energy consumption in building. Bioclimatic design in vernacular architecure aims to lower energy consumption, based on the understanding of the climatic parameters that influence the energy behavior of a building. It requires knowledge of the relation between the building's envelope and the local environment. Reducing energy consumption, using natural resources and providing comfortable, and sustainable living spaces are the aims of bioclimatic design or climatically responsive sustainable building design (vernacular building) in hot-dry areas of Iran.

Key words: Sustainable Architecture, Bioclimatic Design, Passive Solar Methods, Vernacular Architecture.

1. INTRODUCTION

Buildings worldwide account for up to 40% of total end-use energy. Today, in construction of some modern buildings, using new strategies of sustainable design have a great importance on human living and energy using. In this system climate has a major effect on the performance of the building, and energy consumption. The important responsive of the sustainable building design is reducing energy

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consumption, using natural resources and providing comfortable and sustainable spaces for living (Serbescu 2009).
According to accumulation of empirical knowledge in vernacular architecture in differnt parts of Iran, using passive design strategies such as solar orientation, natural ventilation, using of thermal inertia and shading are basically techniques of adaptation with environment. Noticeably, during the last decade, the academic interest in the sustainability of vernacular architecture has grown. Unfortunately, around the world, vernacular traditions are seen to be in a state of decline and are frequently looked down upon, abandoned, neglected or actively demolished. Steadily, vernacular architectural methods are replaced by modern architectural methods, international technologies, materials and forms (Oliver 2003, Knapp et al. 2005, Vakili et al. 2006). Interestingly, these vernacular traditions are exactly the ones that are identified as being able to provide valuable lessons in terms of sustainable design. To many academics these represent a sophisticated, advanced and refined nature of vernacular passive cooling, ventilating and heating strategies (Fathy 1986, Kheirabadi 1991, Qobadian 2006).
In a vast country such as Iran with 1,648,000 km^2 width and very different climatic zones, traditional builders have presented a series of logical solutions for human comfort (Tavassoli 2008). Despite of the high diversity in architectural patterns, there are five principles in all historical buildings. These principales are; 1) introversion, 2) avoidance of vanity, 3) self-sufficiency, 4) architecture structure, 5) people oriented (Pirnia 2003).
This study is based on a research program on traditional building techniques that have used in differnt parts of the hot-dry areas of Iran. The study introduced designing strategies and principles in hot-dry climate in traditional housing based on climate responsive design. These issues related to sustainable and bioclimatic design in vernacular buildings. The research examines the various passive methods that are widely adopted by vernacular architecture in historical buildings. These methods explain their operation in details, solar orientation, distances between buildings, natural ventilation, building envelope, thermal inertia and building form that highlighted the main factors of their use that reduces environment effectiveness.

2. SUSTAINABLE ARCHITECTURE

The history of environmental friendly architecture becoming widespread goes back to 1970's. Since then, the words "Green", "Ecological" and "Sustainable" are terms used by environmentalists to indicate modes of practice (Ghani 2012). The transition from "green" to "eco" to "sustainable" in the design field represents a steady broadening of scope in theory and practice, and to a certain extent, an increasingly critical perspective on ecology and design (Madge 1997).
In Architecture there are many ways a building may be "green" and respond to the growing environmental problems of our planet. Green buildings are high quality buildings, they last longer, cost less to operate and maintain and provide greater

occupant satisfaction than standard development (Ghani 2012). A green building is an outcome of a design that focuses on minimizing the use and on increasing the efficiency of resources. The steady depletion of non-renewable resources of energy has forced the search for energy efficient building alternatives as it is the single largest consumer of energy-intensive materials (Vijayalaxmi 2010).

Sustainable architecture can be practiced still maintaining efficiency, layouts and cost effectiveness. Construction projects typically consume large amounts of materials, produce tons of waste, and often involve weighing the preservation of buildings that have historical significance against the desire for the development of newer, more modern designs. Sustainable development is one such measure, which presents an approach that can largely contribute to environmental protection (Ghani 2012). However, being sustainable is not just about energy saving, but also about the better use of suitable materials. We have to use materials far more efficiently than we do now. Sustainability also means an increased importance being placed on use of materials, which are renewable, recycled and non-toxic. Public awareness must be generated that such buildings, which incidentally are low cost, are not inferior to conventional concrete buildings. Similarly, using locally sourced materials, materials with a high recycled content and ensuring an envelope design, which does not enhance the operational heating or cooling energy can go a long way in designing energy-efficient buildings (Vijayalaxmi 2010).

Sustainable architecture is a general term that describes environmentally conscious design techniques in the field of architecture. Sustainable architecture is framed by the larger discussion of sustainability and the pressing economic and political issues of our world. In the broad context, sustainable architecture seeks to minimize the negative environmental impact of buildings by enhancing efficiency and moderation in the use of materials, energy, and development space. Today, the idea of sustainability and ecological designs are to ensure that our actions and decisions do not inhibit the opportunities of future generations. This term can be used to describe an energy and ecologically conscious approach to the design of the built environment. The aims of sustainable architecture at producing buildings that is adapted to local, social-economic, cultural and environmental contexts, having in mind the consequences to future generations. In this frame, the important priority must be to minimize energy consumption in buildings in both terms of maintenance and embodied energy, through the use of passive design strategies for reducing the use of energy consuming equipment.

Besides all these measures and approaches, passive strategies such as bioclimatic design offer great ways of energy saving. Bioclimatic design is a design strategy which relates climate control in a building to the analysis of weather data and the requirements for human comfort. Bioclimatic design is also the outcome of such a strategy. Hence the bioclimatic design can be understood as the architectural design using human adaptability and passive climate control as interactive measures of energy efficiency (Bromberek 1995).

Traditional and Vernacular buildings in contrast to Modern buildings constructed in 20th century are more climate-receptive; the climate-responsive architecture originates in the pre-industrial era before the introduction of air-conditioning and electric lighting. Each region of the world employs its own techniques and designs in its buildings that are best suited to that particular region and that encompass the region's cultural patterns (Sharma and Sharma 2013). The essence of bioclimatic design is to create a favorable microclimate both inside the building and outdoors through the application of architectural techniques (Bondars 2013). Bioclimatic design measures are centered primarily on the climate of a specific area as thus; building envelope and orientation, energy source, sun shading devices, passive design, indoor air quality, heating and cooling, landscape (Folaranmi et al. 2013). For effective design and good thermal achievement, Bioclimatic design recommends the following factors to be considered:

- Building orientation: buildings should be inclined on site to face the north-east, south-west approach to allow minimum solar radiation into the buildings

- Window openings: the openings should be wide enough to allow maximum natural ventilation into the indoor space.

- Glazing: solar glasses that are double paneled and well laminated that allow light but reduce heat penetration should be used.

- Natural materials: should be used for construction such as adobe, compressed earth, and wood as they have better thermal inertia than most conventional building materials.

- Renewable energy: these energy sources as solar and wind energy are more energy efficient and do not contribute to CO_2 emission which pollutes the environment.

- Landscape: trees should be planted around the houses as they help improve the surrounding air and keeps the environment cool.

- Cross ventilation: houses should be cross ventilated for effective air flow in and out of the building (Folaranmi et al. 2013).

Passive climate control is the climate control achieved as a consequence of the use - exclusive or prevailing- of passive means, that is: means that do not use power (inflows of externally produced energy) to perform the intended tasks (Bromberek 1995).

2.1. Principles of Climatic Responsive Design

The climatic conditions of the central part of Iran share common traits of extremely low annual precipitation and low humidity, restriction of water source, intense daylight and thermal gain from the sun, dynamic seasonal, daily temperature fluctuations, seasonal wind and sand storm.

Composition of architectural components and spaces create dynamically urban areas. In these regions cities illustrated integration of homogeneous and centralized structures that compressed for creating close correlation between components. Vernacular architecture in these areas has demonstrated by sustainable architecture components that suggested various solutions which are adapted with environments potentials, natural ventilation, as a certain parameter for cooling and sense of comfort. The buildings are constructed according to the specific climatic conditions and differ with those built in other climates. Central Iranian vernacular buildings are commonly equipped with thick and high walls, vernacular materials, wind-catcher, central courtyards, water pools and vegetation, basements, loggias and separate seasonal rooms. All these features together form a vernacular passive cooling system that modifies to some extent the impact of the hostile outdoor environment.

Due to lack of access to modem heating and cooling equipment's in ancient times the architects were obliged to rely on natural energies to render the inside condition of the buildings pleasant. By this way, without any mechanical methods and just by utilizing environmental energies such as wind, solar energies and architectural elements such as shape of roofs (using dome and arched roofs instead of flat roofs), walls (using huge and thicken walls), materials (includes mud, mud brick ,stone, brick, mortar, lime and rarely wood), multistory yards or garden puddle (Persian: Godal Baghcheh) in the yard of houses for increasing the contact of building surface with earth, window, wind-catcher (Persian: Badgir) have been provided comfortable condition for occupants. Furthermore, the urban morphology in hot-dry regions is the cause of condensed and concentrated urban texture in which the main arteries are facing the desired wind and opposing undesired one. Many of these vernacular cooling strategies in central Iran are said to have remained relevant to local cultural needs and to work in harmony with the natural environment because they are based on low and local use of energy and resources (Afshar et al. 1975, Heidari 2006). Because of this relevance, it is frequently claimed that there are many lessons to be learned from them in terms of creating a contemporary sustainable design and construction (McMurry et al. 2000, Qobadian 2006).

Through evaluating traditional architecture, designers have taken advantages of difficulties of areas and presented the most suitable settlements designs for each climatic region based on this three scales; macro, medium, and micro scale. This classification is on base urban designing scale, house designing scale and architectural elements designing scale in a house. Basic principles of macro climate responsive are in the urban designing scale. This principal include; Site and orientation of the building, distance between buildings, enclosed urban environment and using organic designing method for creating narrow and irregular streets.

***Site and orientation of the building*:** The most important design parameters in urban designing scale that affecting indoor thermal comfort and energy conservation in building are site and orientation of the building. These parameters depend on topography as a basic parameter, climate, sun radiation and wind direction. Commonly, in these areas houses are situated according to the slope of a city hill.

Effectiveness element in determination of building orientation in this terrain is daily or annual prevailing wind. Generally, in different places buildings oriented in northeast-southwest, north-south and northwest-southeast direction (Pirnia 2003).

Distance between buildings: These areas demonstrated compact urban context. Houses are surrounded by high walls and isolated from the ways. During the day, external high walls of houses usually provide shady areas in narrow streets and especially in central courtyards. By means of thick and heavy walls, a cooler environment in summer and a warmer environment in winter can be provided easily. The walls are structurally independent together that provided thermal protection from the intense desert sun. The exposed surfaces to direct sunlight can be reduced by up to 50% when neighboring walls are constructed closely together (Qobadian 2006).

Enclosed urban environment: The city structure resembles a battlement fully enclosed from all directions. In fact, it is for both defense purposes and to prevent high velocity winds and sand storms from penetrating into the town. For that reason, the appearance of the inside of the city is completely different from the outside, and the air inside is more static than outside the city (Fig. 1).

Narrow and irregular streets: The main streets in the town face are in the prevailing wind direction. Of course, the streets are narrower than streets built in other regions. Surely if the streets were not narrow more sand would have been blown into the streets from the desert and harsh winds would have penetrated into the city districts. Meanwhile the compact nature of the buildings prevents very high temperatures to develop by exposure to the sun. Houses are formed around courtyards and have thick walls and a minimum of openings. They are built close to each other, protecting one another from solar radiation and sandstorms. Narrow ways of 2-3 m are shaded by the high walls of the surrounding houses and allows any air movement to be accelerated. In some area, as a static solution against tall walls bending and creation shady pedestrian, between two tall walls were built vaulted canopies (Sabat) along the pedestrian way (Pirnia 2003, Qobadian 2006), (Fig. 2).

Figure 1, 2. Narrow and irregular streets. Sabat inside narrow way

Fundamentally, medium climate responsive design principal are in the scale of the buildings designing form, construction material and material Self-Efficiency, building coverage and thermo-physical properties of the building envelope in the hot-arid area of Iran.

Building form: Central courtyard was known as an eternal pattern and common typology of houses in these areas. Especially in the hot-dry climate, the central courtyard and pool are the main space of a house. Pool of water and plants in central courtyards create a pleasure micro-climate area by evaporating and creating cooling. The temperature of the courtyard's floor has minimized by the high walls that surrounded the courtyard and created a shady area. Some buildings have constructed multi-stories courtyards "Garden Puddle" (Godal Baghcheh) for benefiting from natural cooling of the earth (Qobadian 2006),(Fig. 3, 4).

Figure 3, 4. Central courtyard, pool and plants. Garden puddle (multistory yard)

Central courtyard, not only is the natural environment, but also it creates introspective relationship between spaces (Memarian 1998, Qobadian 2006). Compact forms are chosen by designer as a best solution to minimize solar radiation that affected the areas. Structure of the central courtyard both in shape (geometry and design elements), and also in the methods (materials and technology), heavily used the feature of indigenous and local empowerment (Pirnia 2003, Qobadian 2006). Various design of plants and pools in the central courtyard with trees that need little water, such as pomegranate, grape, fig and pistachio, that not only it provide the fruits and vegetables, but also it reduces air dryness (Dehghan et al., 2011).

Building envelope: Sustainability and energy efficiency are greatly affected by skin of building. The buildings are built in cubic forms and architects tried to minimize the ratio of outdoor surfaces of buildings (Memarian 1998). Cubic forms help buildings to have a lower exposure to hot weather factors than the other building forms. In observing traditional examples, it can be seen that the transparency ratio of the building envelope is chosen as low as possible and the opaque parts of building envelope were constructed by the materials with a high heat capacity as thick as possible. Using white or light color in facades is a way to minimize heat absorption and maximize sun light reflection from the building's surfaces (Qobadian et al. 2006), (Fig. 5).

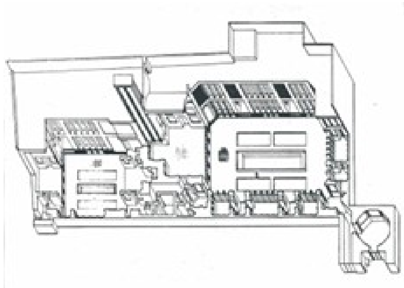

Figure 5. Cubic form of building and multi-central courtyards

Self-Efficiency in materials: Use of the local and vernacular materials such as brick and adobe to reduce energy expenditure is a wise decision since it will also reduce the initial embodied energy as well as cost. They have used the soil of excavating of foundation or multistory courtyards in order to make bricks. Due to very hot temperatures, the building materials absorb heat from the sun and make it available later when the sun goes down. This energy is retained in the walls about 8 hours and the other parts of the building envelope and is gradually transferred to the inner compartments (Qobadian et al. 2006).

Optical and thermo-physical properties of the building envelope: To benefit from the time lag of temperatures in the building envelope, materials with greater thermal mass have been chosen. These kinds of thermally massed envelope details are very convenient for continental climates, where the summers are very severe with high swings in daily temperature variations (Holman 1976, Memarian 1998). Therefore, calcareous rock, stone, mud and the combinations of those materials are always preferred in this climate (Memarian 1998).

The basic of micro climate responsive principals are in the scale of the building elements like loggia, porch, seasonal rooms, designing form, wind catcher, window and canopy, isolation and module of building that have been used in these areas.

Module Construction: This unit (module) is a base for other measurements in construction. All elements of traditional buildings used to be built based on this unit and specific proportions in the building system, especially the proportion of windows to surface of the rooms. This system of measurement allowed architects to use specific geometries of buildings and obtain the advantages of structural resistance found to be suitable (Qobadian 2006).

Eyvan and Revak: Loggia (Eyvan) and porch (Revak) are semi-open areas are used to create shady and cool living spaces during the day. Eyvan is three side closed place in front of the rooms and usually are oriented to the south. Especially, south and east oriented Eyvans are very cool and provide shady places during summer. Revak is another semi-open colonnade arranged in the courtyard always provides shady areas in front of the house and were built in the west (Memarian 1998, Qobadian 2006). (Fig 6, 7).

Figure 6, 7. Eyvan and courtyard, Revak

Seasonal rooms: Rooms and other gathering spaces facing north and are used during hot summer days. These often open onto the courtyard with a small platform (Eyvan). The Eyvan faces the north onto the courtyard which often holds vegetation and water. Winter's siting rooms in south side of buildings is essential where maximum exposure to natural daylight is desired as temperatures may fall to –16 ºC during the winter months at night.

Wind catcher (Badgir): Wind catcher was a common specific feature of architecture found in the majority of warm regions (Fig. 8).

Figure 8. Central courtyard and view of a wind catcher

Wind catcher is like a chimney whose end is underground and the top is elevated above a specific height on the roof. At the upper outlet many small openers or ducts may be set according wind direction. The height of wind catcher, the number of openers and the location of the wind catcher depends on the wind direction and wind force. The wind catcher operates with the change of air temperature and the difference in density of the air inside and outside the channel. The difference of density of the air impels a positive or negative pressure of air which causes the air to flow either to the bottom or to the top (Mikaeili and Memluk 2012), (Fig. 9).

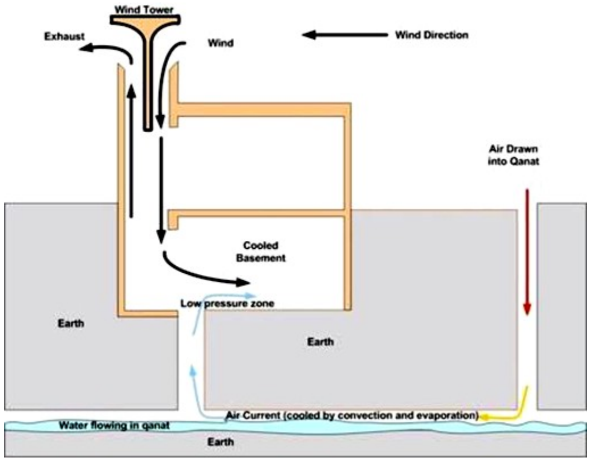

Figure 9. Function of the wind catcher during day and night

The wind catcher operates in response to the condition of the wind and sun radiation in the region. The inside and outside walls absorb a lot of temperature during daytime. As a result they cause a balance of temperature at night and give the attracted warmth to the cold night air. The light warm air inside the wind catcher ascends and is sucked away at the upper elevation. Finally, in a windless environment or waterless house, a wind catcher functions as a stack effect aggregator of hot air. It creates a pressure gradient which allows less dense hot air to travel upwards and escape out the top. This is also compounded significantly by the day-night cycle mentioned above, trapping cool air below. The temperature in such an environment can't drop below the nightly low temperature. The light warm air inside the wind catcher ascends and is sucked by upper elevations. As a result cool air flows from windows and doors into the house and continues all the night (Mikaeili and Memluk 2012).

If wind blows at night, the air will circulates on the opposite direction in the wind catcher. In other words the cold air is sucked into the house. Of course, in such a condition the cold air flowing from the air trap duct which has been heated during the day time will warm the inlet air a little. Nevertheless air circulation again refreshes the inside temperature. During daytime the wind catcher acts contrary to a chimney. In other words the upper parts of the air trap has been cooled the night before and upon contacting the walls of the air trap the warm air cools down and moves towards the bottom and eventually circulates into the house and exits from doors and windows. The flow of air during daytime accelerates the ventilation process (Mikaeili and Memluk 2012).

Window and canopy: Traditional windows "Orsi" not only an aesthetic factor in building but also is a passive solar factor (Fig. 10). Orsi is reticular window with small color glasses in red, golden, green-blue, violet and brown colors that been used in living and guest rooms. The structure of this windows, instead rotating around the hinge, windows pendant move to above. These wooden windows were built from walnut and red willow wood. The first aim of windows with color glasses is controlling sun radiation influx to inside the house. Because colored glasses have made from different material with distinct refractive index, the secondly creates perception of privacy (Fig. 10). Canopy is another climatic design element for controlling intensity of light inside the houses (Memarian 1998, Pirnia 2003). Canopies stand around the windows in horizontal and vertical form with depth 10-15 cm and made of brick or stucco (Fig 11).


Figure 10, 11. Orsi Windows in a massive wall. Canopy views.

Isolation: Creating an empty space between roof and ceiling created an air for controlling temperature. Ceiling was constructed in vault structure with vernacular material mud and brick, but from the outside the roof is flat. This diversity creates a good isolation in building (Fig. 12).

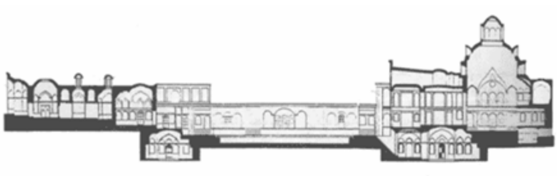

Figure12. The function of multistory roof and isolation

4. CONCLUSION

In this paper attempt was made to suggest a method for achieving of the sustainable architectural design based on vernacular architectural principals. Climate responsive design principals in hot-dry area of Iran were classified in three levels. In the first level, distance between buildings, enclosed urban environment and narrow and irregular streets were considered as macro strategies. Review and development of these traditional urban patterns should be considered in hot and dry cities. Medium scale strategies cover building form, building envelop, self-efficiency in materials and optical and thermo physical properties of building envelop in this paper. Sustainable architecture force us to re-think what we do and synchronize traditional methods of construction and the use of domestic materials. Finally, micro scale strategies demonstrate some more relevant architectural design methods which are the same as contemporary passive systems. The central courtyard must be capable of creating secure in houses or sustainable buildings in the Iranian culture. We present relations between central courtyard and sustainable architecture, and it concluded that the central courtyard is the best strategy to achieve sustainable and economic buildings. The building techniques of the hot arid climatic zones, developed over a long history of construction, have progressed to promote passive climatic conditioning to protect inhabitants from their harsh environments. Those ideas and techniques of city planning, building form, and constructions methods offer great insight to the contemporary designer of Middle Eastern desert architecture.

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IMAGE-BASED MODELING TECHNIQUES FOR THE CREATION OF HIGH-QUALITY TEXTURE IN LASER SCANNER MODEL: A CASE STUDY IN FRESCOED VAULT

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GABRIELLA CAROTI[2]
ANDREA PIEMONTE[2]

ABSTRACT

The new survey tools used in studies aimed to preserving architectural heritage often show some dilemmas. Several studies have been able to confirm that laser scanner surveys allow to obtain three-dimensional models of high accuracy in morphology and topological level. However, nowadays the quality level of colour obtained with laser scanners is not acceptable for high quality texturing. Moreover, high quality colour medels can be obtained through techniques of Structure from Modeling, but feature a lower precision of mesh, even though results obtainable by Computer Vision programs, make this approach increasingly viable. In this context, a case study is proposed on a vault located in the Palazzo Roncioni (Pisa, Italy) decorated with a important fresco painted by the painter Giovan Battista Tempesti in the second half of the eighth century. In this case, different tests will be carried out by Structure from Modeling techniques to have a high resolution texture applied to the model obtained with laser scanner, thus obtaining a model with high resolution texture and high quality mesh. This model allows to generate an accurate documentation of the vault for digital preservation and restoration studies.

Key words: Image-based modeling, Texture Mapping, Structure from Motion, Scanner Laser, Photogrammetry

1. INTRODUCTION

The new technologies for three-dimensional architectural survey - 3D laser scanner, Structure from Motion, etc. - allow the creation of highly faithful virtual models which, when applied to historical-architectural heritage, provide a rigorous documentation of its state as regards geometry, construction techniques and materials used. Applications of such new technologies are now widespread and well established in the framework of interventions aimed at restoration and preservation, as well as in widespread monument enhancement and promotion (virtual tours, digital communication projects, etc.) (Biosca Taronger et al., 2007; Wenzel et al.,

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2013; Guidi et al., 2010; Benedetti et al., 2010; Juan Vidal and Martínez-Espejo Zaragoza 2011; Merlo et al., 2013).
Besides, the potential of documentation and investigation has been increased by the development, in recent years, of new sensors and instruments, capable of either independent or integrated implementation; high performance digital cameras, multispectral, hyperspectral and thermal cameras, with ever increasing resolution, radar, etc. in fact, allow to gain a considerable amount of information, each one related to models derived from laser scanner which, after appropriate processing, are in fact an integrated platform for high-density information (Guidi and Remondino 2012; Adembri et al., 2011; Verdiani 2011).
These new investigating technologies are extensively used both globally, for the survey of the historic architectural complex as a whole, and locally, for the survey of the decorative and architectural details. Among them, the painted decorations (frescoes, surface paintings in general, etc.) are perhaps the most significant, but certainly more fragile, elements, receiving the constant attention of all the figures that in various capacities are involved in the planning and implementation of restoration and conservation (architects, administrators, engineers, art historians, restorers, etc.).
If in the past restoration techniques for pictorial work were based on a traditional inquiry by view, nowadays, with the advent of new digital technologies it is possible to achieve objective, three-dimensional, geometrically accurate data, to which all results of different types of investigation can be referred. New technologies have therefore given a strong boost to digital cataloguing, documentation of and monitoring of preservation state of painted decorations, so that availability of virtual models is now an essential tool in the development of heritage rendering.
It seems clear, therefore, that it is exactly in the phase transition from cognitive and investigative to operational that new technologies are required to interface and integrate with traditional techniques and methods of intervention.
For these reasons, restorers need to have a high quality documentation not only for metric purposes but also for colour. In this context, this work proposes a study of various techniques to apply high quality colour textures to laser scanner based models featuring high precision for topology and morphology.

2. STATE OF THE ART

2.1. Modelling

The last decade has witnessed the emergence of the laser scanner as a consolidated methodology to produce accurate high-resolution three-dimensional models (Lerma et al., 2011; Marambio et al., 2009; Dore and Murphy, 2012; Juan Vidal and Martínez-Espejo Zaragoza, 2011). In particular, this methodology has been applied in many case studies on historical, archaeological and architectural heritage with excellent results (Martínez-Espejo Zaragoza and Juan Vidal, 2012; Caroti and Piemonte, 2012; Bevilacqua et al., 2012; Caroti and Piemonte, 2008).
Compared to earlier methods (traditional discrete points survey with reflectorless total stations, 3D classic photogrammetric survey with manual stereo-rendering, ...),

laser scanning has allowed to obtain very detailed models with reduced field time. By contrast the cost of the instrumentation, both hardware and software, is high and office-based postprocessing is burdensome (a texturized mesh model requires about nine days of data processing every one day of field survey).
Lately a new technique, whose main data are sets of photographs of the object to be surveyed, is proposing to replace or supplement laser scanning methodology: Structure from Motion (SfM). This technique stems from computer vision sciences and is well integrated into the established procedures of classical 3-D photogrammetry (Lerma et al., 2010; Koska and Kremen, 2013; Guidi et al., 2010; Guidi and Remondino 2012; Rodriquez 2012), from which the techniques of optics calibration and the good practice of planning a rigorous geometric structure for pictures takes were borrowed (Wenzel et al, 2013; Alsadik et al 2013).
On the other hand, computer vision legacy includes the algorithms for the automatic detection of homologous points, in order to solve the collinearity equations and, therefore, to define the orientation parameters of the cameras.
However, even if software evolution in this field is very fast and the solutions are gradually higher performing in terms of processing time, amount of manageable data and obtainable precisions, SfM methodologies may not always be considered reliable. In fact, they show non-homogeneous precision, strongly dependent on the pattern present on surveyed objects, as well as the difficulty of having little control of the achievable accuracy at geometric and morphological levels (Guidi and Remondino, 2012; Appollonio et al., 2014).
As regards the latter, we can state that SfM systems fail to compare to laser scanning in terms of homogeneity of accuracy. So, if a metric strictness typical of very large scale (eg. 1:20 or greater) is required, the laser is probably the most suitable surveying tool for the time being.
In general, whether using laser scanning or SfM techniques, it must be emphasized that, if very detailed models at very large scale are needed, it is essential to proceed appropriately introducing different levels of detail (LODs) (Guidi et al. 2010). The idea of LODs originates from the concept of optimization of the model according to the intended purpose.

2.2. Texture

In many cases, particularly in the context of architectural survey, good quality, photo-realistic textures must be used to apply to the model.
These textures are not meant solely as aesthetic completion of the model but as an added tool allowing to better identify the details when using the model as an object of measurement.
In fact, after a texture has been applied to surface models, from the perceptual point of view the collimation of points is driven by the texture itself rather than the underlying geometry.
Applications involving the use of laser scanner or SfM models may require textures with the same level of geometric precision of the models they will be applied to.
These requirements are met by a few different surveying and rendering methods.
Many of the laser scanners have built-in cameras, whose relative orientation is calibrated by the manufacturer, which allow direct true colouring of the point cloud.

These textures are characterized by a high geometric accuracy, but the photographic take system usually does not achieve good results in terms of resolution and colour fidelity (Apollonio and Remondino 2010)
Simplified, realistic-looking models may not suffice for restorers, who require rigorous rendering in both morphology and colour information.
In these cases, it is essential to resort to a dedicated photographic campaign, taken with high quality cameras as regards optics, sensor size and post-processing graphics.
The traditional way to obtain textures from these photos is to derive camera features from a single take, generate the UV map using the so-called texture mapping (Guidi et al., 2010; Baldissini et al., 2010; Apollonio et al., 2010) of the projection of the single-frame model and finally unite the different partial UV maps to generate the texture of the model as a whole. Textures obtained in this way allow to have 3-D models featuring high quality for geometric, morphological and chromatic respects (Fantini et al., 2012).
On the other hand, this procedure is very time-consuming, also requiring constant operator intervention in the collimation of the points on the model and on photograms. In addition, software and procedures commonly used quite often do not take into account the distortion present on photograms.
In the case of SfM software, the creation of models and textures is pretty much contextual and the procedure usually involves the camera self-calibration which also takes account of characteristic distortion parameters. In these models, textures have usually good photographic quality, although, as we said in section 2.1, the overall morphological reliability of such models is not comparable to laser derived ones.

3. MATERIALS AND METHODS

This research proposes a different way to obtain texture models with high quality levels for geometry, morphology and colour, that takes advantage of the strictness of 3D models produced from laser scanner surveys, and of the quality of textures derived from sets of photograms oriented with dedicated SfM software.
The basic concept is to use laser scanner surveys as the geometric foundation. Regarding the texture, a campaign of dedicated photographs is completed and, rather than orienting and projecting each one individually, SfM software is used not so much for the model that it generates, as for its ability to automatically detect numerous sets of homologous points and to solve the problem of calculating the orientation parameters (camera features). Finally, the model generated by the laser survey is imported in the same SfM software used for camera orientation and the images are projected on it. As a case study for this methodology a frescoed vault under restoration has been chosen.

3.1. Object of the test surveys

The frescoed surface object of the survey area is a vaulted structure in a room on the ground floor of Palazzo Roncioni in Pisa, one of the finest examples of mannerist architecture of the city (Fig. 1).

Figure 1: frescoed vault, Palazzo Roncioni - Pisa

In addition to architectural merit, the building retains a rich array of decorative painting by Giovan Battista Tempesti, active in Tuscany and especially in Pisa in the second half of the eighteenth century, the author of important frescoes among which we can mention those in the music room at Palazzo Pitti in Florence, and the depiction of the Last Supper in the cathedral of Pisa.
The root of the geometric construction of the vault in question relates to the type of italian “a schifo” vaults, set on a rectangular plan of about nine by five meters, although not quite regular. The height from the floor of the top of the vault is about 6m. The fresco is largely preserved, save for obvious, recent gaps due to environmental degradation. The vault also shows widespread injury due to a failure of structural nature. The survey of the vault was required to allow for the documentation of the fresco in view of the restoration work taking place in some portions of the building.

3.2. Laser scanner survey
LeicaGeosystems’ C10 ScanStation has been used at two spots, located approximately 1/4 and 3/4 lengthwise and both along the centre across the room (Fig. 2 left). The resolution of the survey was set at 4mm at 10m, resulting in a very dense cloud (on average 70pts/cm^2). The point cloud is in true colours due to the laser scanner’s built-in camera.

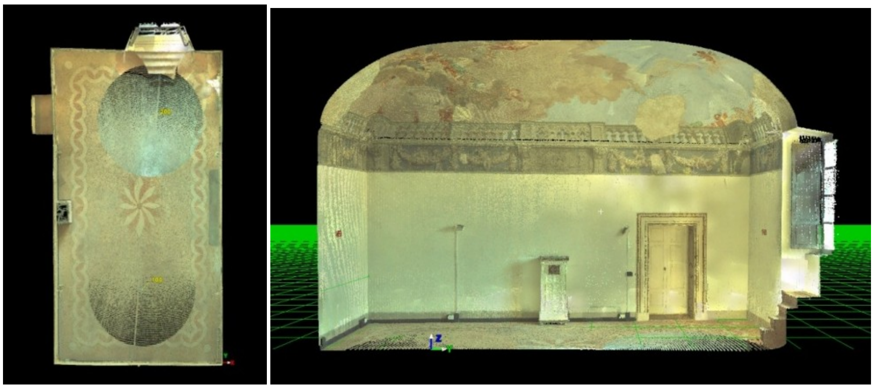

Figure 2: Plant (left) and geometric reference model derived from laser scanner survey (right)

After scans have been aligned by means of a support traverse, aided by the cloud constraint tool in the Cyclone software environment, the cloud point was processed by a reverse modelling software (Inus Technology Rapidform XOR3). In order to simplify the model where surfaces were smooth, a decimation of the points was performed, anyway preserving geometrical information that, however small, are valuable for restorers (local deformation, cracks, ...); finally, a mesh was generated. The model is constituted by about four million points and ten million triangles and is the geometric and morphological reference of the final model (Fig. 2 right).

3.3. Photogrammetric survey

The photographic survey was performed with a Nikon D700 SLR camera equipped with a focal lenght 20mm Nikkor lens. ISO sensitivity set to 400 enabled shooting at 1/25 second with 5.6 aperture, also thanks to the lighting provided by a set of two 2000 W halogen lamps with colour temperature of 5600K. The shooting distance was on average of 4.5m, that allowed single pixel coverage of about 2 mm. The camera and its lens have been previously calibrated. Table 1 shows the features of the camera and the results of the calibration.

Focal lenght	[mm]	20.62
Format size	[mm] [pixel]	36.00x23.95 4256x2832
Principal point	[mm]	X=17.95 Y=12.34
Lens distorsion coefficient	K1 K2	2.876e-004 -4.817e-007
Overall residual RMS	[pixel]	0.0854

Table 1: Sensor features and calibration parameters

3.4. Projection of individual images on the model

A methodology to provide models with colour maps consisting of photo-realistic textures is based on the projection of the individual photographs on the mesh.
Upon completion of the photo campaign, the steps to follow include the collimation of tie points in a reverse modelling software, the collimation of the same points to orient the images using photogrammetric software and finally the definition of the texture through a software for entertainment.
In the photographic take draft the surface of the vault has been divided in areas, characterized by almost constant curvature, in each of which photographic images have been acquired, keeping the optical axis close to the direction of the radius of curvature of the centroid of each area. The photograms must ensure full coverage of the object taking into account that only the central portion of each photogram is used in order to avoid residual radial distortion at the edges.
The processing procedure is the same for each photogram to be projected.
Considering the part in common between the photogram and the 3-D model obtained from the laser scanner, a set of tie points has been chosen with a distribution as uniform as possible. These are exported as coordinates in DXF format, using a point cloud management software of the laser model (eg. Rapidform XOR3, Fig. 3 left). These coordinates constitute the Control Points (CP) which the photogrammetric software (eg. PhotoModeler) uses to orient the photogram. Photogrammetric software is used to derive the image coordinates of the chosen tie points (Fig. 3 right); it is also possible to calculate the camera features along with the precision with which the various parameters were determined.

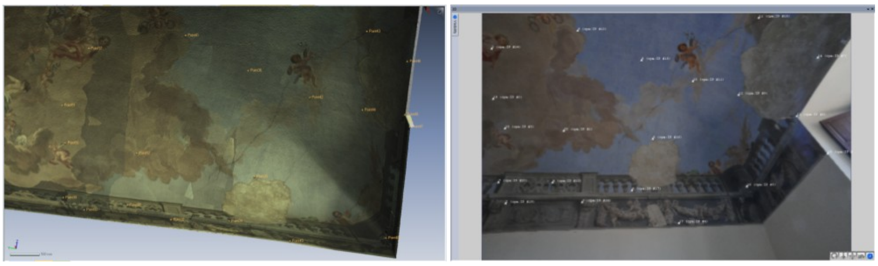

Figure 3: Homologous points on the 3D model (left) and the photogram (right)

Repeating this process for all the photograms yields the orientation parameters of the cameras, each of which is exported in a format compatible with the entertainment software used for texturing (eg. Luxology Modo - format * .fbx).
In order to texturize the model, once it has been imported into the entertainment software, the so-called subdivision surfaces model must be created (Fantini, 2012), and the related UV map is defined (Fig. 4).

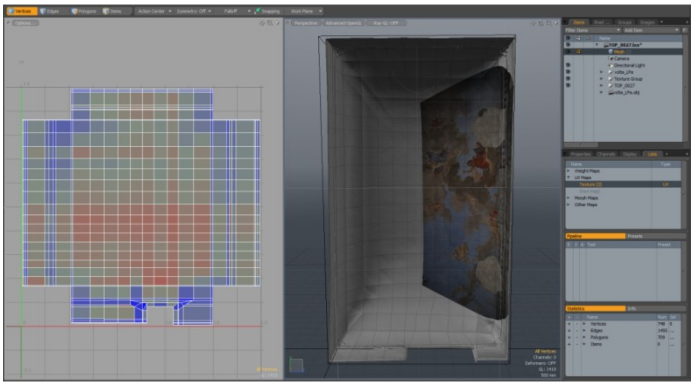

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Figure 4: UV map of the subdivision surfaces model with projection of a single photogram

By projecting individual photograms partial UV maps are obtained for each one (Fig. 5 left) where colour is applied only to the framed part of the vault. At this point, all partial UV maps have to be reprocessed with a photo editing software (e.g. Photoshop) merging them into a single image (Fig. 5 right). In this operation the different images must be processed to produce uniform brightness, contrast and saturation and select the portions of UV partial map that correspond to the central portion of the respective photograms to reduce the influence of the residual radial distortion. Finally the overall UV map is projected onto the laser model using entertainment software.

Figure 5: Partial UV map of a single photogram (left) and total overall UV map (right)

3.5. Creating a model with SfM software

Generation of the model through the SfM software was performed by means of a dedicated photogrammetric campaign. This is necessary because, while for texturing as described in the previous paragraph the photograms are just required to cover the entire surface ensuring a low mutual overlap, SfM software requires an overlap between photograms of at least 70% in both directions. In this respect, SfM software differ from classic photogrammetric software, where the processing is carried on by strips, and a greater overlap for adjacent strips is required only in the longitudinal direction. The new photo campaign was carried out with the same camera and the same optics as the previous one. The SfM software used in this test was Agisoft's PhotoScan 1.0.0. The development followed the steps provided by all software of this type: camera calibration, image orientation, dense point cloud generation, surface generation and texture mapping and visualization (Manferdini and Remondino, 2010).

The result of processing is a 3-D, high colour resolution model (Fig. 6 left), but with a lower quality mesh as for morphology and geometry (Fig. 6 center) compared to that obtained from processing of the laser scanner survey (Fig. 6 right).

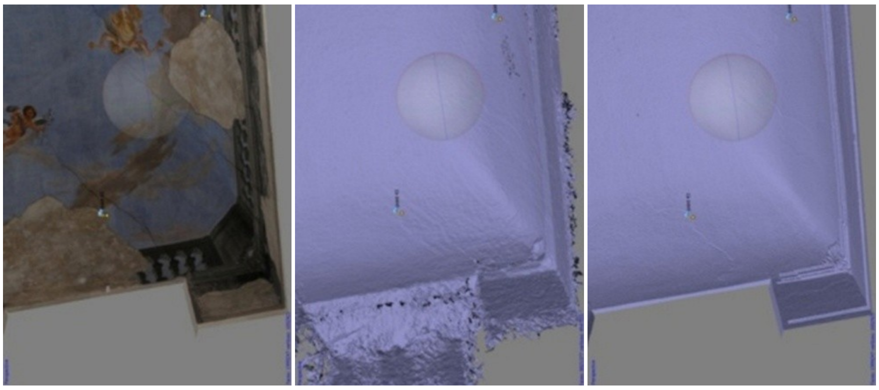

Figure 6: Texture from SfM (left), model from SfM (center) and model from laser (right)

3.6. Projecting the image-oriented on model laser models

It should be emphasized that the lower geometric quality of the 3-D model obtained with SfM software as described in the previous paragraph is to be referred to the ability of the method to faithfully reproduce local morphological changes at a small-scale rather than its ability to render the overall geometry of the survey object. Partial results of SfM modeling have been used, i.e. the camera orientation parameters, and images have been projected on the most faithful model obtained from the laser scanner. It should be emphasized that in order to use this methodology the two models must of course be framed in the same reference system.

The laser scanner model was then imported into SfM software and had the photo-realistic texture applied. (Fig. 7).

Figure 7: Laser scanner model textured via SfM software

4. RESULTS AND DISCUSSION

4.1. Projection of individual images on the model

The procedure of projection of individual images on the model (described in Section 3.4) was followed for the orientation and the projection of eight photograms. As regards the orientation it was based on an average of thirty tie points collimated on each photogram and on the 3-D model. The standard deviation of these points, after the orientation, resulted in an average of 4 pixels. It should be emphasized that completing all the steps of the process took about five working days for one person.

4.2. Geometrical comparison between the laser and the model by SfM software

Figure 8 shows the comparison between the two mesh models, one taken as a reference, obtained from processing of the laser scanner survey, and the other resulting from SfM software.
The latter model well represents the vault in its entirety (standard deviation equal to less than 3mm) but, being strongly dependent on the pattern present on the vault, is not able to ensure a homogeneous local precision in rendering small morphological variations. Greater deviations (variables in absolute value between 7 and 10 mm), coincident with cracks or margins of plaster collapse and gaps in the fresco, are quite obvious. Full knowledge of these geometries is important for restorers planning restoration or safety implementation works.
It is noted that the calculation of the orientation exterior of the cameras done through the SfM software is substantially correct as shown by the value of the mean reprojection error equal to 0.70 pixels on an average of 9000 tie points for each photogram. It should also be noted that the manual intervention of the operator in this procedure is limited to the insertion of the Control Points (10 points input for the test) that allow scaling and georeferencing of the model in the same reference system of the laser scanner. It should be emphasized that the process of creating the

model using SfM software and then calculating the orientation parameters of the cameras has required one working day for one person.

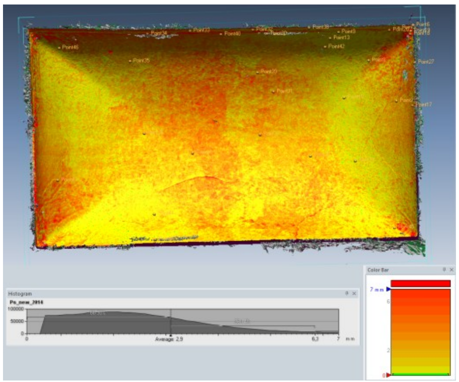

Figure 8: Distance in absolute value between mesh models obtained from laser scanner survey and from SfM software

4.3. Texture precision of final model

The laser scanner model coloured from the data of the camera integrated in the scanner itself may be considered as a reference for both geometry and 3-D texture placement. An analysis of the deviation of the 3-D position of points in the texture between the reference model and that obtained by projecting photograms oriented with SfM software has been subsequently carried out, involving a set of 20 points evenly distributed on the vault and resulting in a standard deviation of about ±3.5 mm.

5. CONCLUSIONS

The proposed methodology allows to obtain a 3-D model featuring the geometric strictness of laser scanner surveys and the quality of textures obtained with photographic survey campaigns.

The most interesting aspect highlighted by the application of the methodology proposed is considerable savings in terms of time and resources compared to the traditional methodology of orientation and projection of individual images on the model. In addition, from the point of view of positioning precision of the textures both procedures displayed roughly the same accuracy.

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INNOVATION TECHNOLOGIES IN GREEN BUILDINGS AND CERTIFICATION

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ABSTRACT

For a sustainable world, recent awareness depending on the depletion of the Earth's fossil resources and global warming due to high CO_2 emissions has impacted building design and construction methods; thereby the green or ecological building concept has emerged. In order to evaluate and categorize green buildings, some evaluation systems were constituted. One of them is accredited LEED certification system (Leadership in Energy and Environmental Design). LEED has silver, gold and platinum certification levels classifying the characteristics of green buildings. In the stages of design, construction and service life, the sustainable building design should satisfy the prerequisites of LEED certification system on sustainable site development, water savings, energy efficiency, materials and resources selection, and indoor environmental quality. The renewable energy sources (wind, solar, geothermal heat pump etc.), efficient lighting, recycling/reuse of resources and materials, and waste recycling should be maximized to ensure the low environmental impact in building technologies. In this study, typical current and innovative technologies in the design of ecological buildings are handled by referring the buildings having LEED certification on different levels.

Key words: LEED Certification, Innovative Building Materials, Building Technologies

1. INTRODUCTION

In a world with an ever growing population, while energy requirements are increasing, limited resources are diminishing. Renewable energy sources (wind energy, solar energy, biomass energy, geothermal energy, etc.) have minimum impact on environment. Global warming and related depleting non-renewable energy sources (oil, nuclear power, coal, and natural gas) force the scientists to focus on environmentally friendly energy resources. Recycled materials as well as

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optimization of water use are other important issues for a global sustainability. Innovative technologies for a sustainable world should be addressed more and more.

The main purpose of this study is to investigate the special features of innovative building technologies (wind and solar energy; heating, ventilating and air conditioning systems; lighting systems; optimized water material use) as well as the certification system of Leadership in Energy and Environmental Design (LEED) to promote sustainable building design.

2. GREEN BUILDING CERTIFICATION SYSTEMS AND LEED

Green building has a lighter footprint on environment and comprises the issues such as energy, water, material efficiency and minimum waste in the design, production, operation, maintenance and demolition removal phases in the life cycle. Various green building certifications (DGNB, BREEAM, CASBEE, and LEED) have been used since the end of 20th century.
The LEED environmental certification by U.S. Green Building Council (USGBC) is most popular and reliable protocol used in over 40 countries. USGBC defined four levels for LEED: Certified, Silver, Gold and Platinum. LEED v4 (2013) is the last version (USGBC 2014). However, teams may still register the projects under LEED v3/2009 until June 1, 2015. LEED v3 has 7 categories: Sustainable Sites, Water Efficiency, Energy & Atmosphere, Material&Resources, Indoor and Environmental Quality, Innovation in Design and Regional Priority) over total 100 points. There also have 6 possible points in Innovation in Design and 4 points in Regional Priority.

3. FEATURES OF INNOVATIVE BUILDING TECHNOLOGIES

In this section, innovative technologies in green buildings are focused by addressing certificated buildings.

3.1. Wind Energy

Wind energy could be converted to mechanical energy through the wind turbine up to the rate 50% (İlkiliç and Türkbay 2010). Worldwide wind turbines installed by the end of 2013 can provide 320 GW and 628 TWh consumptions per year (BP Statistics 2014). This consumption is 2.7 % of global electricity generation. Denmark, Spain, Germany and Portugal are the leading countries in the base on daily wind energy per person (Girgin 2012).
Wind turbines in building are used more and more. Prediction of wind velocity and direction, and orientation of building are important parameters. Two main concepts of wind turbines are under consideration: the horizontal-axis turbines (HAWT) and the vertical-axis wind turbines (VAWT). Three-blade HAWT turbines are popular due to smoother rotational operation and cost efficiency. As a typical example, the massive three-blade 65kW wind turbine on 37 m mast in the site of Alberici

Corporate Headquarters (2005, LEED Platinum) provides 92 MWh as ~20% of annual energy needs [1] (Fig.1a).VAWT system has the advantages such as lower noise / vibration levels, operation ability in lower wind speeds. In addition, this system does not need to be pointed into the wind which is important in urban areas due to highly variable wind direction and local turbulences.

In addition to wind farms, to design wind turbines in urban areas becomes popular in middle-rise buildings. Mast mounted turbines on the roof (Fig.1b, c) maybe seems to be a cost effective solution but not a very aesthetical solution. The connection of two buildings with wind turbines in Bahrain (World Trade Center, 2008), building integrated five-blades wind turbine in London (Strata Building, 2010), and finally mounting wind turbines into tunnels through a tall building in China (Pearl River Tower, 2012) are pioneering solutions (Fig.2). 225-kW three turbines in Bahrain World Trade Center satisfy 11-15 % of total energy demand, that this quantity (~1200 MWh) is equivalent to lighting of 300 homes per year [2], in the 4-20 m/s operation limits of wind velocity [3].

Integration with building involves complex design techniques due to high aerodynamic noise levels, radio/TV interference due to electro-magnetic forces and the vibration which necessitates damped bearings to isolate building. RC structure option and to install VAWT to mechanics floor may give suitable solution.

Cost and energy efficient turbines with less noise and vibration levels as well as integration with architecture become the main issues. Façade integration, double roof or funneling concepts through Venturi effect [4] are new ideas for building architecture as well (Fig.3a, b).

3.2. Photovoltaic Systems

Current worldwide photovoltaic power (PV) capacity is 140 GW, i.e. 125 TWh (2013) (BP Statistics 2014) corresponds to only 0.5 % of global electricity generation. Germany is the leading country in the base on daytime solar energy per person (Girgin 2012).

Photovoltaic materials include silicon, gallium arsenide, copper indium diselenide, cadmium telluride, indium phosphide etc. PV cell can be a mono-crystalline, multicrystalline or amorphous (Kalogirou 2014). Solar cells are mainly categorized into three different types. Inorganic solar cells are first generation, organic solar cells (OSCs) and dye-sensitized solar cells (DSCs) are second generation and hybrid solar cells (HSCs) based on nanostructures are considered for third generation. The power conversion efficiency of first and second generation solar cells were ~25% (silicon) and ~20% (copper indium gallium di-selenide) at lab scale (Babu et al. 2014). Copper Indium Gallium Selenide (CIGS) PVs are a promising technology with moderate efficiency, low cost and light weight characteristics for rooftop installations both in residential and commercial buildings. It is expected nano cells to be commercially available within the next few years, by tremendously reducing cost.

Building-integrated photovoltaics (BIPV) either in the façade and/or roof of the building are the typical application of PVs (Fig.4a, b, c). To prevent additional thermal load and efficiency loss, a gap is created between the PV and the building element (brick, slab, etc.) for air circulation. PVs are recently used on external automated shading system moving around on tracks (Fig.4d, e).

In PV systems, generator is used for deep charge the batteries a few times annually to extend their lifespan or to charge the batteries dropped below a critical ratio (e.g. 20%).

If the construction site is not near electricity lines, a zero energy building can be designed as off-grid system; e.g. Audubon Center, LA (LEED Platinum) gain 110.5% energy (demand is 55 kWh/m^2 per year) via roof- mount via 25-kW polycrystalline off-grid PV system (Gevorkian 2008). Energy need of the building can be provided by battery cells during four or five winter days without direct sun light.

3.3. Heating, Ventilating and Air Conditioning (HVAC) Systems

Automatically operable windows by monitoring outside weather conditions, carbon dioxide (CO_2) monitors to adjust necessary airflow levels throughout the building, under floor air-distribution system supplying air at the level of the occupants are the some characteristics of green buildings.
Blocking north face of building with masonry walls is a good and well known way to save indoor heat. Double façade helps the building maintain its thermal conditions by trapping heat that is radiated from the building and blocking solar heat. Reflective surfaces are used to reduce heat absorption and cool the air.
Low-grade waste steam from neighboring cogeneration plant can be exchanged to heat or used to drive chiller for cooling instead of electricity to reduce energy costs.
Orienting wind through funnel (Venturi effect) by flowing toward open atria on the roof is another innovative method for ventilation (Siemens HQ, Masdar City, LEED Platinum, 2014) (Fig.3a, b).
Temperature and humidity monitors maintain optimal thermal comfort, indoor reflective pond and plants also regulate humidity levels naturally. In addition to outdoor green walls as well as green roofs are organized to reduce heat gain and loss in building. 20 m living wall of atrium in La Maison Du Développement (LEED Platinum, 2013) (Lagace 2014) is a special example to indoor applications (Fig.5b).
Geothermal wells are installed underneath the building (e.g. Clock Shadow Building, 2012, LEED Platinum) to efficiently remove heat from the building. In La Maison Du Développement (LEED Platinum, 2013) on the total area of 6350 m^2, 28 geothermal wells (14 kW) were drilled down to 152 m to satisfy nearly 100% of the heating and cooling requirements via geothermal energy (Lagace 2014). Siemens HQ (2014) has the deepest one of 2.5 km [5].

Pond with aquathermal heat pump system can be used for heating during the winter and cooling in the hot summer. 37 % reduction in energy cost was predicted in Saginaw Valley State University (2008, LEED Silver) over 5 ha manmade pond (Thompson and Kerbelis 2013).

Combined heat and power system (CHP) (SUNY-ESF's Gateway Center, LEED Platinum, 2014), is a new alternative to provide steam and electricity in green buildings due to minimal waste output and efficiency twice according to traditional technology by using biomass in addition to other energy sources well [6].

In the near future, it is thought that a technology called "Enhanced Geothermal Systems" would be attainable that involves drilling at least down to 10 km in a similar way to oil exploration techniques [7].

3.4. Lighting Systems

South-facing rooms for daylighting, blocking west-facing windows via masonry wall are known solutions. Work places can have almost fully natural lighting. Computer controlled shades and louvers optimize the amount of daylight brought in and prevent glare (Fig.4d, e and Fig.6a, b) in ecological buildings. Innovative shielding system in Al Bahar Towers requires less artificial lighting and 50% less air conditioning (Fig.6c).

Roof mounted mirrors, heliostats, fiber optic system directing the daylight into the building through skylight and sun pipe system delivering daylight up to 14-story (Fig.7a, b). Tertiary mirrors are typical natural lighting techniques nowadays (Fig.8a). The reflective pool in the atrium or the reflective panels on atrium walls are light distributing mechanisms as well. Milled acrylic prisms can be used to enhance reflection, diffuse light, prevent heat absorption and eliminate glare due to halogen lights at night (Genzyme Center, LEED Platinum, 2003) (Fig.8b).

3.5 Material Usage and Impact on Environment

It is a well-known reality that the cement sector is responsible for ~7% of global CO_2 emissions. In order to decrease this emission in huge construction sector, innovative techniques such as to change the raw material $CaCO_3$ with $MgCO_3$ or to produce concrete without cement via 100 % fly ash are under development. In view of structural systems, the embodied carbon emission to ultimate strength ratios (Fig.9) (Kuruscu and Girgin, 2014) reveal the importance of recycled material utilization instead of virgin one (e.g. steel, aluminum) as well as green concrete and masonry blocks by partially replacing cement with waste by-products such as fly ash, blast furnace slag, rice husk ash etc. Recycled aggregate usage, to put waste tire pieces as aggregate into concrete, to apply CO_2 cure to masonry blocks (Fig.10) and to use chemicals absorbing emissions in concrete decrease environmental impact. Some applications such as illuminating concrete and translucent concrete provide aesthetical solutions to save lighting energy in indoor and outdoor applications (Fig.11).

Wooden composite structures from renewable and certified forests are currently being constructed to reduce CO_2 footprint more and more. Formaldehyde-free glues and paints in wooden composites are used to prevent health problems in humans (Fig.12).

Building materials from local sources in high ratios and water-based finishers reduce impact on environment. Nearly total waste of construction or demolition should be diverted to landfill, reuse, donate or recycle.

Green roof by planting an insulated roof membrane assembly (IRMA) is a wide spread application in green buildings. Moisture sensors installed in the soil (inside and outside) is a good solution to eliminate unnecessary watering (Fig.13a). In Alberici Corporate Headquarters won the highest LEED rating (60 over 69 credits in six categories in 2004), rainwater from the garage roof is collected in retention ponds and used in the building's cooling tower and sewage conveyance system (Fig.13b). Thus, less water consumption up to % 70 is possible via rainwater collection and other preventions.

4. CONCLUSION

Innovative technologies progress toward min. energy requirement and almost full usage of recycled/reusable materials in buildings. Zero-energy building, 70 % less water consumption, ecofriendly recycled/reusable material in high ratios, 100 % lighting of work places are possible in current green buildings certified by LEED.

Renewable energy technologies such as solar panels, geothermal wells, wind turbines are under progress. Although initial capital cost in green buildings is relatively high, especially lifetime energy expenses are less compared with conventional buildings. However, sustainable buildings should not be designed not only to be registered by LEED but also should be affordable for common housing by people as well. It is suggested that the credit in LEED for Innovation in Design can be encouraged with higher points than current 6 points to provide the development and use of innovative technologies.

4.1. Figures, Graphics, Photographs and Tables

a.  b.  c. 

Figure 1: a. Alberici Corporate Headquarters (USA, 2005), b. Hafencity (Germany, 2014), c.Twelve West (USA, 2009) c. [8, 9]

a.  b.  c. 

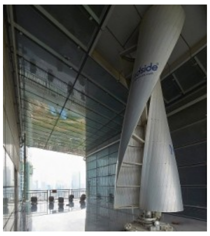


Figure 2: a. Bahrain World Trade Center (Bahrain, 2008), b. Strata Tower (London, 2010), c. Pearl River Tower (China, 2012) [10-13]

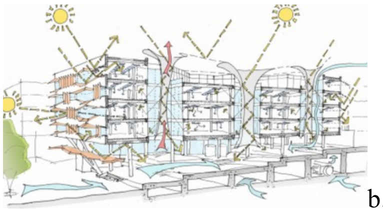
a.  b.  c. 

Figure 3: a. Sketch of ventilation and Venturi effect in Siemens HQ (UAE, 2013), b. Orientation of voids for Venturi effect, c. A typical exterior shaft [14, 15]

a.  b.  c. 

d.  e. 

Figure 4: Building-integrated photovoltaics (BIPV) in the façade and roof [16-20] :

a. Colorado Court (USA, 2002), b. Water and Life Museum (USA, 2007), c. Media-ICT Building, (Spain, 2011), d. Solar Fabrik Headquarters (Germany, 2005), e. Shadovoltaic panels


a. b.

Figure 5: a. Green roof of the Vancouver Convention Center (Canada, 2009), b. Atrium with living wall [21, 22]

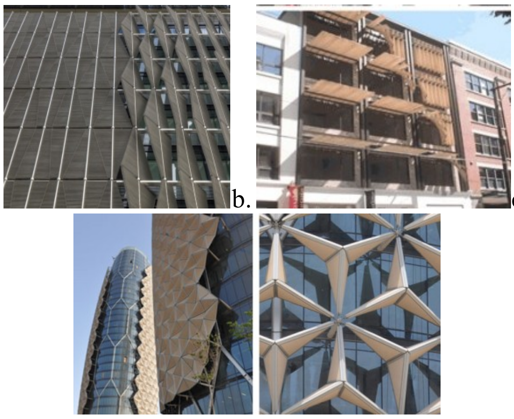

a. b. c.

Figure 6: Computerized panels : a. Kinetic façade b. ThyssenKrupp Quarter Essen Building (Germany, 2010) façade, [23-25], c. Al Bahar Tower, overall view from the north and folded panel view

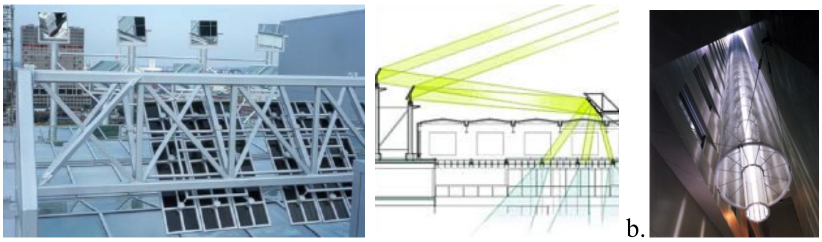

a. b.

Figure 7: a.Roof mounted mirrors (heliostats) directing sunlight into the building through a skylight, b. A 14-storey height sun pipe [26, Mayhoub 2014]

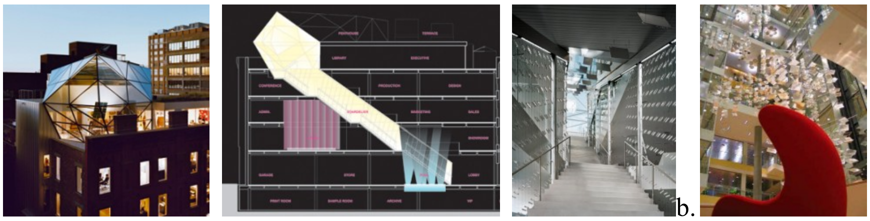
a.  b.

Figure 8: a. Tertiary reflective mirrors (Diane von Furstenberg (DVF) Studio-USA, 2007), b. Milled acrylic prisms in Genzyme Center (USA, 2003) [27, 28]

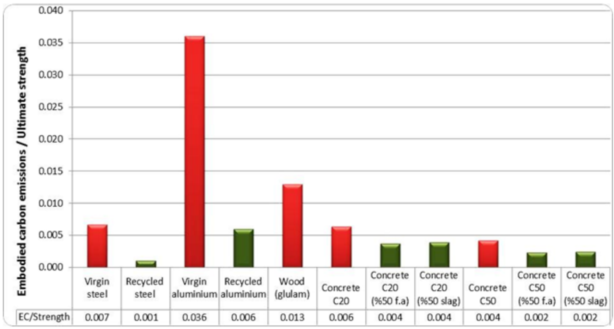


Figure 9: Embodied carbon emissions to strength ratios in structural materials (Kuruscu and Girgin 2014)

a. 

Figure 10: a.Recycled aggregates, b. Concrete with rubber pieces, c. CO_2 cured concrete masonry blocks [29-31]

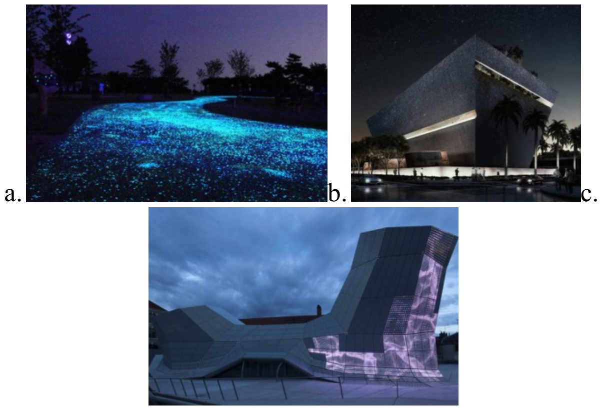


Figure 11: a. Illuminating concrete pathway, b. Transcluency in Fairholme Capital HQ (USA) and Les Turbulances-Frac Center (France, 2013) [32-34]

Figure 12: a. Certified forests, b. A typical wooden composite structure (Olympic Oval, Canada, 2008), c. Formaldehyde-free painting [35-37]

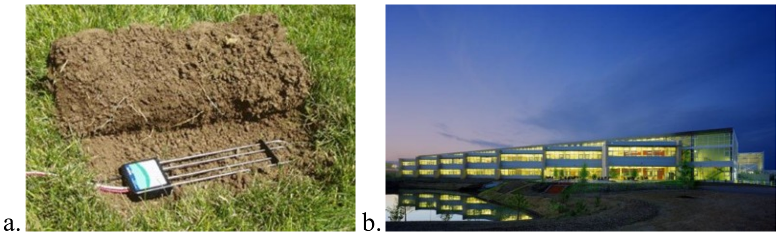


Figure 13: a. Moisture sensor b. Alberici Center Headquarters and rainwater pool [38, 39]

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KEYNOTE SPEECH

(20 November 2014 Thursday, 15.30-16.00)

Prof. Dr.Mattias KÄRRHOLM

"Territorial Production and the Temporal Use of Public Space"

TERRITORIAL PRODUCTION AND THE TEMPORAL USE OF PUBLIC SPACE

MATTIAS KÄRRHOLM [1]

My aim with this text is to present territoriality as a way of discussing spatio-temporal aspects of everyday urban life, with a special focus on urban and material design. I will start by introducing a conceptual framework that enables an analysis of the territorial structure of public space at a micro level. I then go on to present an empirical study of the urban square Stortorget in Malmö, Sweden, discussing how architectural and urban design play different roles in the production and territorialisation of time-space. Finally, I discuss how (and why) a time-space territorology, can be used to investigate and describe the role of urban design in the shifting and transformative power relations of an ongoing everyday life.*

The concept of territoriality is well known in research, and has been used in a wide range of different disciplines. For some reason it has never been very popular in architectural research, where other spatial concepts such as place, space, site and zone, often have been preferred. The concept of territory has a long history and a wide variety of uses. It has its origin in the Latin word *territorium* which was used to mean the area surrounding a roman city, but also used to mean those foreign states that had connections with the Roman Empire. The word is sometimes thought to come from *terra*, meaning earth (and territorium meaning, that which belongs to earth). Sometimes it is said that it might come from terrere (which means to frighten) or tererre (to step on). Looking through the literature on territoriality one can see that it has two primary uses, one within the behavioural sciences and one within the social sciences. The concept began to be more widely used in the behavioural sciences during the 1960's and was then used to indicate the claiming and defending of space (in Swedish often distinguished as *revir*, and in German as *Revier*). The concept was first influenced from zoology and ethology, where it had been used at least since the 1920s in order to denote animals marking their territory (for example, the territorial singing of birds). In studies of human territoriality, however, research soon became more interested in spatial claims that were not actively defended, but even so perceived as owned in some sense. In the social sciences the use of the concept goes back to its Roman origin, and is used (for example, in political geography) to denote spatial strategies of power, for example the delimiting of land into nations, municipalities, regions, etc.

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So why is territoriality of interest to architects and planners? Simply because architecture and urban design play important roles in the production of territories and territorial effects. If we want to use territoriality as a way of analysing or discussing architecture one might, however, need to change the perspective on territoriality slightly. Traditionally, both within the social and behavioural sciences, territoriality has been studied from the perspective of a privileged actor, whether that actor is an individual, a group, a community or some kind of institution. Focus has been on the 'master' of the territory: who is establishing it and why? Another perspective would be to start from place, in an effort of describing the territories that are effective at that place. What territorial power relations can we find, and how do the territorial effects come about? Looking at it from this perspective one can often note that the attribution of a territory to just one actor, or one 'master of place' is not always easy, or at times even possible. Instead there are a lot of people, things and designs that together produce the effect of a certain territory. Territorial power is in short the result of complex relations between humans and non-humans. The built environment is often co-producing the territorial productions of the urban landscape – walls, lines, markers and doors are important parts in shaping and stabilising territorial power.

Territories are produced everywhere. They can be stable or unstable, they can be long lasting or just temporary. In order to more fully describe different territorial productions it could be useful to distinguish between different modes of production. First there is the intended production of a territory, where you deliberately delimit a certain space as a means to some end. This intentional production could be done either by territorial strategies or territorial tactics. Territorial strategies represent impersonal, planned and to some extent mediated control, and often involve the delegation of control to things, rules, etc. Territorial strategies are always planned at a distance in time and/or space from the territory produced. All planned spaces involve some territorial strategy, from playgrounds to parking lots. Territorial strategies also have a temporal side to them, that could be made more or less salient. Strategically produced time-spaces could, for example, include the opening hours of shops, parking garages, or the operating hours of factories. Territorial tactics refers to a more personal relationship between the territory and the person or group that mark it as theirs. This includes situational and more spontaneously produced territories, i.e. more unofficial or informal tactics, such as the temporary marking of a chair at a café with ones jacket or scarf. This might also include micro-situations such as the emission of certain phatic utterances, intended to stall for time and keep one's audience quiet and attentive while attempting to finish a thought, or somewhat more stable procedures, such as setting up one's tent for the night, personally claiming a certain time-space in a public park.

Besides intentional strategies and tactics, territories can also be produced in a more indirect manner, through associations and appropriations. Territorial associations and appropriations represent productions that are not planned or intentionally established, but are consequences of established and regular practices. These practices may be the effects of rational and planned decision; but not with the explicit intention of producing a territory. Territorial appropriation produces territories through the repetitive and consistent use of an area by a certain person or group who to some extent perceive this area as their own. The object of territorial appropriation could, for example, be one's home, one's street or one's regular table at a restaurant. Appropriation thus often includes a territorialisation "through time", but can also ensue during a very short period of use. Taking a seat for a lecture, for example, often implies an appropriation of a time-space. This would become noticeable if the place in question were contested: if the seat were taken by someone else during a short coffee break, one would probably be left with the feeling that one's seat had been taken ('but, that seat was mine, at least until the end of the lecture!'). The object of territorial association represents an identifiable area, characterised by a certain usage and those specific conventions and regularities that underpin this usage. These areas do not necessarily have to be considered by any person or groups as 'their own', but are nevertheless associated by others as pertaining to a certain function or category of users, and could for examples include 'bathing places' or 'climbing trees'. A lot of places in the city are associated with a certain behavioural regularity that involves both time and space: activities such smoking a cigarette, walking a dog or going to the toilet are often connected to a certain spatial and temporal extension. If you stand in front of an ATM, you are expected to use that space during the time it takes you to withdraw money. If you use it too long or incorrectly – for example, as a place to eat your lunch – protest would probably ensue. If one starts to look around for territorial productions one soon notices that one space is often layered with several different territorial productions, so there is not just one territory for each space. A lot of spaces in the city are thus associated both with a specific use and an approximate or 'proper' duration of that use, whether it is the pedestrian crossing or the table of an outdoor café. The spatio-temporal 'borders' or limits of associated or appropriated time-spaces might not be clearly expressed or settled (as in tactics and strategies), nor might they be agreed upon, but they are there, and at some point they might be contested, or it might simply become clear that a particular time-space situation has come to an end or been transformed into something else: 'It is ok to take the seat, I was finished anyway'.

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The four different forms of territorial time-space production discussed above, will now serve as a basic way of describing the territorial landscape of Stortorget in Malmö and its changes from 1978 to 2013. The square, Stortorget, was inaugurated in 1530s, and it was then largest square in Northern Europe measuring c:a 140 * 140 meter. The square has a long history and is an important and emblematic space for the city of Malmö (a city situated in the south of Sweden of approximately 300.000 inhabitants). In 1978, Korosec-Serfaty (1982) did a thorough study of the square observing its everyday activities. Malmö was in the late 1970s an industrial city in crisis with a declining population. Perla Korosec-Serfaty study of Stortorget in Malmö, *The Main Square, Functions and Daily Uses of Stortorget, Malmö* (1982), summarizes a large empirical work made by "Study group on public squares" in 1978. This was around the time that the pedestrianisation of Malmö inner city started. Malmö was in the late 1970s an industrial city in crisis with a declining and ageing population. Today Malmö is a growing city and it is, together with Copenhagen, part of a large and growing European urban region. Comparing

Korosec-Serfaty's results with how the square is used today (2013), 35 years later, shows some interesting differences when it comes to territorial production.

First, it should be noted that the square of today looks remarkably similar to the square of 1978. The benches have a new design but are still there, a kiosk has been substituted for another one. In terms of more permanent territorial strategies (the roads, a statue, a fountain, a large parking lot, a pedestrianised area) things remains similar. One difference is, however, the introduction of temporary outdoor restaurants which today takes more than 600 sqm of the square. Another is the proliferation of temporary planned large-scale events. In 1977, most of the (167) newspaper articles reporting from the square mentions political gatherings and activities on the square (26 %). In 2012, the articles (119 all in all) tend to focus on collective celebrations (23 %). The new collective celebrations tend to be quite large scale week-long events such as *Malmöfestivalen* (the city festival) and *Musikhjälpen* (a fund-raising event), with concerts and cultural performances. A study made by the municipality of Malmö in 2008 shows that this eventalisation of the square also seems to be welcomed by the inhabitants (Malmö Stad 2008). In line with the process of eventalisation, a lot of the stores that were there on Stortorget during the 1970s (selling everyday things) have disappeared or given places to cafés and restaurants. Although the pedestrian precinct with hundred of shops starts here, the square itself has today just five shops (but fourteen in 1978). Perhaps this can be seen as signifier of how the square now is being turned into a specialized space for events – territorial strategies of a temporal nature, often dominating the square as a whole. In short then, the temporary territorial strategies have been added to the square together with a territorial association of the square as a place of events. What about territorial appropriations and tactics? One way of looking at this is to see changes in how people cluster on the square of people. From the comparison of an observation study made in 1978 (of 901 clusters) and that of a study made in 2013 (of 2079 clusters), one could see that the ratio of women walking alone has increased from 18 to 29 percent, although the square is still somewhat dominated by male presence. In terms of clustering one interesting change is that the number of adult couples has decreased with c:a 30 % and so has the number of people in groups of 3 or more adults. People primarily tend to appropriate the square on their own.

Comparing photographic studies of 1978 and 2013 (listing 4341 and 13798 users respectively), one can see that there is a smaller percentage of people sitting on the square today as the ratio of sitting people has gone from 45% to 21%. A higher percentage is walking and also a somewhat higher percentage is taking shorter breaks on the square. In all it seems as if people spending shorter time on the square on a regular day, people take shorter breaks (most of the talking on the phone, texting or taking photos), and tend to sit less and walk more. Although people certainly spend a lot of time on the square during the large and planned events, one could argue that it has become increasingly rare for larger groups to temporarily appropriate the square for non-official uses.

The territorial association of the square as a place of official activities would appear to have given way to the square as a place of events. The dominating role of the rhythms of the industrial city – including the role of the male-dominated workplaces the retired people on their benches, the busy weekday rush hours and the calmer weekends – have, to a certain extent, been replaced by rhythms more strongly associated with consumer society. Stortorget thus seems to have found its role as a specialised place within the pedestrian precinct of Malmö. With a decreasing number of permanent activities, a faster pace and shorter pauses from temporary activities on the one hand, and an increasing frequency of prearranged temporary events on the other, Stortorget has come to play a double role. The square facilitates movement to, from and through the pedestrian precinct. Sometimes, during large events, it works as a strong and highly accessible if temporary magnet, but otherwise it acts as a facilitator of movement to other places than the square itself. The duration and ratio of temporary appropriations and tactics seem to have decreased since the 1978 study; instead, a larger ratio uses the square purely for thoroughfare movement. Furthermore, the temporary stays that do take place tend to be made more by individuals and less by groups, less by residents of the city centre and more by tourists, visiting shoppers and those eating lunch. The general pace has changed as well; and the activity during the working week tends to be more intense, its timeframe undergoing expansion with a colonisation of evenings and weekends. All these territorial changes are traceable at different temporal scales. The number of small artefacts and objects moved about and used on Stortorget has also increased, and these seem to affect the temporary use as well as how visitors temporarily claim space by way of tactics and appropriation on the square; for example, pausing while standing rather than sitting down. On a larger temporal scale, the role of territorial strategies in the form of advertisement campaigns, outdoor restaurants and large-scale events, lasting from a week to a whole season have increased.

Even if the material design and outline of Stortorget is fundamentally the same today as in 1978, the role of the material figures on the square has undergone transformations as human behaviour has changed, and new artefacts have come into play. For example, the podium of the statue of the riding king, located at the centre of the square, has become more important for eating, the Town hall benches for resting with bags, and the fountain has become more important for pausing with cell phones and cameras. The built environment of Malmö's Main Square might thus look the same today as in 1978, but the timespaces produced here do not. Counting territorial productions, it is perhaps impossible to discern a greater variety today, i.e. when it comes to the range of different time-space territorialisations. However, territorial complexity has decreased due to the increasing dominance and stabilisation of certain types of territorial productions (people walking by, scheduled events, etc.) and also due to an increase in verticality, where certain territorial strategies (such as major events) are made to manage a series of others.

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One of the main points of the study above is to try to see public space as a complex, sensitive and transformative ecological system of territorial productions. Theories of urban design have often shown a tendency to address public life as a homogenous and general phenomena (e.g. Hillier 1996, Gehl 2010) where connections between isolated categories are made into universal truths, like: "doubling the amount of bench seating meant doubling the number of people seated" (Gehl and Svarre 2013:111), or that "spatial configuration correlates powerfully with observed movement by both pedestrians and drivers" (Penn 2003:31). In one way or another, this approach has been dominant in public life studies from Jane Jacobs to Jan Gehl. Although full of good intentions, the effects of methods such as Gehl's and Hillier's seem to be an urban designs promoting homogenisation and universalisation. The present study seems instead to suggest that one must take more generic recipes for public space design with a grain of salt. The material figures of Malmö's Main Square are largely unaltered, but their actor roles change as they get new associations. A thorough development of a time-space territorology might be one way of studying public space use as a complex system, acknowledging that the territorial production of time-spaces are never static or independent, but always relational, interdependent and entangled in transformative processes. In studies of material culture, discrete objects such as clothes has been showed to play a fundamental part in how we use public spaces and the city (see for example Banerjee et. al. study of the Indian sari, 2003, or Sixtensson's study of women in veil in Malmö, 2009). The division of labor between researchers of urban design and morphology (focusing on buildings, streets, etc.) and researchers of material culture (focusing on artifacts), has unfortunately often resulted in that materialities are handled in different discourses depending on size rather than their role in a certain situation. One aim of a time-space territoriology is to map actors and objects based on their relevance for the territorializing situation, and this will necessarily includes actors, practices, materialities etc. of different sizes and relating to different scales. Material factors are indeed vital for the understanding all forms of co-existence. For example, our time is always shared with objects, things that perish – batteries that run out, coffee that gets cold, food that gets eaten, etc. Activities like texting, smoking and reading takes, time and demand the territorial appropriation or tactics of a time-space. Things – and this goes for all objects: a square, a bike, a cell phone, etc. – have their own autonomy, and thus also bring difference to situations in public space. However, the relation between materiality and use is never a simple one, it cannot be isolated as a direct relation between means and ends, or objects and subjects, instead it must be studied as part of an 'ecological' and multi-scalar landscape.

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SESSION 3

20 November 2014 Thursday, 16.00-17.15

Chairperson: Prof. Dr. Michael U. HENSEL *(Invited Speech)*
Schools of Thought - Local Specificity and Questions of Identity"

GLOBALIZATION FACING IDENTITY: A HUMAN HOUSING AT STAKE - CASE OF BAB EZZOUAR IN ALGIERS

MAKHLOUFI LILIA[1]

ABSTRACT

The commune of Bab Ezzouar is situated in the nearest periphery of Algiers and symbolizes a residential zone par excellence. The commune corresponded to a big place of accommodation with a predominance of rental public housings, social participative housings and particularly renting-sale housings realized by Housing Improvement and Development Agency (AADL). The aim of this housing policy is to establish equity and social cohesion. Nevertheless, it appears difficult to escape a repetitive architecture, considering the rigorousness of the economic system of the construction and the constraints due to the prefabrication process. The ideology of globalization would like that sooner or later no one escapes living in the same way, to satisfying some identical needs and to constructing similar cities. However, the real-life experiences prove to be more complex. Better, the inhabitants resist to the homogenization. Bab Ezzouar commune lets appear its fragility, the standardization proved to be maladjusted to aspirations of inhabitants. Does similar dwellings imply similar lifestyles and behaviours? Actually, the "standard" solutions led important modifications. The inhabitants have introduced transformations at the level of the internal distribution of the dwellings as well as the composition of the façades. Do some distinct identities suppose specifics dwellings?This paper will analyze the pros and the cons of architectural and urban innovations in matter of housing in Algiers, while observing their effects on the local identities, but particularly on the conception of one's home.

Keywords : Identity, Globalization, Dwelling, Homogenization

1. INTRODUCTION

Algeria witnessed in the last decade significant construction development with the particular emphasis on housing projects. These housing developments aim for a better social cohesion and coherence in the intervention of the different public services in relation to institutions and populations. Currently enterprises and property developers investigate partnerships opportunities in order to achieve a common vision between the different actors and thus improve management of such projects. In that respect, housing became a major stake in terms of reflection and action. But can the territorial development only be defined according to institutional and economic criteria? Can housing be only the product of an interdependent system of actors? A quick survey of the mutiple housing projects is expected to help to identify

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the different actors and beneficiaries and to recognize the existence of a particular setting of reference.

2. HOUSING IN THE CORE OF PUBLIC POLICIES

In Algeria, housing shortage prompts immediate political intervention to launch important programs of housing. According to the Ministry of Habitat and Urbanism, the first economic plan launched between 1999 and 2003 permitted the realization of 693.800 housings with almost a half million in rental-public housing units and social-participative housing, with an average rate of 140.000 housings realized per year. Nevertheless, the rate never exceeded 100.000 units per year. To face an estimated deficit of 1.1 million of housing units, the Government announced a new program that spreads from 2005 to 2009 with:

- 24.9% of rental-public housings, (a group of block of flats built with public money for low-income families).
- 20.9% of social-participative housings, (this category of housing is based on the claimant's financial participation: 30% advanced by the claimant, 30% as a banking loan and 30% as a non-refundable help from the Algerian State).
- 10.3% of renting-sale housings, (this category of housing allows the claimant to pay his dwelling by easy terms: 10% to begin, 15% when the block of flats is achieved, and the rest payable monthly during 25 years).
- 3.1% of promotional-public housings (realized by property developers, promotional housing is characterised by its high quality, its big surface and its good finishes, the access to this private property being truly out of range for a lot of households).
- 40.8% of rural housing, (a group of small homes built with public money to encourage low-income families to stay in the countryside instead of moving to the nearest towns).
- Without forgetting the private housings, otherwise said, the whole individual homes constructed by the Algerian citizens by using their own financial means.

The construction of more than one million housing units was expected by 2009 by the Ministry of Habitat and Urbanism (MHU). This ambitious program was included in the law of finances of 2005, at a rate of 70 billions of Algerian dinars (approximately 744 millions of euros). However, in the setting of a liberal economy, invitations to tenders have been launched by the MHU, the realization was therefore opened to foreign enterprises and thus to competitions.

The new quinquennial Plan (2010-2014) intended to reinforce the intention of the Algerian State to continue its intense answer to housing demand according to the speech of the President of the Republic. Another million of various categories of housings will be delivered during these five years. The new Prime Minister added on the 16^{th} of October 2012 that a complementary program of 1.450.000 housings has been launched. In all, 2.450.000 housings are expected to be achieved during this quinquennial (Figure.2). Graphs below were realized on the basis of data collected by the Ministry of Habitat and Urbanism.

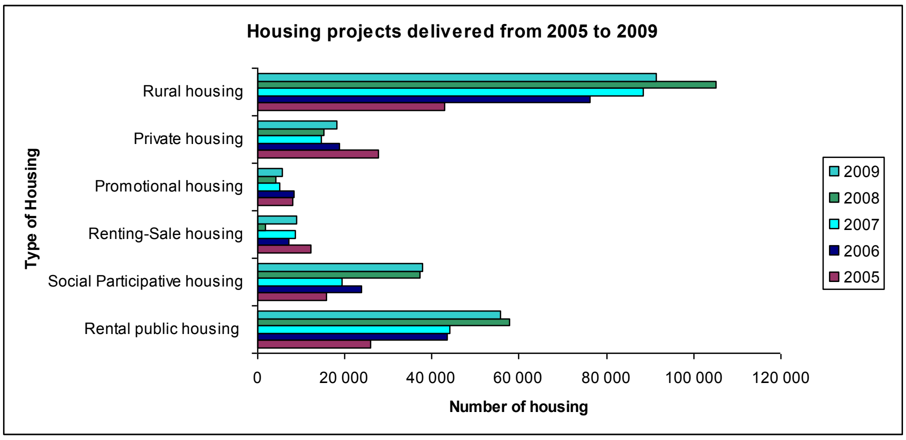


Figure 1 Housing programs achieved in Algeria (before 2009)

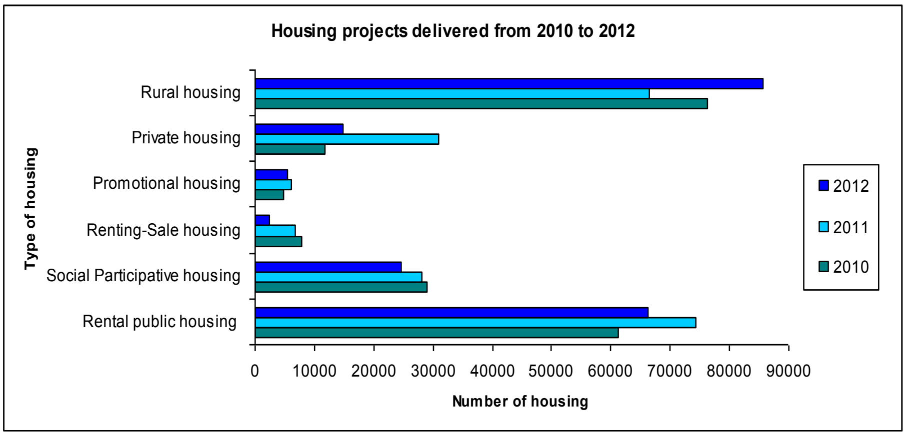


Figure 2 Housing programs achieved in Algeria (after 2009)

3. METHODOLOGY

In Algeria, the Ministry of Habitat and Urbanism put the emphasis on the realization of multiple quinquennial plans and that through all the territory. An intense real estate development advocates a collective habitat; which consumes less space and generates collective displacements, articulates itself around a setting aiming all social categories, promotes the diversification of housing models and encourages the participation of citizens, but who decides? Who are the actors that lead these operations? And who are the beneficiaries? In Algeria, the variety of the housing offer is perceptible in construction sites and generates an important development. Under the double pressure of politics and citizens, the claimants are oriented according to their own financial means towards rental-public housings, social-participative housings, renting-sale housings, promotional-public housings and rural housings. Whether it is considered as a challenge for the instigators or an opportunity for the beneficiaries, housing welcomes nevertheless the social life, and is above all a fundamental territory for man.

Offering many dwellings, the new urban spaces in Algeria are supposed to respond to today's population needs, their construction capacity is important, they are aired and equipped with relevant facilities. But, are they really a place where people want to live, now and in the future? What about urban harmony and wellbeing in this case? This research analyzes firstly, the renting-sale housing realized in Algeria while focusing on the financial and administrative methods adopted by the Algerian State. This paper investigates secondly, the housing projects realized and their impact on inhabitants' welfare, by examining the case of Bab Ezzouar in Algiers, a representative example at the national scale when it comes to renting-sale housing. The investigation analyzed the city starting from its residents who reside, practise and live the space in a subjective and personal way, the objective being to seize the problems that inhabitants meet as individuals and as community in their built environment.

4. INVOLVING THE FINANCIAL MEANS OF THE POPULATION: WHICH STRAGTEGIES FOR THE DECISION-MAKERS?

The participation in housing sector is encouraged with the renting-sale housing which permits to subscribers to buy a real estate by easy terms with an initial contribution of 25%, the rest being paid monthly on a period of 25 years. This procedure was widely accepted since its launching in 2001, why? What are the advantages for the citizens? And what are the limits for the decision-makers? To understand this strategy and its socio-economic impact, an investigation is needed.

4.1. Strategy to Promote Renting-Sale Housing

Agreed to subscribers who don't possess in all property schemes a dwelling and who don't benefit from any financial help from the State, and who have a level of income that doesn't exceed five times the SNMG, the renting-sale housing widens the offer to the residence or to the high-class apartment. But, what was the procedure to follow, this time?

In accordance with the foreseen legislation and the authorized dispositions, every claimant of a dwelling in the setting of the renting-sale procedure fulfilled an initial contribution of 25% minimum of the housing price[1]. The subscribers proceeded to the payment of the 10% of the global amount of the housing (a margin of 12.000 to

[1] According to the article 7 of the ministerial decree n°01-105 of April 23rd, 2001 fixing the conditions of acquirement of renting-sale housing

40.000 DZD), as a firm option of acquirement, and to the payment of 15% (between 200.000 to 300.000 DZD), once the dwelling was achieved. A notary has been in charge to prepare a contract indicating the amount of money that was due to be paid every month by each beneficiary for twenty five years.

The renting-sale housing was achieved by the Agency of Housing Improvement and Development (AADL) and realized on the budget of the State or on the one of the local communities, according to previously determined norms relating to surfaces and indoor comfort.

Their price was fixed on the basis of the final cost of the construction while integrating expenses of the land acquirement and expenses of the technical and administrative management, the whole lot calculated on the period preceding the transfer of property, the latter being not executed until the payment of the totality of the selling price.

Consequently, the evocation of renting-sale housing, the setting up of this strategy of participation, on which numerous expectations are based, would justify the encouragement of mechanisms of consulting, of association and of implication that it supposes, but what about their realization?

4.2. Beyond the Strategies of Participation, a Feasibility in Question

According to the Minister of Finance, the hundred public corporations were not able to participate massively to the programs. Therefore, the Government took deliberately the position to intervene on behalf of foreign operators like China State Construction & Engineering Corporation for instance, present since 2001, to construct renting-sale housing in the big cities like Algiers or Constantine; where the qualified manpower for the realization of these building blocks being lacking.

Another problem raised by the Minister of Finance, was the availability of construction materials. If the local production is important for the brick, it is on the other hand insufficient for the wood, the cement and the steel. The irregularity of supply entailed many delays in construction sites, from where a decrease of housing deliveries; e.g. in 2007, 19.478 renting-sale housing units were built.

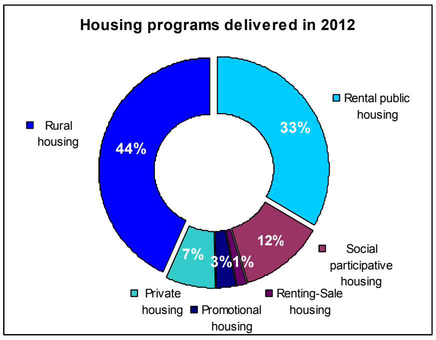
On the 31st of March 2008, the balance sheet of housings established by the MHU emphasized 460.000 housings assigned and 544.000 others under realization, with realization rates varying from 10% to 70%. However, the accumulated delays did not worry the Minister of Habitat who affirmed that all construction sites passed the long and coercive period of the administrative procedures.

In fact, 9.043 renting-sale housing units have been delivered in 2009, 7.777 delivered in 2010, 6.816 housing units delivered in 2011 and only 2.422 renting-sale housing units have been delivered in 2012. Indeed, many construction sites in the setting of renting-sale housings have made long delays of deliveries and the concerned citizens have made many protests to show their discontent.

The Algerian State has taken the commitment to achieve renting-sale housings programs dating from 2001 and 2002, and all the remaining subscribers have been accommodated by the Minister of Habitat and Urbanism in Mars/April 2014.

This fact doesn't prevent the Housing Improvement and Development Agency (AADL) to launch in June 2013 new programs of housing at the national scale, and thousands of subscribers have used the Agency website to make their demand.

In Algeria, the acuteness of the residential crisis doesn't stop persisting despite the efforts of the State to attenuate it. Indeed, 199.179 housings have been delivered in 2012. In the same way, the Algerian State launches every year new housing projects, for instance, 484.061 housings have been launched in 2012 (Figures 3 and 4).



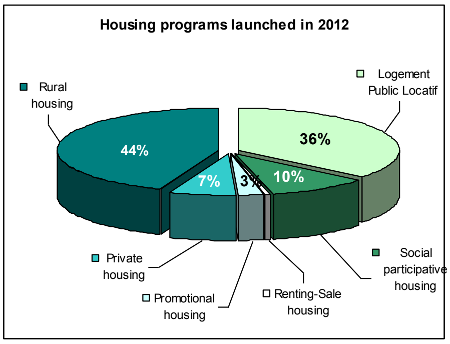


Figure 3&4: Statistics concerning achieved/launched housing programs in 2012

However, the appreciation of the quality of life in these housing projects cannot be associated to the only assignment of housing and to the only logic of its market, except to accept a reduction of its complexity. The perception of the new built environment is bound to the logics of action and interests of all concerned actors, from where the difference between inhabitants and the other users.

In order to realize many housing projects in a very short time, urban planning had to adapt itself to politics. Public private partnerships have been created. A decent habitat develops thanks notably, to a regimentation of prices of construction materials. But, is it necessary to suppress differences between ways of life? And to construct similar residential spaces in order to all homogenize? Today, in a period of globalization, the 'local' still produces culture. "Globalization" is a historical process, the result of human innovation and technological progress. It refers to the increasing integration of economies around the world, particularly through trade and financial flows. The term sometimes also refers to the movement of people (labour) and knowledge (technology) across international borders. There are also larger cultural, political and environmental dimensions of globalization. It is a fact, populations that occupy a singular place in which they live and construct a singular world are integrated completely in a vast system.

The conception of housing is usually marked by the full/empty ratio, in other words to open for reasons of aeration or ventilation, lighting and sun, to close in order to preserve the comfort of each member of the family and its intimacy from all kind of impropriety. This dialectic concept considers as well the relationships between individuals as the physical devices that unite or divide the privative, collective and public spheres of the habitat. Architecture is a tool that offers different levels of intelligibility, e.g.: volumes, façades, exterior/interior ratios, dynamics or statics, integration into the environment. Doesn't one has to promote the protection and the valorisation of some ways of constructing and some ways of living the space, in order to aim at an enrichment and not at uniformity?

5. BAB EZZOUAR: A COMMUNE FACING THE UNIFORMITY OF CULTURES

Globalization has been made possible by the progressive dismantling of commercial barriers and the mobility of capitals, as well as by the technological progress and the regular decrease of the cost of transportation, communications and data processing. Advantages of globalization are manifests: sustained economic growth, more elevated standard of living, increased innovation and faster diffusion of technologies and techniques of management, new economic perspectives for individuals as well as for countries. However, the globalization of the economy goes together with a global standardization of the architectural production. According to Jean-François Dortier, the West had colonized the world previously by strength, producing thus ethnocides. Today, westernization develops mainly by acculturation, a voluntary adherence (Dortier, 2007). Thus, if all big international cities have the tendency to look alike, it is because globalization produces certainly homogeneity, but also creates diversity, crossbreeding and identity, because the cities develop continuously cultural diversity. Is it then, today, completely obsolete to worry about the urban and architectural shapes?

In Bab Ezzouar, the residential spaces let appear obvious maintenance difficulties. The inhabitants denounce the formal and architectural poverty of these innumerable buildings made of concrete and don't hesitate to ask plumbers or masons for help, in order to renew the inside as well as the outside of the apartments. An investigation to understand better the present context is needed.

According to the interviewees: *«the balcony is exposed to the indiscreet looks of passers-by* […] *a veranda will allow us to make use of the balcony, in all intimacy»*. Otherwise, it is not rare to see that the balcony is not anymore autonomous but became a part of the living room or the kitchen, without thinking about problems of thermal insulation or humidity.

The inhabitants call into question the image of Bab Ezzouar in general and of its apartments in particular: *« the depreciation of the locality, when this one is not chic, doubles itself of the one of a concrete-city compromised by the illegibility of places* […] *and other burrs that badly sign the concrete and the coat of plaster»*.

As voluntary urbanism example, the commune of Bab Ezzouar is confronted to difficulties that it must surmount. Some dissuasive measures have been taken to thwart the alterations worked out by the new residents and to warn them about the risk of damaging the building structure which can get unsafe. From our interviews to the AADL Agency, it emerged that: «services of the AADL don't have the right to go inside the apartments, in order to estimate the damages […] only a report done under control of a process-server is necessary to estimate the acuteness of the deteriorations […] several families have been told, after intervention of a process-server, that it is forbidden to add a window or a veranda and therefore to modify the façades, a dissuasive measure for all the neighbours who expected to transform their balcony ». It is difficult to have an exact evaluation of the number of inhabitants who have remodelled their apartment, without any authorization. Several families have been told, after intervention of the court, that it is forbidden to modify the façades and of course to modify the inside. The judge stipulated that tenants have to put back the balconies in the state in which they found them and to pay a fine. That is why the inhabitants didn't allow us to take some pictures of their apartments, anonymity being thus respected.

While examining the conduct of inhabitants concerning dwellings and the one of the AADL control services, the investigation has demonstrated that no sociological survey has been led beforehand, and that if one applies the standardization of lifestyles, it is translated by a ceaseless need of change for inhabitants. Otherwise, the architectural conception of buildings in Bab Ezzouar is so rigid that it would be erroneous to believe that many transformations are possible, according to how the inhabitants feel, and that because of prefabricated walls in reinforced concrete impossible to pull down.

For the meantime, it's the ground-floor spaces that are lived as elements of identity because one finds out under arcades a set of small boutiques, recalling Algiers and its powerful commercial device composed of a juxtaposition of stalls and shops. Therefore, one can regret the absence of a feeling of adherence in a newborn territory. Beyond the supposed assets to make of it a place of exchange and urban life, the local registration is, in the context of Bab Ezzouar, the key of the local cultures renewal and the permanence of their specificity. *«The possibility to identify ourselves positively to a place [...] to develop the pride to live in»,* this is the essential stake for the new residents. It is therefore a question of personality. People lack a picture of reference, a proof of identity and anchorage in their territory. For everyone, the images evoked by one's home and town are inextricably linked to processes of identity. The image of the new town is linked to how it is used by the residents from the moment they move in, whether by choice or constrained by circumstances.

Our position is not attached to the past. It neither defends the historic city nor praises a kind of architecture in particular. We merely want to seize dimensions making possible to act up, but not to brush an ineluctable and irreversible future. We try, on the contrary, to adopt another stance facing the contemporary city. Globalization must be much more than the expansion of markets. One would not consider the economic domain as independent from the social and political context and to accept that it is only subjected to its own logic. To survive and to prosper, the world economy must settle on shared values and steady institutional practices and must serve more equally ambitious social objectives. Let's recall that the urbanism goes beyond the simple material dimension and also includes the social, economic and political matters. The real-life experiences, in the context of Bab Ezzouar, have proved to be much more complex than they appear. Since, the population resists to all shapes of homogenization. In our point of view, the architectural and urban field must focus more on the local, for localized contemporary cities, tempting to refute this ideology of globalization. In the objective to preserve identity and financial aspirations, architectures must be referred to precise places, by constructing multiple faces, alternative to the totalitarian features of the so-called global city.

5.1. Beyond the Dwelling, Living in One's District

Beyond the simple addition of housing, of activities, of services, of streets, the city defines itself by its districts and its characteristics, the animation, life that results from the combination of all these elements. Every year, thousands of lodgings are taken in site in the new town. For their occupants, to lodge is necessary, but not sufficient. Around that, they expect to find a district, with its exchanges, a town full of life. The worry for the dwellers' welfare in their new environment is accompanied by a willing to endow every district with sufficient collective services. According to the interviewees, what was missing lies in:*« public spaces, true streets with sidewalks, places edged with boutiques and arcades to take shelter* […] *a garden where to stroll or to eat lunch, a market where to go shopping; places of meetings and exchanges, crowded day and night* […] *well planted trees, correctly fixed lamps, well laid fences ...all that has been neglected»*. The idea that inhabitants adapt themselves with difficulty to life in Bab Ezzouar has imposed qualitative interventions that aim at the improvement of living conditions in the new districts, in order to make some fully-fledged life places.

The deterioration observed in these districts (deterioration of the public space) leads to asking questions under another angle than the one of the formal and architectural relevance of the residential spaces; the perception being bound to the logics of action and interests of all concerned actors, from where the difference between inhabitants and the other users. The supplying of appropriate public services implies a great concern. Planning presented clear layouts that might suppose that the realization was going to be simple. The rational character of these plans corresponded to the idea to give the new generations a balanced environment. Urban planners having thought that a satisfactory life quality got itself thanks to a strong population density, solely capable of guaranteeing services, transportation and animation of the district. Today, as the city tries to define its role, it undergoes periodic adjustments, taking into consideration the social disparities and lifestyles, makes feel itself more and more. According to the interviewees : *« the too linear volumes, of an immediate proximity, let appropriate themselves with difficulty, too many discontinuities and hollows subsist leaving a flavour of incomplete,* […] *without forgetting the absence of collective spaces management»*.

The local authorities have made the bet to give them more than a dwelling, an urban environment thanks to a dense network of tertiary facilities and big projects next to the university of Bab Azzouar, the arrival of financial and commercial activities in a substantial number can entail the creation of new atmosphere. Wanting to create an attractive urban setting in which nothing should lack or nearly, but again and particularly an urban and social life, the local authorities meet difficulties to manage the time factor. The commune of Bab Ezzouar is supposed to respond today's population needs. Its construction capacity is important. It is aired, endowed of important facilities. Certainly, its dynamism and interrelations that it will have to tie with its environment plead for the pursuit of its development.

However, the 21st century urban life cannot be considered without taking into account the globalization because it offers extensive opportunities for truly worldwide development. With globalization, one can have access to more capital flows, technology, cheaper imports, and larger export markets. But markets do not necessarily ensure that the benefits of increased efficiency are shared by all. Therefore, all the question is to know if globalization that finally puts in competition economic and social systems, is likely to take into account a society where the social tie would be exclusively merchant, or on the contrary, to consider societies that estimate indispensable to preserve "non merchant" cultural spaces, valorising thus the cultural capital of societies, because that one does want it or not, the identities construct themselves, even today, essentially in a territorialized dimension.

6. CONCLUSION

The local life and the spatial dimension being a privileged support of identity, the evolution of Bab Ezzouar commune must start from the needs of its inhabitants, their motivation to participate in adequate organizations expressing their life conception; this in relationship with the economy, the culture of the country, the choice of local construction materials, aiming a human architecture rather than a fashionable one. At the present time, one realizes that this commune is progressively affected by regional, interregional, national and international economic conditions. Crossroad of expertise and initiatives, stimulating support for education and innovation, it encourages the economic take-off. This reality becomes more and more striking if one evokes globalization, since the financial markets push subtly toward uniformity, including architecture. This tendency consists in making everything similar because that is less expensive. What about respect for cultural diversity in habitation in this case?

The case of Bab Ezzouar pushes to the critical judgment, to the definition of the pros and cons, to a hold of position towards these big housing projects and the challenge that they raised. To build blocks of flats is, for the Algerian decision-makers, a good answer to housing shortage, despite the fact that the inhabitants denounce the architectural poverty of these multiple buildings of concrete. In Bab Ezzouar, the built homogeneity is defined by its identical blocks signaling paradoxically who lives there and why. Actually, it seems difficult to escape a repetitive architecture, due to the constraints of the prefabrication process. Certainly, housing being above all an object defined by its spatial dimension, it is characterized by three attributes: the metrics, the scale and the substance. Nevertheless, housing constitutes also the concrete matter of the social space and contains the material contexts of the social life.

The analysis of our investigations and interviews indicates that the representations of the residential spaces of the inhabitants depend closely on their experience at the same time personal, social and spatial. Consequently, constrained by inhabitants' attitudes, housing projects cannot conceive themselves outside of their context and must define themselves according to the will of the local actors and their prerogatives certainly, but also and especially according to the inhabitants needs. The construction, design and type of housing are critical to the long term quality of life for the inhabitants who will live in these spaces. Therefore, greater efforts must be done to build inhabitants' participation into all steps of the development process. If inhabitants are given a feeling that they are able to contribute to decisions affecting their lives and the lives of their children, friends and neighbours, the housing projects in general and Bab Ezzouar in particular will become more sustainable.

Creating buildings and urban environment that people enjoy living in and working in requires therefore, best practices at the same time economic, social and environmental. Building and strengthening a sustainable community imposes as well, to improve the quality of life of the population and to consider the longer term implications of decisions. For the present as for the future, the local authorities must learn to put the inhabitants first, not fees or speed of construction, while going beyond the simple information of the population, while accepting to approach "topics that annoy", while admitting the contradiction and while accepting to be disavowed sometimes, because that they do want it or not, the adherence of citizens to projects that concern them is, in the present context, the key of a strong local identity. Henceforth, and beyond its appearance, that everyone can appreciate in his manner, it contains the capacity to be renewed, while leaning on its internal dynamics, made of tensions, like any dynamics. Let's join André Bruston to say that: *« it is not the new that matters, but its capacity of future».*

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METHODS TO OVERCOME THE BARRIERS AND THE DISINTEGRATION EFFECT OF PORT AREAS IN THE CITY CENTER AND THE FACTORS DETERMINING THEIR CHOICE

MLADEN TANOV [1]

ABSTRACT

Port warehouse complexes and transport infrastructure around them, located near the urban centers of major cities are huge barriers and buffers in urban organism. Once engines for the emergence and development of cities, in the last 40 years these areas act as restraints in the development of cities. At the same time historically formed cities also do not allow modernisation and expansion of ports. Economic dynamics and the new functional profile of the coastal towns exert asignificant pressure for change, requiring the transformation of these large areas for new features, their opening to wider user groups and their greater commitment to the historic core of the town.

What are the opportunities to reconnect the city to the coast, to extend the city center and accommodate new needs, increase pedestrian, recreational and green areas near the center and improve the overall quality of living environment?

In some cases this is achieved through the transformation of part of the port complexes in open public areas, enriched by various social-service and recreational activities. In others - through the complete removal or relocation of activities (port, warehouse, industrial) and a new design/redesign of the towns. In the yet other - through purely spatial-invasive solutions that give people access to water without changing port areas.

The report examines the factors determining the regeneration solution and the main methods of approach based on analysis of 12 realized coastal transformations and several approved but unrealized projects. Particular attention is paid to the functional profile of the renovated areas and predominant functions in the mix and the inclusion of these new parts in the functioning of the urban organism.

Key words: Regeneration, Port Areas, Urban Planning & Design, Green Areas and Open Public Spaces

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1. INTRODUCTION

The modern city is a place in which live and reside many different groups of people – considered by social, cultural, professional, ethnic and religious signs and this diversity is much greater than at any other past point in history. Clash of interests and activities is intense and this greatly increases the importance of city management, that has to balance those interests and protect public interest. Certain events and trends of the last 50-60 years, threaten the convening character of the city by creating insurmountable buffers and isolated areas, gated structures, and gated communities.
This happens because these events provoke many negative effects, one of the most important being the gradual degradation of a wide brim of these areas and loss of attractiveness of many central urban areas. Port complexes of the time of the Industrial Revolution are a kind of a city gated structure and actively participate in the described model. Today there is a great need to find a new form of relationship and interlocking between the city and the port.

2. PROBLEMS OF WATERFRONTS TODAY

2.1. Historical Development of the Port Areas

Convenient location for construction of protected ports is the key factor for the coastal cities. Ports are the main structural elements of these settlements and engine for development.
Many modern port centers in Europe formed in the Middle Ages as a result of increased trade with the Middle East. Some of them existed in Antiquity, but we can assume that in their present form, without time interruptions they have basically medieval origin. Strong political and economic development marked the centers of maritime trade on the route Middle East - Italy - Western Europe: Genoa, Venice, Amalfi, Bruges, Ghent, Hamburg, Amsterdam. Strong cash flows stimulated the development of the banking system and wealth gave their independence.
Renaissance changed the nature of trade, the main trade flows in terms of destinations, as well as type and quantity of goods. Development of overseas warships and commercial carriers lead to a rapid expansion of trade. New water routes between Europe and East Asia realized import at lower prices compared to transport by land. The discovery of America, and its tobacco, gold and silver trade opened new horizons to the Far East. Thanks to the experience gained in ocean navigation, Europeans occupied a decisive position in the Asian trade shipping. Emergence of joint stock companies in the shipping.
Since the Industrial Revolution occurred in Europe first, this continent is the center of the world trade network throughout most of the 19th century. The growth of industrial production is accompanied by a rapid expansion of trade in goods and raw materials. They in turn stimulate significant changes in transport - both vessels and ports are enlarged and modernized; railways stimulated the rise of internal trade. Strong development of production and trade concentrates huge capital in cities and generates migration from rural areas. So the early 19th century port cities inevitably

transform in large industrial centers because they have everything - raw materials, capital, labor and technology, and markets.
Three phenomena of Post-industrial times change the meaning of ports for European cities and from engines for development, they become handicaps.

- Changes in the economic profile of the cities and their transport infrastructure: dislocation and change in the heavy industry, specialization and modernization of ports, reduction of cargo processing time and increase the share of air freight
- Ports Barrier effect against typical urban areas and the effect of restricting development and degradation in the border lines between them
- Strong growth in the leisure, tourism and services, which creates "hunger" for new attractive areas; the waterfront can serve modern city various functions

2.2. Principles of Modern Urbanism

Intensive urbanization and the development of democratic social system require regulation, guaranteeing the rights of citizens for high-quality living environment and access to social services and universal benefits. Principles of modern urbanism are the product of the development of urban and social science and practice. The proposed classification based on international agreements on human rights and sustainable development include:

- Principle of pure and favourable environment for living
- Principle of openness, responsiveness and maximum accessibility of the environment
- Principle of parallel evolution of the urban areas; fairness in the distribution of wealth
- Principle of multi-functionalism and enhancement of the urban environment
- Principle of conservation of the focal character of the city and the traditional center
- Principle of maintaining diversity, uniqueness and historical memory
- Principle of effectiveness in the use of land resources and sustainable development;

Comparison between the current situation and these principles revealed the wide range of existing imperfections in the territories. They are grouped into 4 groups of problems.

2.3. Basic Problems

Socio-economic problems and Efficiency:

- Status and profile of the economy (decline of industries important to urban structure)
- Unemployment (due to closed enterprises and ports)
- Demography and dynamics (e.g. outflow of residents because of economic downturn)
- Significant social needs - housing, parks, sports facilities, servicing, culture objects

Urban problems:

- Lack of connectivity and accessibility and the presence of barriers
- Negative impact on the development of the central areas and their peripheries
- Limited visual connectivity of the city with the coast and the water

- Structural and functional dissonance - define the “tearing” of "urban fabric"

Problems with cultural heritage and architectural image:

- The existence and condition of valuable historical buildings and ensembles in the port;
- Presence of preserved historic urban ensemble in proximity and the level of relation between it and the regenerated area (compositional and visual)
- Preservation of historical memory about the functions of the area
- Monotony and lack of aesthetic qualities of the coastal skyline

Ecological problems:

- Problems of urban ecology
- Environmental problems of water area
- Problems with the Coast and dynamics of water level
- Negative impact on protected natural areas and water areas

Based on the a/m classification and for the purpose of this PhD research, an analytic matrix was developed to evaluate regeneration projects by comparing the situation before and after their implementation. The effects in each of the a/m groups bring a certain number of credit, as leading group and weight is pre-defined.

3. APPROACHES TO SOLVE THE PROBLEMS

To solve the problems are applied approaches, bearing different names - revitalization, redevelopment, regeneration, waterfront renovation, etc. We will not dwell on the specifics of the terms, but will mark the trends in the development of waterfront update. Historically several stages of regeneration practices can be defined, which are characterized by differences in the scope, objectives and value of projects, participants and results.

In the First stage (from 60-ties to the early 80-ties) the private sector has the leading role. The low price of degraded areas attracts investors who turn them into highly profitable business centers. Changes do not take into account the needs of the city and society and do not contribute to the opening of the city nor provide a coast for wide use. The scope - local.

The Second stage (80-ties and 90-ties) is characterized by the beginning of the public-private partnership. Local authorities impose stricter conditions on projects that cover the whole port area. First attempts to create mixed areas including service and recreation.

In the Third stage (from 90-ties) design is based on equal public-private partnership, the recovery task is prepared on the basis of studies on the role and functions of the coasts and linking them with the master plan of the city. It specifies the function, structure and balance of the area. Local authorities have a leading role in the preparation of the assignment and in monitoring. The scope includes the entire waterfront.

This PhD research focuses on the transformations during the second two stages, aiming to classify the different solutions in terms of the urban aspect. The functional profile, the structure and intensity of development and linking with neighbouring regions and the city are the key assessment indicators that affect the participation of green and open spaces. The analytic matrix examines in detail 10 cities famous for their successful projects: Genoa, Naples, Bilbao, Barcelona, Amsterdam, Antwerp Hamburg, London, Liverpool and Cardiff, as we will briefly present some of them. Another 10 cities including Valencia, Toronto, New York, are also the focus of study.

3.1. Brief Analysis of the Significant and Successful Waterfront Regenerations

Amsterdam - Shortage of Housing, Excess of Water
The purpose of the transformation of the eastern docks is turning them into a residential area – the concept of the compact city and because of the great need for housing. The main requirements are: high density of occupation; good connectivity, permeability and accessibility of urban areas; broad social mix of residents
Functional profile and urban image: In the regeneration of the eastern port area functional area is divided into western multi-functional area bordering the periphery of the city center and eastern residential area which is seriously remote and isolated from the center of linear barriers. In the south-western and central parts many of notable historical buildings have been converted to shopping centers, hotels and restaurants, cultural and entertainment centers; institutes, museums and libraries and in modern buildings are located a cruise terminal and a modern music hall. The Eastern zone, consisting of 4 peninsula, was converted into a purely residential area with diverse architectural style - from luxury single-family homes to large-scale multi-storey social housing. Despite the high density everywhere were realized green and public spaces and pedestrian areas.
Specific characteristics of the decision:

- Preservation of many storage buildings and the waterways and use for new needs
- Diverse in style, structure and scale architectural style, which is distant from the typical urban environment and this requires close coordination and harmonization
- Poorly balanced functional areas with a lack of facilities and services
- Unresolved problem with linear barriers, well realized commitment to the city by public transport
- Well laid and implemented system of green and open spaces with high qualities
- Complete regeneration of the east zone; incomplete regeneration of the central zone

Analysis on key indicators:
1. Level of solving socio-economic problems and achieved efficiency in land utilisation (amount of credit: 3/10);
1.1. Functional efficiency according to the level of functional mix and effective functional balance (credits: 0/2);
1.2. Functional efficiency according to the level of satisfaction of the socio-economic needs and gaps - jobs and services for the population (credits: 2/2)
1.3. Functional efficiency according to the level of stimulation of the urban economy (cr: 0/2)
1.4. Functional efficiency according to sustainability of the loading of the area (day-

round, all-seasons, long-term) (credits: 0/2);
1.5. Functional efficiency according to the level of wide-mix of users (credits: 1/2);
2. Level of solving of urban problems (amount of credit: 8/12)
2.1. Achieved transport linkage with the region and the city (credits: 2/2);
2.2. Implemented pedestrian links (credits: 0,5/2);
2.3. Level of development of the green system and the system of open public spaces (cr.: 2/2);
2.4. Achieved visual connectivity (credits: 2/2);
2.5. Structural adequacy of the urban environment / harmonization with the typical urban structure (credits: 1/2);
2.6. Functional harmonization and consistency with the surrounding urban areas (cr.: 0,5/2);
3. Level of solving the environmental problems (amount of credit: 4/8)
3.1. Level of improvement of the urban ecology (credits: 2/2)
3.2. Level of improvement of the quality and characteristics of the water area (credits: 2/2)
3.3. Level of improvement in the management of water levels
3.4. Level of reduction of indirect negative impact on protected natural areas and water areas
4. Level of solving the problems of cultural heritage and creating a memorable architectural image (amount of credit: 5/10)
4.1. Level of alignment with the historic environment and cultural heritage (credits: 0/2)
4.2. Conservation and recovery of valuable historic buildings and ensembles in the territory (credits: 1/2)
4.3. Preservation of historical memory of the historical functions of the area (credits: 1/2)
4.4. Prominence and aesthetic qualities of architecture (credits: 1/2)
4.5. Diversification and enrichment of coastal silhouette (credits: 2/2)
Credit rating: 20/40.

Hamburg - Second City Center
Purpose of the transformation: Reviving one of the oldest harbor and storage areas, and its integration into the urban organism as a central urban area Hafencity.
Functional profile and urban image: Typical downtown area of the wide center of the European city. More than 30% of the area is occupied by residential buildings - permanent and temporary occupancy. There are many office and administrative buildings, head-offices of large international companies, a substantial share of educational, research and museum centers, places of trade and services, restaurants and cruise terminal. Appropriately situated many open public spaces, recreational areas and green spaces.
Specific characteristics of the decision:

- Comprehensive renovation of the southern coastal areas, turning them from an industrial port into a complete urban area – new residential, cultural and business center
- Structure connectivity and adequacy of the urban environment and successful

harmonization with the typical urban structure with a gradual transition from the architectural style of the existing historic buildings to the contemporary office and residential buildings; Using some of the landmark old buildings for new functions

- Well-developed system of public spaces, recreational and green areas associated with existing urban spaces and pedestrian routes; high quality design of open spaces
- high proportion of residential areas to ensure full-time occupation of services because of the remoteness from the center and large size of the area compared to the center.

Analysis on key indicators:

1. Level of solving socio-economic problems and achieved efficiency in land utilisation (amount of credit: 10/10);

1.1. Functional efficiency according to the level of functional mix and effective functional balance (credits: 2/2);

1.2. Functional efficiency according to the level of satisfaction of the socio-economic needs and gaps - jobs and services for the population (credits: 2/2)

1.3. Functional efficiency according to the level of stimulation of the urban economy (cr.: 2/2)

1.4. Functional efficiency according to sustainability of the loading of the area (day-round, all-seasons, long-term) (credits: 2/2);

1.5. Functional efficiency according to the level of wide-mix of users (credits: 2/2);

2. Level of solving of urban problems (amount of credit: 12/12)

2.1. Achieved transport linkage with the region and the city (credits: 2/2);

2.2. Implemented pedestrian links (credits: 2/2);

2.3. Level of development of the green system and the system of open public spaces (cr.: 2/2);

2.4. Achieved visual connectivity (credits: 2/2);

2.5. Structural adequacy of the urban environment / harmonization with the typical urban structure (credits: 2/2);

2.6. Functional harmonization and consistency with the surrounding urban areas (cr.: 2/2);

3. Level of solving the environmental problems (amount of credit: 4/8)

3.1. Level of improvement of the urban ecology (credits: 2/2)

3.2. Level of improvement of the quality and characteristics of the water area (credits: 2/2)

3.3. Level of improvement in the management of water levels

3.4. Level of reduction of indirect negative impact on protected natural areas and water areas

4. Level of solving the problems of cultural heritage and creating a memorable architectural image (amount of credit: 7/10)

4.1. Level of alignment with the historic environment and cultural heritage (credits: 1/2)

4.2. Conservation and recovery of valuable historic buildings and ensembles in the territory (credits: 1/2)

4.3. Preservation of historical memory of the historical functions of the area (credits: 1/2)
4.4. Prominence and aesthetic qualities of architecture (credits: 2/2)
4.5. Diversification and enrichment of coastal silhouette (credits: 2/2)
Credit rating: 33/40.

Bilbao - Cultural and Tourist Identification
The goal is a complete restructuring of the city after the decline of the metal production industry and transfer of the port to the bay, to stimulate a balanced socio-economic development of the city with a focus on the development of tourism, culture, education and services, and to restore the unity of the urban organism. Regeneration program includes 16 major transformations in the coastal regions, in infrastructure and environmental measures to restore the river ecosystem. Here we present Abandiobarra /in the central part of the city in a port and storage area/ and Barakaldo /near the district center in a port and storage area
Functional profile and urban image: mixed multifunctional zones in a park area with residential, hotels, business, concert and congress centers, large shopping centers, sports and landscape subareas, university and office buildings, museums; memorable sculpture park design and decoration; many parks, green squares and pedestrian spaces, parts of the waterfront promenade; Abandiobarra is organically linked to the Guggenheim Museum and the bridge Salve constructed earlier.
Specific characteristics of the decision:

- the urban fabric is restored - streets and squares constructed with expressive urban silhouette and while these solutions immerse buildings in green, and the density of the buildings gradually decreases towards the river and passes into a coastal park
- appropriate mix and functional structure, but different for the two zones; many green areas, well-integrated system to be adopted in the green city
- Good pedestrian and car links with neighboring territories and city in Abandiobarra were constructed; in Barakaldo linear barriers - highway and train lines - are overcome on one place on land, on a second place - through a tunnel, and on a third place - through a trestle.
- In Barakaldo the old building ILGNER is converted into an office center and mining industry facilities are exposed in a theme park, in Abandiobarra the ship museum is the only sign of historical past.

Analysis on key indicators:
1. Level of solving socio-economic problems and achieved efficiency in land utilisation (amount of credit: 10/10);
1.1. Functional efficiency according to the level of functional mix and effective functional balance (credits: 2/2);
1.2. Functional efficiency according to the level of satisfaction of the socio-economic needs and gaps - jobs and services for the population (credits: 2/2)
1.3. Functional efficiency according to the level of stimulation of the urban economy (cr: 2/2)
1.4. Functional efficiency according to sustainability of the loading of the area (day-

round, all-seasons, long-term) (credits: 2/2);
1.5. Functional efficiency according to the level of wide-mix of users (credits: 2/2);
2. Level of solving of urban problems (amount of credit: 12/12)
2.1. Achieved transport linkage with the region and the city (credits: 2/2);
2.2. Implemented pedestrian links (credits: 2/2);
2.3. Level of development of the green system and the system of open public spaces (cr.: 2/2);
2.4. Achieved visual connectivity (credits: 2/2);
2.5. Structural adequacy of the urban environment / harmonization with the typical urban structure (credits: 2/2);
2.6. Functional harmonization and consistency with the surrounding urban areas (cr.: 2/2);
3. Level of solving the environmental problems (amount of credit: 6/8)
3.1. Level of improvement of the urban ecology (credits: 2/2)
3.2. Level of improvement of the quality and characteristics of the water area (credits: 2/2)
3.3. Level of improvement in the management of water levels (credits: 2/2)
3.4. Level of reduction of indirect negative impact on protected natural areas and water areas (credits: 2/2)
4. Level of solving the problems of cultural heritage and creating a memorable architectural image (amount of credit: 7/10)
4.1. Level of alignment with the historic environment and cultural heritage (credits: 1/2)
4.2. Conservation and recovery of valuable historic buildings and ensembles in the territory (credits: 0/2)
4.3. Preservation of historical memory of the historical functions of the area (credits: 2/2)
4.4. Prominence and aesthetic qualities of architecture (credits: 2/2)
4.5. Diversification and enrichment of coastal silhouette (credits: 2/2)
Credit rating: 35/40.

Genoa - Naval History - Tradition and Modernity
The aim of coastal regeneration is to improve the physical conditions and public services, revitalize the economy and mobility and increase the attractiveness of Genoa as a cultural destination (the center is a UNESCO site). A complete regeneration of the old port is performed.
Functional profile and urban image: Mixed multifunctional zone including: Half-sheltered arena and outdoor arena; large green square, transformation of cotton warehouses into a congress center and children's attraction, aquarium and tropicarium, commercial centres, sports facilities, museums and research institutes, restaurants, cineplex, hotels. Development of marinas, travel, cruise and ferry terminals with diffusion of public functions in them.
Specific characteristics of the decision:

- An overall renovation of the area, turning it from an industrial port into a city center, busy all year round and offering many opportunities for recreation and entertainment.

- Creating an environment for cultural events and conference activities and converting the city into an international tourist center; Transformation of the old warehouses;
- Overcoming the barriers and connecting the cost with renewed city center
- Many open public spaces, but few green elements; they will increase after implementation of Ponte Parodi building with roof gardens

Analysis on key indicators:

1. Level of solving socio-economic problems and achieved efficiency in land utilisation (amount of credit: 10/10);

1.1. Functional efficiency according to the level of functional mix and effective functional balance (credits: 2/2);

1.2. Functional efficiency according to the level of satisfaction of the socio-economic needs and gaps - jobs and services for the population (credits: 2/2)

1.3. Functional efficiency according to the level of stimulation of the urban economy (cr: 2/2)

1.4. Functional efficiency according to sustainability of the loading of the area (day-round, all-seasons, long-term) (credits: 2/2);

1.5. Functional efficiency according to the level of wide-mix of users (credits: 2/2);

2. Level of solving of urban problems (amount of credit: 12/12)

2.1. Achieved transport linkage with the region and the city (credits: 2/2);

2.2. Implemented pedestrian links (credits: 2/2);

2.3. Level of development of the green system and the system of open public spaces (cr.: 1/2);

2.4. Achieved visual connectivity (credits: 2/2);

2.5. Structural adequacy of the urban environment / harmonization with the typical urban structure (credits: 2/2);

2.6. Functional harmonization and consistency with the surrounding urban areas (cr.: 2/2);

3. Level of solving the environmental problems (amount of credit: 4/8)

3.1. Level of improvement of the urban ecology (credits: 2/2)

3.2. Level of improvement of the quality and characteristics of the water area (credits: 2/2)

3.3. Level of improvement in the management of water levels (credits: 0/2)

3.4. Level of reduction of indirect negative impact on protected natural areas and water areas (credits: 0/2)

4. Level of solving the problems of cultural heritage and creating a memorable architectural image (amount of credit: 10/10)

4.1. Level of alignment with the historic environment and cultural heritage (credits: 2/2)

4.2. Conservation and recovery of valuable historic buildings and ensembles in the territory (credits: 2/2)

4.3. Preservation of historical memory of the historical functions of the area (credits: 2/2)

4.4. Prominence and aesthetic qualities of architecture (credits: 2/2)

4.5. Diversification and enrichment of coastal silhouette (credits: 2/2)

Credit rating: 36/40.

3.2. Classification of the Urban Models for Waterfront Regeneration

Main groups of regeneration models:

A. Solutions with complete removal of port complexes in suburban areas and clear the waterfront of the "core" city

B. Decisions / Solutions with transfer of handling, ship repair and military terminals and storage areas outside the "core" city and development of passenger and fishing ports with diffusion "typical urban" functions.

C. Decisions as to which ports remain in the same range (due to lack of suitable areas and unjustified expenses) and other tools are used to overcome the inaccessibility.

Complementary groups of Regeneration models:

ME. Mega-events. Conversion associated with these projects is realised by full or partial relocation of ports and they are an intermediate stage of models A and B.

LB. Linear barriers. Overcoming them through various methods is an approach that combines with each major group of regeneration models.

The following factors should be taken into account when choosing a group:

- Is the port complex a barrier and a buffer for the town itself and its center?
- Is there a practical way to move the equipment?
- Is there a need to modernize the port and service infrastructure?
- Are there potential host areas without such problems?
- Are there serious environmental problems in the sea and land?
- Are there a valuable ecosystems and areas of high nature value in the area?
- Are there areas with high cultural and historic value in the complex?
- What is the tourist and ecological potential of host territories?

Subgroups of Regeneration models:

A. Solutions with complete removal of port complexes can be developed as:

A1. Parks or predominantly park areas

A1.1. Classical park areas

A1.2. Parks, filled with objects of public services and attractions

A1.3. Multifunctional areas in parks

A1.4. Large specialized parks: zoo, botanical, sports, fun / attraction parks

A2. Wide-area exhibition complexes

A3. Mixed multifunctional central zones with predominance of services and recreational functions and restoration of urban "fabric"

A4. Business, administrative and research centers

A4.1. Business areas with offices and hotels, richly designed with open spaces

A4.2. Predominantly administrative complexes

A4.3. Dominated by research and education centers

A5. Mixed residential areas with offices, hotels and services

The following factors should be taken into account when selecting the subset:

- The proximity to the city center and the district center and pedestrian accessibility
- The size of the city and the district center, population
- The ratio of the transformed area to the area of the functional center of the city
- Available or possible connection to functioning pedestrian zones and parks
- Presence of nearby stops of high capacity ecological public transport
- Tourist profile of the city and forecast tourist capacity
- Significant social lack/ need

B. Decisions with transfer of some of the terminals and the development of passenger and fishing terminals that are "open" to the city and most often become multifunctional areas saturated with marketing, attractions, museums, hotels, congress centers, open spaces and green areas. According to the functional balance they are:
B1. Multifunctional central areas dominated by service sites
B2. Park recreational areas saturated with social-service facilities
B3. Entertainment areas saturated with social-service facilities
B4. Complexes dominated by hotel-residential functions
B.ME.1. Land hosting single mega events
B.ME.P. Small permanent exhibition and trade fair complexes with administration.

C. Other measures to overcome inaccessibility to the waterfront – subgroups:
C1.Transforming part of the terminals in multi-functional zones and aesthetization or visual isolation of the other terminals, that have low permeability of urban functions
C2.Inner-port translations, followed by port transformations; the terminals that can act as multifunctional zones are transferred to the center and the others - to the periphery
C3.Space-invasive solutions and structures for public access to the waterfront ceded public spaces in restricted areas; applied when no other methods are available
C3.1.By opening public access to existing bridges, piers and docks that can be released and access to them will not interfere with the operation of the terminal

C3.2.By facilities that bridge the port area - pedestrian gangways or relief-morph buildings and structures whose roofs are used as public open spaces

Key factors in determining the structure and architectural image:
- Distance from the center and the intensely built-up urban areas
- Preservation of historic formed central-urban ensemble nearby
- Homogeneity / heterogeneity of the architectural style in the complex; ensemble
- Homogeneity / heterogeneity of buildings nearby; ensemble / diffusion

- Presence in the complex of valuable buildings for preservation; ensemble/ diffusion
- Presence in the vicinity of a structure expressed with visual and communication axes
- Presence in the complex of space to restore the urban fabric

In recent decades the dilemma for partition of preserved monuments is decided more clearly thanks to the activity of UNESCO for declaring of ensemble monuments of World cultural heritage on the coasts. Assessment of value is necessary for the start of designing.

3.3. Metodology for selection of a regeneration model

- Analysis of the territory and the city by groups of problems
- Defining of a leading group /groups/ according to the importance of issues in a particular case and distribution of weight between the groups
- Defining of the possible areas-receivers and the possible degree of transfer
- Selecting the main group of regeneration model based on the above choices
- Adding a complementary group LB or ME.
- Determining a subset regeneration model. For a group A or B this is based on ratios, functional and structural adequacy, significant social lack and possibilities for connectivity to the center.
- For a group C - based on the conditions of implementation and the type of terminals.
- Determination of structure and architectural image
- Phase separation and determination of scheme of partnership in terms of financing, implementation, monitoring and management of public-private partnership.

4. CONCLUSION
THE MOST SUCCESSFUL SOLUTIONS TO RESTORE THE URBAN FABRIC AND CONNECTIVITY OF THE WATERFRONT TO THE CITY

To select the most appropriate for each case decision all factors and conditions in the city must be taken into account, as well as the public needs and characteristics of the surrounding areas and to identify solutions for maximum of the existing problems. However, aggregated dependencies show that:

- When selecting regeneration models A and B, the more remote the port area from the city center or the district center, and the greater the ratio of its area to the area of the active center, the greater must be the share of housing and employment areas. Conversely, the closer the regeneration area is to the active center and the smaller it is compared to the center, the more easily this zone can be converted into its natural extension. This ensures a sufficient number of users of services, trade, green areas and public spaces in it. If this rule is not obeyed, these objects and spaces will be deserted, as they will not have enough users. Public transport has an important role also, since it can generate permanent and sustainable user load of the territory
- The connectivity of the city and its elements is greatest in the center and decreases towards the periphery, so in order the waterfront to be a fully functional part of the city, its zoning must provide such a distribution of functions, which can respond to this dependence
- The intensity and multi-spectrality of usage of urban areas is highest in the center and decreases towards the periphery
- A greater functional mix would ensure a sustainable daily, yearly and long-term load and economically sustainable solutions
- Maximum accessibility and maximum range of users have both a moral aspect and also ensure sustainable development.
- Because of the specific situation of the old ports (near to the city center) and the need to serve a variety of functions, pure mono functional decisions are not the best, nor most effective and sustainable.
- On the other hand the green and open spaces are a necessary component of the solutions to urban waterfront, because they provide the final link in the system of pedestrian routes and common accessibility requires it.

These statements define the range of eligible effective urban solutions:

- In city centers in small coastal zones (up to 1/2 of the area of the center) suitable park solutions saturated with services, mix areas in parks and mix areas rich in green spaces
- In more remote from the center and wider zones (more than 1/2 of the area of the center) are appropriate solutions of the "core zones" type with a strong participation of homes and services and availability of parks
- In the urban periphery and suburbs are eligible limited accessibility parks (fun and sports centers, protected natural areas, big zoo) and zones with more greenery (campuses, research centers, large exhibitions, luxury residentials) or

other gated complexes such as storage and non-polluted industrial zones.

- Classical park areas being variety of the mono-functional decisions are also a controversial decision, especially when they are monotonically conducted along the entire coast. When planning the city waterfront area we should be looking for an opportunity to lay on an uninterrupted "green" pedestrian strip along the coast that pulsing (by size and diffusivity) to "overflow" in the a/m areas and provide accessibility and connectivity of pedestrian routes. In case of shortage of green areas in the city center, the choice of a green area full of public service facilities is suitable for the central coast. It must comply with realities (structure and function) of the adjacent urban periphery and adapt appropriately. Thus the main axes of communication from the city will spill over into the main lanes of entertainment and shopping facilities, and the load of the side of the park areas will gradually decline and will respond to the quiet residential areas. Rhythmic pulsation of the workload with visitors and sites along the coast is appropriate. An important aspect is the promotion of the usage whole park area through adequate service by public and private transport. An important condition for successful implementation is the limitation of motor traffic in these areas – it must be either underground or be strictly limited and controlled in order to prevent "falling apart" of parks.

4.1. Figures, Graphics, Photographs and Tables

HAMBURG

Fig.1 Left: Hamburg and new Hafencity on Google Earth; right: New concert hall Elbphilharmonie and 5-star Hotel in old cocoa warehouse, Architects: Herzog & de Meuron, from: www.formwaende.de/single/article/elbphilharmonie-hamburg-1.html

Fig.2 Hafencity from bird eye – structural harmony between new and historic structures, from:www.hafencity.com/

Fig.3 Hafencity, functional and structural analysis

BILBAO

Fig.4 Left: District Barakaldo and area Galindo in Bilbao;
/from www.bilbaoria2000.org, www.barakaldo.org/.;
Right: functional and structural analysis of the same area;

Fig. 5 Left: District Abandiobarra next to the cetre of Bilbao
/from www.bilbaoria2000.org/.;
Right: functional and structural analysis of the same area;

Fig. 6 Landscape design of Abandiobarra (left)
Barakaldo-Galindo regenerations (right)
/from www.bilbaoria2000.org/

GENOA

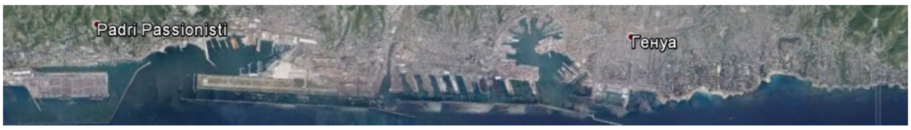

Fig. 7 Genoa metropolitan waterfront on Google Earth

Fig. 8 Functional and structural analysis of the Old port /Potro Antico/;

Fig. 9 Potro Antico from bird eye /from: www.portoantico.eu/

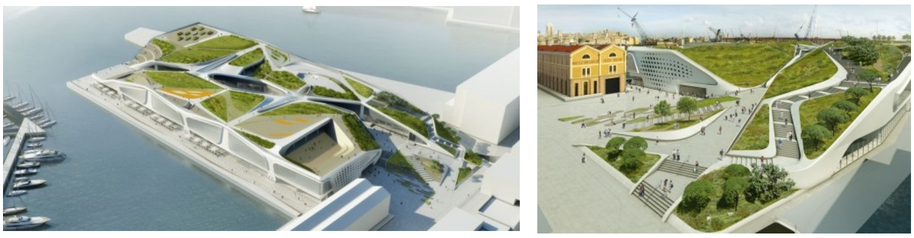

Fig. 10 Design of new Relief-morph building on Ponte Parodi, Architects: UNStudio, /from:www10.aeccafe.com/blogs/arch-showcase/2011/12/06/ponte-parodi-in-genoa-italy-by-unstudio/

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READING THE CONSTRUCTION OF IDENTITY IN ACADEMIC WRITINGS THROUGH THE CASE OF MARDIN

NURCAN GÜNEŞ[1]

ABSTRACT

Today, in many spheres of life including architecture, "to have an identity" is considered to be an important qualification for anything, and the reverse is considered to be extrinsic. Particularly, "identity" is emerging as a theoretical obstacle / limiter in architectural education and also in the professional practice. Construction process of identity is possible to refer in field of architecture as in all human sciences. Identity is a subject which is hard to talk about, despite its quality of creating new controversy routes. While the research of humanities related to identity issues tend to refer to dichotomies, in the field of architecture it produces clichés. When the PhD and master thesis that are done in the field of architecture were made subject to textual analysis is thought that identities of architects, architectures, urban districts and buildings are all produced in similar pragmatics. This paper will focus on how academia- which is one of the identity constructing actors- constructs identities. In the study, examples about production of urban and buildings' identification will be given. Thesis was written in Turkish academic institutes which included keywords of "architecture" and "identity" will be examined. Such research that has a small but effective cross-section is expected to reveal academia's role in the production of identity. After identity constructions or productions of ideals in academia are tried to be explained through several examples, their impacts on the production of novelties will be discussed in the conclusion. What kinds of problems will emerge from interference to an urban area, a building or an object which is considered a production of architecture with identity rhetoric or engagements will be discussed. In this respect, if holiness references such as owning an identity or essence are being produced by academia, it is possible to talk boundaries about understanding and signification. Despite the studies that are made to bring architectural products identity into view, it is argued in this study that here is no hierarchical priority among the numerous combinations that form the identity.

Key Words: Identity

[1] R.A., Mardin Artuklu University, Department of Architecture, MARDIN

1. INTRODUCTION

It is known that many academic gatherings held in Turkey for so many years have frequently thematized their sub-titles with ‘identity’. Particularly in architectural and urbanism studies of social sciences, it is possible to mention several titles focusing on identity. Taking this as a point of departure and assuming that identity is constructed by several specific means, it is safe to argue that academia is also one of those means.
The academic world of architecture has also produced many identities and particularized that knowledge with the domination of scholarship. This study is written, as a reference to a chapter in the thesis titled ‘A new reading approach to Identity: the Discursive Construction of Identity and the Case of Mardin,’ which was submitted to Karadeniz Technical University in 2013, with the purpose of developing a critical point of view with regard to scholarship produced by academic works.

2. EXAMINATION OF IDENTITY PRODUCTION IN ACADEMIA THROUGH EXAMPLES

Knowledge production in academia is a subject that needs to be studied and criticized. Aiming particularly to know and understand the subjects, this domain’s occlusive approach to create identities is noteworthy. In academic circles, yet especially in architectural academic circles, the ongoing dominance of positivism can be seen as the reason for such approach. Restraining almost all knowledge into a concept by categorizing them is one of most frequently used methodology in academia. Most academics not only conflate all concepts and use them in one ideal monolithic term, but also create a homogenizing reflection vis-à-vis such concepts. Further, they label the research topics with a codification of forms. This eventually leads us to a description of the research subject as ‘absolute,’ existing in a space far away from its own reality (albeit directed to a nearby space).
This approach, which to some extent is understandable in natural sciences, is not practical in social sciences since ever-changing research object in such disciplines is ‘humans. ‘Likewise, the discourses of identity by academics, for the sake of being objective, are produced with idee fixe that freezes or stabilizes human factors as much as possible. I criticize not the quantity here but rather the very belief on the invariance of the quantity. The reason for that is because different identities are constructed on the quantities that are regarded as invariant in academic texts written in the field of humanities, and even these constructed identities are expressed repeatedly as entrenched stereotypes.
At this juncture, when we look at the meaning of the concept of identity we see that the concept itself produces a continuous dichotomy between its meaning and the object it describes. For example, when one says " something with A identity,’ this at the same time means that the described thing is regarded as similar to all identity A

holders or members and dissimilar to other non-A identities. This case makes hybrid identities difficult to include or even think about them in existence. On the contrary, the absence of hybridity cannot be the case at all.

Owing to the scope of this study, the construction of identity in urban and architectural context is examined with relevant examples. For example, "Turkish House" (Sarıalioğlu, 2007) epitomizes one of the most widely used and remarkable examples of the construction of this identity, which is a commonly written stereotype in this regard. Sarıalioğlu, studying the conceptual construction of "Turkish House"(Sarıalioğlu, 2007), argues that the concept of Turkish house roughly began to be discussed and therefore constructed since the 1930s, concomitantly when Turkey's traditional residential architecture or cultural heritage began to be 'officialised.' The conclusion of Sarıalioğlu's work evidently demonstrates how academia constructs an identity.

"During 1928-1950 when the earliest texts on "Turkish house" in Turkey were written and in the process of developments in the Early Republican Era's Turkey, a "national "category, under the name of "Turkish house" was created. With its known discourse, typological, morphological, social, and even esoteric approaches were developed for the subject categorized under 'Turkish house; not only in architectural narratives or in historical narratives on architecture, but also in in the popular imagination, the term Turkish became a concept that everyone agreed to use. It is evident that the aim of that approach was to melt the pluralism/diversity of normal housing into a 'singular' national architectural category. Therefore, the construction of the 'nation' in Turkey is accompanied by the concept of 'Turkish house.' In the texts written after the 1960s, however, it is seen that the construction of the concept of 'Turkish house' was completed, that is to say, there was left no doubt about the existence of 'Turkish house' typology by then. "

Accordingly, construction of a similar structure can be observed in many theses written on urban identity. Moreover, it is likely to see a variety of identity construction in many theses written in other fields, apart from architecture and urbanism. For instance, if the study subject of a work in any field of study is about a city or an urban area, it is possible to read the monolithic identity that is constantly produced for an urban area in the titles describing the field of study. To exemplify, when theses that are written about and around Mardin[1] are examined the said two cases appear to be a common feature. In this line, some of these theses contain identification of local findings and design models that are developed based on such identification. In these theses in question, the concern of "protectionism" leads to an approach that accept building dating back to only a certain period, or 'old' architecture as meaningful and valuable stands out.

Apart from these, likewise in many of the titles of these theses, the information on the identity of Mardin presents many stereotypes and even myths, which indicated the latter case. The phrase, "History and Culture of the city of Mardin" (Davutoğlu, 2008), (Demir MM, 2010) is present in almost all theses studying the city. In the

[1] List of last ten years' examples are provide from the1st Attachment of "A new reading approach to Identity: the Discursive Construction of Identity and the Case of Mardin"

same way "historic urban fabric" is presented as magnum opus or masterpieces, decontextualized from its social fabric (Gündüz, 2011).

It is demonstrable to see the impact of academia in identity formation in many studies as in the abovementioned examples. After such recognition some discussion as well as frameworks on the definition of the identity can be discussed.

To begin with, for example, one of the topics needs to be discussed is the design grammar that is built on the acceptance of the historic urban fabric and architecture of the city. In these works, which are mostly based on formal data, it is observed that the reading of social relations networks seems insufficient. In such a reading methodology, the performer's point of view is fixed with numerical values, thereby; a definition that defines an invariant inferred from relationship diagrams of specific but limited number of networks is the conclusion. In this methodology, which can also be described as the implementation of mathematics to space, regardless of numerous results, because the conclusions are fixed, the method intrinsically is limited too. This following tack is followed in this methodology. First of all, the identity of the subject of the research is determined and then this presupposition is regarded as factual input for the next stage. The determined identity is regarded as a grammar however this grammar is established solely on subjective readings. At the end of each study, a presupposition or postulation is developed based on the grammar therein While studies conducted with this framework might be important for proposing alternatives, they are problematic at the same time because they also produce the perception as though there is a single and monolithic identity in that respect. Furthermore, it is seen that the methodology used for drawing such a conclusion reduces the design activity to a "chemical reaction" whose input, output and catalyst are deemed self-evident. However, architectural design indicates a further level in which social inputs continuously produce different and time variable results. With the progress in computer technology and its incorporation into architectural design process, one can see the inevitable use of this method in architectural theses completed in this field.

An example of this case is again present in one of thesis conducted on Mardin. The thesis, titled "Contemporary Mardin Housing Settlement Arising from Tradition," as the author argues, " aims to write about development of an design method of residential alternatives derived from modern housing typologies compatible with historical texture. " (Uzbek, 2004). As the author points out that the study is carried out in order to develop an alternative in the first chapter, the second chapter, however, describes the characteristic features of "Mardin houses." In the third chapter, the author develops presumptions regarding the new residential settlements, employing the grammar that is established from the characteristics of houses.

Although the study is successful in terms of its methodology, it can be argued that the thesis also poses some problematic issues as well. When starting with the design and doing so by a presupposition of characteristics of Mardin houses, developing typology in this manner is required. However, this presupposition is questionable in terms of its correctness and seems to consist of an imagined and self-produced morphology. Another issue of conflict is the assumption that the tradition is regarded as a value that needs to be produced, sampled or imitated or followed. In addition, the type of relationship that an image that is denominated as "traditional" would have in this "traditional state" of space or how it will establish a presence in" contemporary" settings should be contemplated and described.

One can make reference to many more theses that are written in this regard. Nevertheless, without dwelling on this subject more, it is useful to touch on the construction of tradition in order to better understand the construction of identity. For creating an identity, grammar or a language, one primarily needs ‘ideal' or more generally, a typology. The production platform for this construction is the existing theory and previous academic studies. That is why especially the chapter in which the object of study is defined contains many academic references and quotations.

For example, the book by Füsun Alioğlu, titled " Houses and Texture of the city of Mardin" is considered as one of the most important works among texts, studies, and books written about Mardin. The book, which was published as a book in 2000 and was derived from Alioğlu’s 1988 doctoral thesis titled "An Essay on Traditional Houses and Texture of the City of Mardin," as well as other subsequent and enriched studies by the same author has been a textbook many researchers (Seçkin, 2007). The foregoing book, however, is a reference book for researchers working on Mardin. In the preface of the doctoral thesis, which was published into a book 12 years after its submission, first impressions and generalizations of a researcher draw the attention. The thesis, which aims to establish characteristic of Mardin houses within the framework of traditional houses and with the help of then research on "Turkish house," and to understand the composition of the urban fabric in Mardin, endeavors to explain the "historical" and "formal" identity of the region. In the introduction of this thesis, Alioğlu writes that periodic readings can be demarcated however she mentions that it is difficult to determine chronology in terms of structures (Alioğlu, 2003).

"The effects of increasing industrial developments in the world since the 19th century, was the case in Anatolia after the second half of the 20th century. Mardin is one of the latecomers of this process in which both large and small settlements were affected. This is the reason that Mardin is more preserved today compared to other settlements, and this itself was regarded as an opportunity, which also determined the decision to work on Mardin in this thesis. In studies on traditional Anatolian cities and houses, conclusions are derived usually ignoring the East and Southeast regions.

The main point of debate in these studies is centered on the texture of the city before and after Turkish period. In the pre-Turkish period texture of the city, although Hellenistic, Roman traces are tracked down, more often the question regarding what the Byzantine meant and what the Turks had added on top of that background was the case. The cities located in the southeast of the country, albeit within the borders of Turkish period Anatolia, could not receive attention and space in the narratives aiming to cover the overall subject, basically because these cities also had undergone Arab-Islam dominance prior to Turkish period. Another objective of this thesis, at this point, also revealed the need for studying traditional texture and houses of the city of Mardin"(Alioğlu, 1989).

It can be seen that, when stating the objective of her thesis, Alioğlu describes the city's architectural heritage with an identity narrative based on race, region, nation or rulership. Such an identity narrative can be claimed to challenge a research that aims to have and integrated approach focusing on Mardin from today to the past. The reason is that because the city does not appear to be suitable for making an identity distinction leading an architectural heritage typology thereto. It can be argued that a historical analysis would yield more objective results without developing a typology.

3. CONCLUSION

As a result, this study elucidates the construction of identity or production of 'ideal' by academic works through focusing the case of Mardin. Similar studies can be carried out on architecture, urban studies or even all cases involving identity discourses. The main criticism that is aimed to be made in this study is the unchangeable, occlusive and uncritical conclusions of discourses of identity. When examining the studies done, contemporary researchers, as Tanyeli also argues (Tanyeli, 2011, p. 459), should take into account the fact that an 'identity is not unique at least in four aspects.' The first of these aspects is that identities are not objective but rather subjective. Identity can differ according to person or who defines identity. Another aspect is that criteria for differentiation of an identity also contain many other identities as well. Defining the third parameter as the time, Tanyeli points out, identities can transform in the course of time. Finally, describing the fourth parameter as the context, Tanyeli underlines that each time an identity is articulated it is defined differently and questions which contextual identity should be accepted as 'the genuine' articulation of that identity.

Throughout the study, the discussion of what determines identity is particularly not mentioned. That is because identity is regarded as a discursive discipline and can permeate all sociological fields, therefore all kinds of identity discourses that are produced by academic works overall is the focus.

Likewise, concepts used in architecture and urban studies such as architectural identity, and structural identity are also criticized in the same pot. Any predetermination of studies aiming to read identities that does not take into consideration those four parameters above as well as numerous combinations thereafter seems to be out of the hearth of the issues and self-evident. In the urban context, if the references of sanctity are attached to some terms such as locality, identity and having a particular identity are produced by academia, then, it is possible to talk about a tendency towards a deadlock, which has its own boundaries with regard to understanding and explaining such concepts. Tanyeli's criticisms of identity and architectural identity, in this context, seem to be elucidatory and informative.

"Let's suppose that we can to build things that reflect our 'identities,' then, we have to specify, according to whom, when, and which components of which of our identities they should reflect. Those arguing that a city lost its architectural identity

or has a fake identity, should first try to define the original identity they talk about. Of course, that does not yield any answers. Such identity definitions cannot be made. Neither is it possible, nor is democratic. Let alone being rational "(Tanyeli, 2011, p. 461).

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BUILDING INFORMATION MODELING TOOLS: OPPORTUNITIES FOR EARLY STAGES OF ARCHITECTURAL DESIGN

ÖMER HALİL ÇAVUŞOĞLU[1]

ABSTRACT

In the practice of building design, numerous researchers point out that, at the early stages of architectural design, many significant decisions are taken to directly affect functional qualities, the performance of the building, aesthetics, and the relationship of the building with the natural environment and climate, even if there is no certain and valid information to create and obtain satisfying design.

In this paper, I particularly focus on the early stages of architectural design and search for the opportunities provided by Building Information Modeling (BIM) tools, towards the concept of performance analysis and aesthetic variations. Study also includes case study implementations which visualize the early processes of architectural design with benefits of BIM under different conditions to evaluate its opportunities during these design processes. To clarify and to test the benefits of BIM tools, the task is done to create a concept model with Vasari and Revit software. Participants are asked for designing alternatives within the given requirements and synchronically, I analyzed the process within the perspective of how design products are shaped and also how the process effects the designers while they are designing.

Later on, I observe how participants use the tool to obtain aesthetic variations and how tool provides a connection between aesthetic issues and the performance realities. At this stage, BIM tools provide an evaluation platform to crosscheck the current design alternatives with the selected building components and environmental conditions such as temperature, sun light directions, wind directions, and so on. By this way, designers are able to realize the relationship between the design product and the environment and also be able to obtain performance analysis of the alternatives on the very early stages of architectural design.

As a result of these case studies, I observe that the BIM tools (Vasari and Revit) which are used in this study, do not provide an automated design process, but only analyze the designer’s existing design to enable the evaluation of the relationship between the building and the environment. Then, the design relies on both the functional realities and the subjective judgements of designer. This operation continues as an iterative process until designer feels satisfied for his/her design product.

As a summary, early stages of the architectural design are accepted as the weakest point of the BIM systems. In this study, two case studies have been implemented to reveal how BIM can help to designers in these stages. As a result of the

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implementations, it is understood that BIM is a powerful early stages of architectural design tool, not for designing but for design supporting.

Key words: conceptual design analysis, computational design analysis, building information modeling

1. INTRODUCTION

Architecture is a profession that is in a tension between imagination and reality. The architect's task is to convert the client's dreams into a concept design which is expected to lead to a functional, legally proper, and aesthetic design (Foqué, 2010). The role of the architects in the related process often begins from the starting point of the project to the end of the construction. As the architectural design process has a complicated structure with different purposes, it is divided into stages.

Numerous researchers point out that, at the early stages of architectural design, many significant decisions are taken to directly affect functional qualities, the performance of the building, aesthetics, and the relationship of the building with the natural environment and climate, even if there is no certain and valid information to create and obtain adequate design.

In this paper, I particularly focus on the early stages of architectural design and search for the opportunities provided by Building Information Modeling (BIM) tools, towards the concept of performance analysis and aesthetic variations. The focus of the study is to offer, not an alternative way for traditional design practices but a supporter. From this perspective, firstly, I review the literature on early stages of architectural design, its characteristics, usual habits, and positive / negative aspects. The following two sections (Case Study A and B) are the implementations of BIM tools (i.e. Vasari and Revit) in the early stages of architectural design. These sections also include assessment of the cases to discuss the strong and weak features of the tools. In the last section, I also evaluate the findings of the case and literature review in the same context to constitute a new approach for early stages of architectural design.

2. EARLY STAGES OF ARCHITECTURAL DESIGN

Stages of architectural design process are defined within the various procedures by different authorities. For instance, the Royal Institute of British Architects' (RIBA's) Plan of Work includes nine main stages as inception, feasibility, outline proposals, scheme design, detail design, production information, bills of quantities, tender action, and project planning (Thompson, 1999). From the perspective of RIBA, the early design stages refer to inception, feasibility, outline proposals, and scheme design.

Other studies show that, in the early stages of architectural design, sketching and drawing with paper and pencil still has an important role for exploring possible design alternatives, evaluating the ideas, and also communication with self (Do, 2002; Lawson, 1994; Herbert, 1993; Graves, 1977; Schön, 1985; Goldschmidt, 1989). On the other hand, being digital makes CAD softwares more effective than traditional drafting methods in terms of time, cost and ease of use. However, these CAD software which are really useful for drafting, are not suitable for initial design tasks like exploring new ideas.

In this stage, designers also are expected to decide on key factors such as building orientation, building shape, structural system, building envelope and interior finishes with inadequate and indefinite information (Gervasio et. al., 2014; Granadeiro et. al., 2013; Oral & Yılmaz, 2002; Oral & Yılmaz, 2003; Hong, Chou & Bong, 2000; Holm, 1993; Gratia & De Herde, 2003). These decisions which are taken with often inadequate information on the site, climate, geography, also provide a basis for the final performance and the aesthetics of the final outcome.

To address both the negative impacts of designing with inadequate information, and the emergence of the performance requirements for the building efficiency, researchers and practitioners become aware of the need for digital preliminary design information databases which are systems including all relevant statistical informations about the existing environment such as temperature, sun light directions, wind directions and so on.

Do (2002) mentions that in order to support creative design, design tools might offer additional capabilities to standard drafting and editing software. She argues about a computational sketching system and emphasizes in parallel the importance of knowledge-based editing, simulation, and accessibility of relevant design information. Since 2002, these database systems have been more and more used as integrated parts of BIM software. Now, designers can exploit the advantages of BIM software (such as powerful drafting, visual analysis reports, scheduling and budgeting features) and also analyze their designs within the conditions of given information in the same media.

Foqué (2010) expresses that “intuitive thinking and rational thinking are not opponents; they are the twin poles between which the artist structures reality”. In addition, he also asserts that with the emergence of modernity, architecture practitioners hover between science and art (Foqué, 2011). Within this context, he states that research by design is a keystone as it comprehends possible realities, searches their attraction, shifts the existing reality by implementing a new one and evaluates the resultant reality by creating design applications, relying on technological knowledge and artistic interpretation (Foqué, 2011).

All in all, I can underline that taking advantage of essential information in the early stages of architectural design is useful and important for the whole design process and the final product. Additionally, BIM tools with their “information” capability, operate as an improved architecture software with powerful 2D and 3D drafting features, performance simulations, and visual analysis feedbacks. It must be mentioned that these tools (Vasari and Revit) do not provide an automated design process, but only analyze the designer’s existing design to enable the evaluation of the relationship between the building and the environment. Then, the design relies on both the functional realities and the subjective judgments of designer.

In this section of the paper, I study the current realities of the early stages of architectural design by literature review, and then, I explain how BIM tools can offer new opportunities within the design processes. Below are the implementations of two case studies to evaluate the efficiency of BIM tools within the context of basic design decisions with regards to the later stages of architectural design.

3. CASE STUDY A

3.1. Problem Definition

Case Study A is an implementation of designing an office building in Istanbul/Turkey, at the very early stage of architectural design, which is needed to have 5000 m2 area with decent energy performance. I determine some constraints to make design simpler and also to give Vasari (conceptual mass design tool which is used for this implementation) more freedom. These constraints are: Assuming the immediate environment is unconstructed (1), evaluating the aesthetic issues as only aesthetic variations (2), assuming land use property limitations such as ground usage or maximum height as free (3), and also ignoring the relationship quality between the topography and the building model (4). There is also another constraint that the only design tool used in this case is Vasari.

3.2. Case Study Methodology

At this case, to clarify and to test the benefits of BIM tools in the very early stage of architectural design, the task is done to create a concept model with Vasari software and to observe its reflections on the designer and design product. Case study has been done by a master degree student of architectural design computing department who has a moderate BIM knowledge.

Participant is asked for designing alternatives within the given requirements. Synchronically, I analyzed the process within the perspective of how design products are shaped and also how the process effects the designer while he is designing. Later on, I observe how participant uses the tool to obtain more aesthetic product and how tool provides a connection between aesthetic issues and the performance realities.

3.3. Implementation

Towards to the benefit from the capabilities of Vasari, case study participant decided to create three basic alternatives to work with. These alternatives were the basic masses which are dimensioned as 25x100m with two floors, 20x50m with five floors, and 22.3x22.3m with ten floors. At this point, he also decided to differentiate the alternatives within themselves. To achieve these variations, participant used the conceptual mass analysis and the energy model feature. Within energy model feature's settings, participant defined the building type as office, location as Istanbul/Turkey, building operation period as 24/5 facility, and HVAC system as Central VAV, HW Heat, Chiller 5 (Figure 1). Also, participant used the default building component settings of Vasari and automated three more alternatives (percentage of glazing as 20%, 50%, and 80%) for each initial three alternatives. All the information that the software used when producing the new alternatives are taken from the database of Vasari.

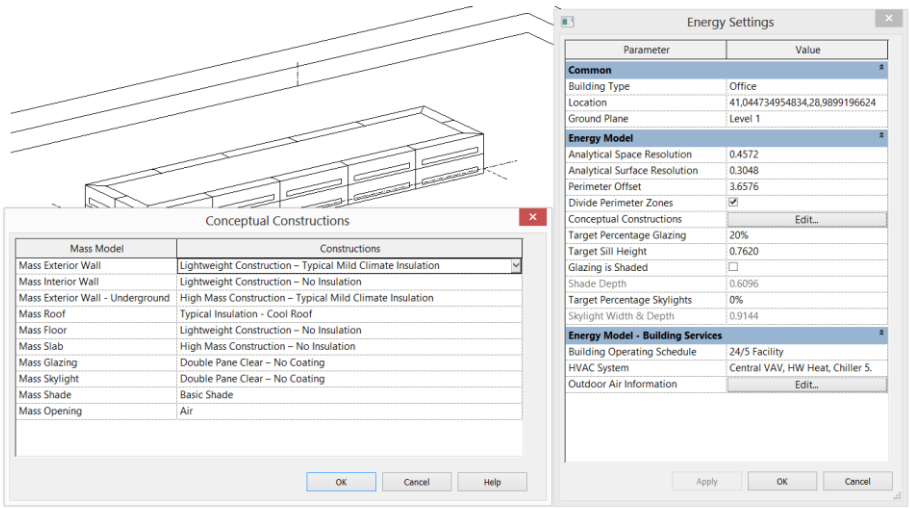

Figure 1. Energy Settings of one of the alternatives

At the end of this semi-automated process, participant obtained nine different office building variations with all different energy performance and appearance (Figure 2). Later on, participant compared the performance analysis of the alternatives and noticed that the one (Alternative 3 with 80% Glazing, ninth alternative) which participant was willing to continue his designing process, was also the one with the worst performance. To make better of the performance of the building, participant decided to change some components of the building such as high insulation construction materials and one meter length sun shading units (Figure 3). With these building components, ninth alternative achieved the requested requirements and was approved.

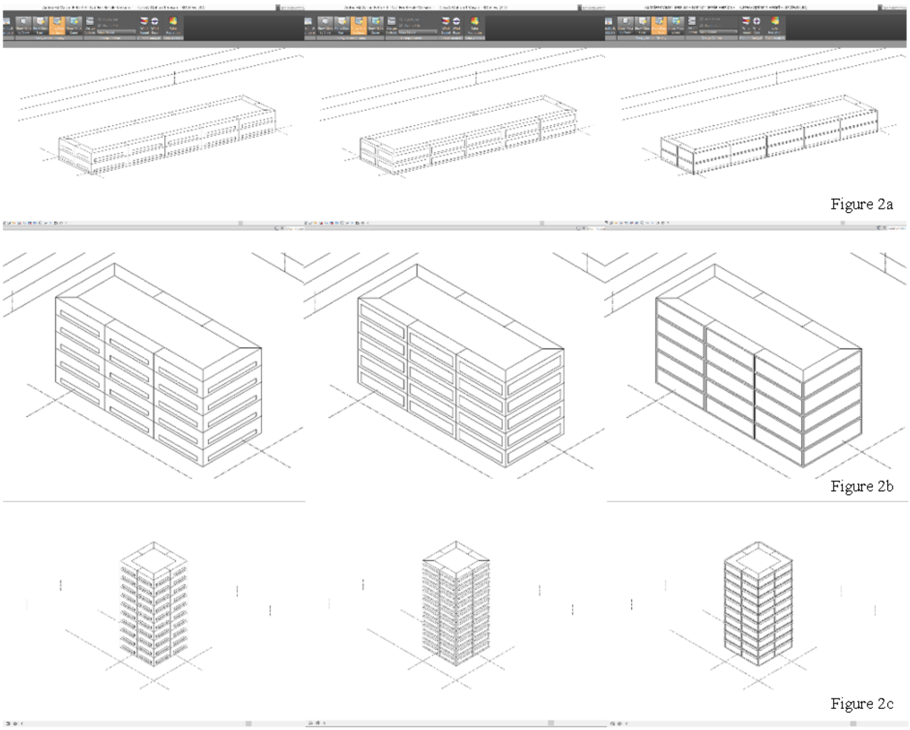

Figure 2. Three conceptual mass alternatives with their three derivative alternatives

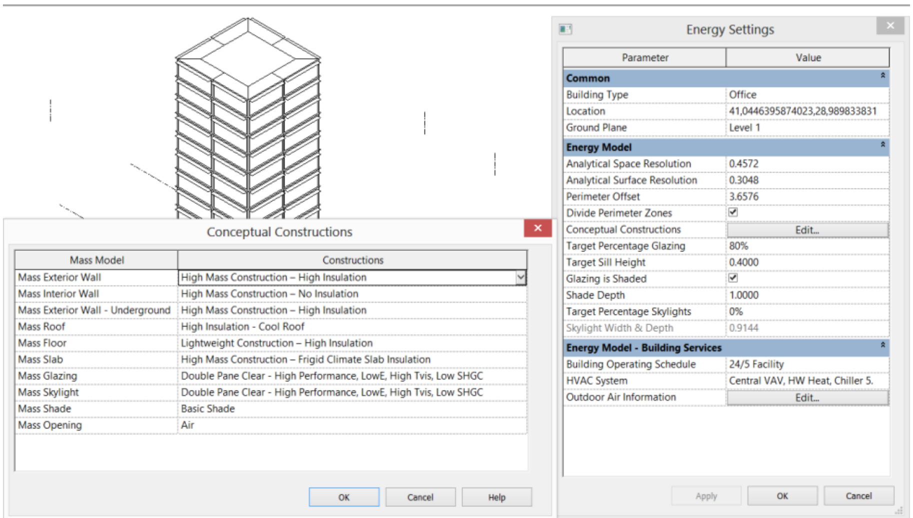

Figure 3. Ninth alternative with the high insulation building components and sun shaders

After the alternative was approved as an initial design product, participant applied solar radiation, wind (Figure 4), and shadow analysis to the model to obtain the related information about the relationship between the environment and the building. Again, participant did not have to know about the statistical information about the environment because Vasari includes them in its own database. As a result of this information, participant collected the information about which direction wind and sun lights come from, and how they interact with the building.

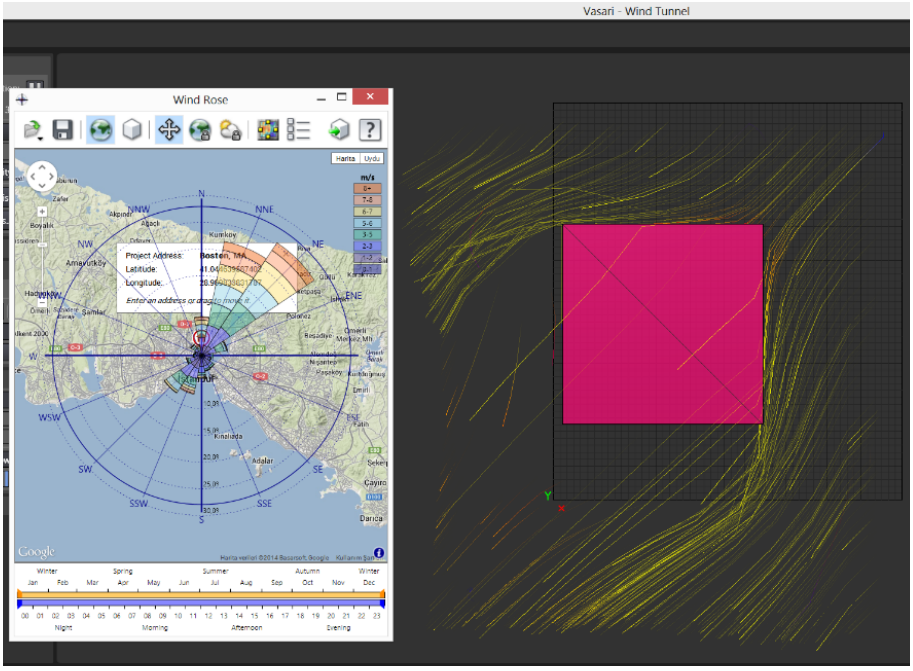

Figure 4. Wind analysis simulation representation of the given date

3.4. Findings

While observing the Case Study A, I notice that the participant uses the feedbacks of the Vasari to provide a better design. As it is mentioned above in the introduction section, Vasari provides a great opportunity to support design ideas with analyzing them from the perspective of performance. In addition, whenever a designer decides to change a variable, Vasari also provides an instant visual response which lets a designer to see both the appearance of the model and the new performance values.

With the capability of the database system and the various analysis features, Vasari offers a new way of evaluating design products which is not easy to do without digital computing tools. Thus it is clear that this situation will make Vasari an important design tool in the early stages of architectural design.

4. CASE STUDY B

4.1. Problem Definition

Case Study B involves the process after the Case Study A. In this implementation, conceptual mass design of the approved alternative was exported to Revit and modelled with the building components such as exterior walls, windows, and interior walls. There is still no detailed information about the specs of the building components but Revit recognizes these components as what they are. This implementation contains the process which starts from the end of the conceptual mass design to the stages of documentation.

4.2. Case Study Methodology

At this case, to clarify and to test the benefits of BIM tools in the scheme design stage of architectural design, the task is done to create a virtual building model with Revit and to observe its reflections on the designer and design product. Case study has been done by the same participant and criteria have been evaluated as the same with the Case Study A.

4.3. Implementation

To achieve from what it is expected from Revit and Case Study B, he started the process with creating a virtual building information model which has the main components such as walls and windows without any technical specifications. These components also have the feature to add related information in later stages when some detailed decisions are taken into consideration.
After completing the virtual model, participant obtained six different spaces from the interior walls and defined them as rooms. After this process, participant also had a chance to analyze each room and to decide specific decisions about room’s area, volume, performance loads and qualities (see Table 1). Later on, participant decided to change some parameters of the spaces to obtain all the rooms would have minimum requirements. To improve these kinds of space specific analysis and decisions, Revit also has more detailed and differentiated analysis tools as add-ons, but they are ignored within this study.
At the end of the implementation, with all decisions taken, participant applied solar study simulation which demonstrated sun activity from the date of 22 April 2014 to 22 April 2015. In this case, because of ignoring the constructed environment, simulation only provided to achieve the opportunity of seeing the relationship between direct sun light and the building. But also participant noticed that it would be really useful when designing in a constructed environment since it directly affects the accessibility of sun light and also wind load.

4.4. Findings

Revit as a BIM software is able to do both conceptual mass analysis and building elements mode analysis. In Case Study B, the conceptual mass analysis process which is already done within the Case Study A with Vasari is ignored. I notice that if a designer uses the Vasari as an early stage design tool, Revit has not much more thing to give if not using extensive add-ons. On the other hand, Revit constitutes a working and communication media which link the works done within the very early stages of architectural design to the maintenance or even demolition stages.

Space Summary - 1 Space

Inputs	
Area (m²)	86.92
Volume (m³)	211.95
Wall Area (m²)	48.89
Roof Area (m²)	0.00
Door Area (m²)	1.95
Partition Area (m²)	0.00
Window Area (m²)	27.19
Skylight Area (m²)	0.00
Lighting Load (W)	936
Power Load (W)	1,216
Number of People	4
Sensible Heat Gain / Person (W)	73
Latent Heat Gain / Person (W)	59
Infiltration Airflow (L/s)	9.4
Space Type	Office (inherited from building type)
Calculated Results	
Peak Cooling Load (W)	**4,056**
Peak Cooling Month and Hour	August 09:00
Peak Cooling Sensible Load (W)	3,817
Peak Cooling Latent Load (W)	239
Peak Cooling Airflow (L/s)	257.9
Peak Heating Load (W)	**2,285**
Peak Heating Airflow (L/s)	120.6

Components	Cooling		Heating	
	Loads (W)	Percentage of Total	Loads (W)	Percentage of Total
Wall	165	4.07%	369	16.17%
Window	1,666	41.07%	1,668	73.00%
Door	0	0.00%	0	0.00%
Roof	0	0.00%	0	0.00%
Skylight	0	0.00%	0	0.00%
Partition	0	0.00%	0	0.00%
Infiltration	154	3.81%	247	10.83%
Lighting	752	18.54%		
Power	978	24.11%		
People	341	8.40%		
Plenum	0	0.00%		
Total	**4,056**	**100%**	**2,285**	**100%**

Table 1. Room Specific Report for the Space named as “1 Space”

5. CONCLUSION

The main objective of the study is to reveal the opportunities of the BIM tools for the early stages of architectural design. To examine the features which BIM provides for the designers, two case studies have been implemented. During these implementations, I notice that Vasari and Revit don’t offer powerful features for designing in these stages, but they offer significant and useful capabilities to judge the design product and also indicate the potential advantages which can be easily applied to the existing product without any certain and detailed information.

For instance, during Case Study A, the designer created nine different alternatives with given requirements for obtaining office building mass designs. When this basic design process was completed, he was also able to obtain the detailed analysis reports for all these alternatives. Later on, he noticed that the one which he felt close to continue, was also the one with the worst performance. By this way, Vasari warned the participant about the performance outputs of his design and also advised him to change the related predefined construction materials to obtain better results. On the other hand, during Case Study B, the designer was able to work with more definite factors such as the area, volume, wall area, and window area of the room. Also, there was some estimation about the lighting, power, cooling and heating loads. With these analysis, he decided to change the interior wall settlements to provide larger areas for the needed rooms.

In this study, two major acceptances were taken as case study constraints. Firstly, the nine alternatives were accepted enough for the aesthetic form seeking. Because the task is not designing an aesthetic product but it provides to understand how these tools interact with designers during the evaluation of design products. Secondly, neighborhood relationships such as nearby buildings, land use issues, social impacts, and topography are ignored. For this reason, it is needed to do more case studies with more complex functional and performance requirements within the respect of aesthetic performance to reveal more benefits and/or limitations of BIM tools during the early stages of architectural design.

As it can be understood from the previous examples, BIM tools provide an opportunity to test the existing design products and also offer a way to improve them. Then, the designer also has a chance to design and analyze their own ideas within an iterative process until they feel satisfied. This way of working proposes a connection between functional realities and designers' subjective judgments which can interact with themselves.

In conclusion, BIM is still an ever-developing system which is one of the most popular research and implementation topics of AEC industry. From the first stage of the design to the end of the building life, BIM offers many benefits to its users. In spite of that, early stages of the architectural design are accepted as the weakest point of the BIM systems. In this study, two case studies have been implemented to reveal how BIM can help to designers in these stages. As a result of the implementations, it is understood that BIM is a powerful early stages of architectural design tool, not for designing but for design supporting, which visualizes the given inputs of climate, geography, material information and so on, to analyze and improve current solutions.

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SESSION 4

20 November 2014 Thursday, 17.30-18.45

INTERACTIVE ENVIRONMENTS AN INVESTIGATION INTO REAL-TIME RESPONSIVE SPATIAL SYSTEMS

Dr. Nimish Biloria[1]

ABSTRACT

The design-research work illustrated in this article is centred on the emerging field of Interactive Architecture. The real-time information exchanging spatial outputs showcased in the paper demonstrates a fusion between the human, the material, the electronic and the digital domains. This fusion is explicitly attained through a synergistic merger between the fields of human psychology, embedded sensing and control systems, ubiquitous computing, architectural design, kinetic systems and computation. The resultant interactive projects attain the dimension of complex adaptive systems, continually engaged in activities of data-exchange resulting in physical and ambient adaptations of their constituting components in response to contextual variations. Interdependent componential networks, where every constituent component of a spatial prototype becomes a potential information hub by means of its ability to collect, process and communicate contextual data. Apart from this, the components themselves operate, as an actuated detail owing to their ability to kinetically re-position themselves in three-dimensional. A strategy apt for binding physical with the digital and the human counterpart is thus illustrated via selected research and design projects conducted at Hyperbody, TU Delft, The Netherlands.

Key words: Real-time interaction, sensing, actuation and control systems, performance, adaptation, human computer interaction

1. UNDERPINNINGS

The contemporary environment is increasingly being engulfed in a networked digital information exchange based paradigm. The potential of re-envisioning the physical environment itself as an interface to this very digital medium, thus becomes an interesting proposition. It is in this context that the paper explores the importance associated with information regulation and the creation of the much-speculated real-time interactive forms of architecture, which thrive on a purposeful fusion of the

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digital and material domains.

As proposed by Ishii and Ulmer 1997: towards seamless interfaces between people, bits and atoms [1], the paper stresses on the idea of giving physical form to digital information by coupling the dual worlds of bits and atoms. The age old conception of architectural space as a closed system is seen as a complete contrast through this paper to perceive architecture as a subject for real time adaptation.

The systemic prototypes, expanded upon in this paper are conceived via multidisciplinary studies in the field of emergence [2, 3], natural systems and self-organization. The paper exemplifies the dynamism inherent in biotic systems, and applies the study of such complex systems through a synergetic merger of the fields of electronics, material technologies, embedded computation, sensor and actuation systems and swarm behaviour based principles. The products hence are an active contribution to the much-researched field of information driven, real time interactive architecture. The paper exemplifies information exchange by means of tactile augmentation of physical structures and ambient modulations of associated media such as sound, light and colour generated as a response to human, environmental and contextual intervention. Tangible adaptation is manifested via integrating physical materials with digital, electronic and information media. Carefully assigning the generated data into a display that successfully masks the information into new forms and gestures (by means of the nature of information generated, the tectonic variations etc), in the visual, tactile or audio space (multi-modal) is thus speculated through the research investigations.

Besides this, some of the projects illustrated in this article are the resultant of a strategic fusion between Industry, Praxis and Academia sectors. Such collaborations typically involve series of associative brain storming, simulation, prototyping and testing sessions focusing upon the usage of pneumatic and electro pneumatic technologies, interaction design concepts, integrated control systems, structural stability and performance aspects concerning the conceptualized spatial configuration of the system. Experimentations with material systems as regards their flexibility, shape retention and strength ratios coupled with kinetic structural systems formulate a vital part of the collaborative research agenda. Parallel research and development in interaction design, ubiquitous communication, creating computational routines via strategically using a mixture of software as well as developing project specific sensing networks are also carried out under such collaborative design initiatives.

Context, for such interactive bodies, instead of being understood as physical attributes such as fenestration, scale and aesthetics, is understood as a dynamic data set of continually monitored parameters such as density of people, temperature variation, humidity levels, noise levels etc. Understanding context as a dynamic information field of intensive and extensive parameters is thus deemed essential in the development of a meta-system, or in other words creating a ‘soft’ computationally enriched open systemic frameworks (informational) which, in real-time interface with the ‘hard’, material component and the users of any interactive architectural body developed by us.

2. ADAPTATION AND INTERACTION

Adaptation, at a physiological, behavioural and structural front is a vital aspect to be considered while developing such Interactive projects. The study of this phenomenon results in discovering inter-disciplinary bridges of knowledge. Adaptation, when looked at from the perspective of Evolutionary Biology, concerns the origin of species from a common descent and the decent of species, as well as their change, multiplication and diversity over time. Adaptation as a process can thus be defined as the change in living organisms that allow them to live successfully in an environment. It enables living organisms to cope with environmental stresses and pressures. According to Julian Huxley [4], adaptations can be categorized as structural, behavioural or physiological:

- Structural adaptations are special body parts of an organism that help it to survive in its natural habitat (e.g., skin colour, shape, body covering).
- Behavioural adaptations are special ways a particular organism behaves to survive in its natural habitat (e.g., phototropism).
- Physiological adaptations are systems present in an organism that allow it to perform certain biochemical reactions (e.g., making venom, secreting slime, and homeostasis).

These three features, namely structural, behavioural and physiological adaptation, in the architectural domain formulate the crux for developing bottom-up interactive spatial systems. A component based approach can thus be embarked upon where akin to cells in natural systems, components can be seen as intelligent building entities endowed with abilities of structural, behavioural and physiological adaptations. In the case of building components, adhering to a performative agenda (per component) the three aspects of adaptation can thus be seen as follows:

- Structural adaptations is seen as a by-product of the inter-dependence between geometry, material and fabrication based affordances in order to produce structurally stable component variations (e.g. Creating morphological variations of the same component in terms of shape, size)
- Behavioural adaptations is closely associated with the domain of responsive interaction which the component should inherit in order to successfully survive and communicate with its context in both active and pro-active ways (e.g. kinetic abilities, information exchange abilities, ambient abilities, sensorial abilities)
- Physiological adaptations in the case of building components is directly linked with the manner in which the component can deal with issues of self sustainment (e.g. energy conservation, retention and dispensation abilities, power generation, distribution and circulation abilities)

Interaction is a terminology used to elaborate the action, which occurs as two or more objects have an effect upon one another. The generation of a two-way effect/dialogue instead of a one-way causal effect/monologue is the basic underlying principle for Interaction. The combinations of many such, simple interactions can lead to surprising emergent phenomena. Interaction has been interpreted in a variety of manners in differing fields of sciences such as medicine, communication, media art, physics, sociology and statistics.

What is of interest however is the manner in which all the above-mentioned fields adhere to the phenomenon of pro-active communication. The area of Physical Interaction where a technologically mediated whole is conceptualised with the central issue of Interaction is of specific importance to such interactive prototypes. The physicality of space itself tends to be perceived as a subject (rather than the modernistic/industrial objective notion), possessing its own behaviour, which is carefully developed with a user oriented (Human computer interaction) perspective. A response (programmed in accordance with event based scenarios), specifically acting upon the interpreted logic from a received message/action (sensed data) formulates the basis for a successful Interaction. Such responsive behaviour is specifically termed as Interactivity. Interactivity is similar to the degree of responsiveness, and is examined as a communication process in which each message is related to the previous messages exchanged, and to the relation of those messages to the messages preceding them – Sheizaf Rafaeli. The understanding of the term is further clarified when taken into consideration the degree of responsiveness substantiated in the interaction process. As Sheizaf states, there are three basic levels of Interactivity: Interactive, Reactive and Non-interactive. These respectively account for the following levels of response:

- Interactive: a state when a message is related to a number of previous messages and the relation between them
- Reactive: a state when a message is related to only one previous message
- Non interactive: when a message is not related to previous messages

What this implies is that in the case of Interactive and Reactive response, the roles of the sender and the receiver are interchangeable with each subsequent message. Thus, a basic condition for interactivity to prevail is a coherent response from each communicant, in the case of this paper, between people, space and the context.

3. DESIGN RESEARCH PROJECTS

The following design research projects are exemplified in this section: The Emotive Interactive Wall, The Muscle Re-configured, The Muscle NSA and Performative Building Skin Systems. The projects are specifically selected in order to showcase multi-scalar implications of fusing the aforementioned discussion on Adaptation and Interaction. Scalar variations ranging from the component scale (building skins), an architectural element scale (wall) as well as an interior scale (interior section of space), are featured in this article. Design driven thinking and the creative, yet, systematic inclusion of computational and technological domains to address the issue of real-time adaptation and interaction of architectural space are thus explained in this paper. Besides the scalar variations, the parameters to which, these experiments respond also vary. Environmental variations (sunlight, wind, sun angle), movement of people, proximity of people, speed of approaching an installation as well as the coordinates of constituting components of architectural space are some of the vital parameters that the experiments selectively address.

3.1. The Emotive InteractiveWall

The Emotive InteractiveWall installation was developed by Hyperbody in 2011 as a multi-modal real-time interactive spatial system composed of 7 separate wall elements that display real time behaviour by swinging their body back and forth, displaying patterns of light on its skin, and emitting localized sound in response to the presence of a visitor. As architecture becomes emotive, responsive, and interactive participants can influence its behaviour and vice versa.

Fig 01. The skin of each InteractiveWall covered by a unique, irregular distribution of dynamically controlled LED's that form a highly reactive interface.

The InteractiveWall's multimodality is made up of three behaviours. The first behaviour concerns the autonomous tactile bending behaviour of the walls. This is triggered per wall based upon their proximity to approaching people as well as the speed and frequency of the person's movement in front of each wall unit. The wall units, in time, also start to become aware of their neighbouring wall unit's movement and slowly start synchronizing their wavy motions with each other. The second behaviour concerns the skin of each InteractiveWall, which, is covered by a unique, irregular distribution of dynamically controlled LED's that form a highly reactive interface. The LED skins respond directly to user presence by glowing brighter when users are near, and glowing dimmer as they move away. In addition to dimming, the

LED skins pulse rapidly and slowly in relation to node position, having a tendency to flash together when the nodes are in sync. The third modality of the multiple behaviour of the InteractiveWall is localized sound, representing only the state of the local sync. Moments of synchronicity are represented by calmer sounds, while asynchronous behaviour results more intense sound. The propagation of the sound from high to low intensity is varied throughout the InteractiveWall wall, thus each node is a member of a choir that sings a complex pattern of oscillating chords. Although similar, the physical movements of InteractiveWall, and the light and sound patterns change independently. The synchronous behaviour between the InteractiveWall units contrasts with the behaviour produced by user presence, resulting in a series of complex wave patterns that propagate through the InteractiveWall structure as a whole (Fig. 01).

Fig. 02. Top: The InteractiveWall at the Hannover Messe 2009 displaying real time behavior by swinging its body back and forth, displaying patterns of light on its skin, and projecting localized sound.

Starting from a clear interactive design concept, Hyperbody developed a one-to-many interactive system that exhibited emergent behaviour and performed liked a living system. The result is an independent system built on synchronous behaviour

that is interrupted by the game-like response of multi-participant interaction. This layered system encourages the intended cycle of observation, exploration, modification, and reciprocal change in the participant, reinforcing believability in the system, and providing a sense of agency to the user.
Real-time adaptation (Fig. 02), in the case of the InteractiveWall, thus became a complex negotiation between contextual data and the three modalities constituting the wall's make-up. The principles of adaptation and interaction in this case, not only apply to the individual panels, with respect to their movement patterns but also extended to the real-time co-ordination of lights as well as sound based adaptations and their relationships per panel.

3.2. The Muscle Re-Configured

This project focused at materializing a real time responsive habitable space utilizing pneumatic fluidic muscles from Festo. With an objective of experimenting with an interior space, the re-configured prototype is conceived as a 3D habitable Strip: a three dimensional section in space, programmed to respond to its occupants through its sensing (proximity and touch sensors), processing (graphical scripting for real-time output) and actuating (fluidic muscles) enhancements.

Fig. 02. Top: The InteractiveWall at the Hannover Messe 2009 displaying real time behavior by swinging its body back and forth, displaying patterns of light on its skin, and projecting localized sound.

The construct harnesses a flexible composite panel's (Hylite) property to bend and the fluidic muscle's property of linear compression to interact with each other, in order to transform the otherwise hard edged (visually) spatial strip into soft luxuriant variations. Each Hylite panel is coupled with two fluidic muscles to form the basic unit of the strip. Subsequent panels are joined together to create a closed 3D loop, in the process creating a series of nodes (junctions where the panels join). These nodes, owing to the possession of actuation members, are linked in space in a highly interdependent manner, constantly exchanging information (in terms of air pressure variations), thus behaving as a collective whole to attain varying spatial reconfigurations (Fig. 03).
This dense network of nodes has two typologies: external and internal node typologies. The external (constituting fluidic muscles at the junctions) predominantly dealing with sets of sensors and actuators and the internal (corresponding air valves and their array sequence in the graphical script) dealing with computation and data processing elements. A rule based control algorithm developed in Virtools (game design software) binds the two node typologies together to produce the desired data exchange and data output scenarios (amount of air pressure to be released to the fluidic muscle). The Muscle re-configured project, works in a componential manner by means of cumulative coupling of the basic unit mentioned above. This componential interactivity oriented approach is utilized for developing specific behaviours (in terms of kinetic movements) giving rise to three distinctly behaving elements: responsive floor, ceiling and walls joined together in a closed three-dimensional loop.

Fig 04. Top: The Muscle Reconfigured being tested for cumulative curvature variations of all three elements (seating, walls and roof), Bottom: The Muscle Reconfigured inviting users to

interact with it with its pro-active behavior at the TU Delft, The Netherlands

These elements are linked in space in a highly interdependent manner, constantly exchanging information (such as occupancy of the seating units, proximity of people, local topology variation of the three elements etc), yet, behaving as a collective whole to attain specific spatial configurations. The seating occupancy status triggers a topology modulation in the ceiling and the wall units in order to provide an engulfed feeling by the curvature of the ceiling units with a comfortable viewing angle for projections cast on the wall units (Fig. 04).

3.3. The Muscle NSA

The NSA Muscle is a pro-active inflated space, its surface being populated with a mesh of 72 pneumatic muscles, which were all addressed individually. The prototype is programmed to respond to human visitors through its sensing, processing and actuating enhancements. To communicate with the players, the NSA Muscle has to transduce physical quantities into digital signals (sensors) and vice versa (actuators). The public connects to the NSA Muscle by sensors attached to reference points on the structure. These input devices convert the behaviour of the human players into data that acts as the parameters for changes in the physical shape of the active structure and the ambient soundscape.

The input setup consists of eight sensor plates with three sensors each: motion (for sensing the presence of possible players from a distance of 6 meters), proximity (for sensing the distance of the players to the MUSCLE within a distance of 2 meters) and touch (for sensing the amount of pressure applied upon the surface). The analogue sensor input channels are converted to digital audio signals (MIDI) and transferred to the computer. The 24 sensor impulses, interpreted, processed and weighted by several scripts containing multiple levels of behavioural algorithms, affect the system in a variety of ways.

Depending on the active emotional mode the sensor parameters set the actions of the individual muscles thus determining the volumetric alterations of the external form, by changing the length (varying the pressure pumped into them) of the tensile muscles. A three-dimensional visualization of the MUSCLE rendered on a flat screen informs the public about the nature of this being (Fig. 05). This model is the computational process itself. From this model the state of each muscle is determined. The activity of the muscles is displayed in three colours in the model: red / inflating state, blue / deflating state, and grey / passive state, and in the internally used organizational 72 digit string.

Also represented in the model are the eight sensor plates changing scale and opacity on activity and the overall behavioural state of the MUSCLE, visualized as a gradual colour changing background. Images of practical architectural applications, using muscle technology, complement the graphical display. The real time model is actively viewed from multiple camera positions as to really feel the behavioural patterns at work. Viewed in combination with the actual physical model this graphical interface contributes to the public’s level of understanding. The MUSCLE was exhibited at the Centre Pompidou, Paris in 2003 (Fig.06).

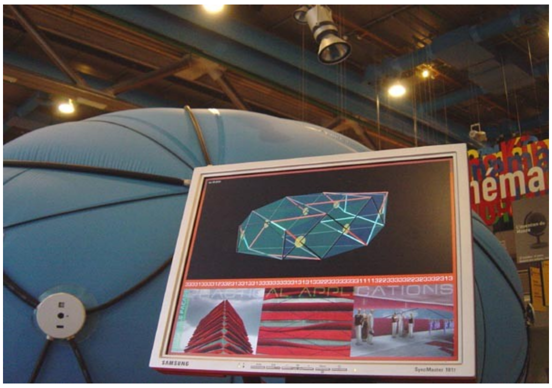

Fig 05. The NSA Muscle's real-time computational process being shown via a monitor at the NSA exhibition. The activity of the physical muscles is displayed in the digital world in real-time in three colors in the model: red / inflating state, blue / deflating state, and gray / passive state, and in the internally used organizational 72 digit string.

Fig 06. Visitors interacting with the NSA Muscle sensor nodes at the Centre Pompidou, Paris, 2003

3.3. Building Skin Systems

A research experiment conducted at Hyperbody, aimed at developing Performative Building Skin Systems resulted in the production of a skin prototype: The Hyper Human Heart (HHH). The prototype, a real-time light response and climate control based interactive skin system, was developed by means of professional collaboration with an Ethylenetetrafluoroethulene cushion (ETFE) manufacturing company; Buitink, The Netherlands. An ETFE cushion is primarily composed of two thin sheets of a very strong and clear polymer, welded at their perimeters such that the space between the two sheets can be filled with air. The developed component, takes

the form of a flap based shading system made out of PET foil in the form of two triangular movable membranes (the movement of which is controlled by an integrated electro-active actuator connected to a motor) which are fixed internally along the ETFE cushion perimeter (housed within) an ETFE cushion. The movement patterns for the PET flaps were attained via a parametric design based simulation using Generative Components©, in which simulations of the three dimensional model of the flaps responding to the sun position were developed (Figure 7).
The PET flaps are layered with an electro-chromic film, which can change its opacity levels relative to small amounts of electrical current induction. The sandwiched component (Figure 8) also hosts a light sensor (for sensing external light conditions) attached to the external frame and an ultra sonic range sensor (for sensing the proximity of people from the skin) and a touch sensor on the internal surface of the frame.

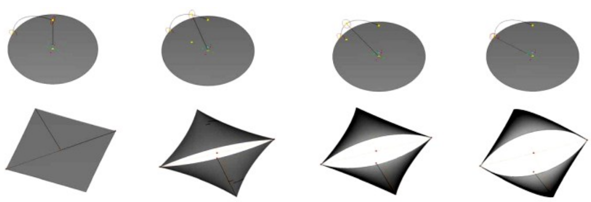

Fig 07. The Generative Components based simulation showing the first row with different sun directions and the second row representing various opening configurations of the PET flaps.

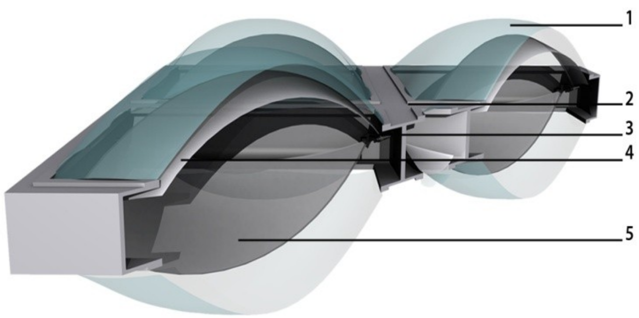

Fig 08. View showing the internal structural make-up of the sandwich component. The ETFE sheets (1) are inflated and connected to the C profiles (2) along their perimeter. The pointer (3) shows the connection point between one of the movable extremities and the small rail in aluminium (that is welded to the C profile). The two movable membranes (4, 5) have a triangular shape and assume two opposite curvatures during their movement.

The readings from the external light sensor and the touch sensors are relayed to a micro-controller embedded inside each component which is scripted using Max MSP & Jitter for activating the embedded motors. The motors are in-turn connected with a kinetic mechanism, which controls the movement of the internal PET foil membranes as a direct response to external light conditions as well as user touch. The actuations of the two motors per component are carefully regulated such that the internal flaps are completely open when the sun angle is horizontal and is closed when the sun angle is perpendicular (in order to allow diffused lighting instead of harsh sunlight).
During the day, the opening system changes proportionally in accordance with the solar inclination by a scripted routine, which will measure the angle between the sun direction on the x and y plane and the perpendicular vector on the skin's surface. This parametric skin therefore remains closed (saving energy) during the night because the sun angle is more than 90 degree.

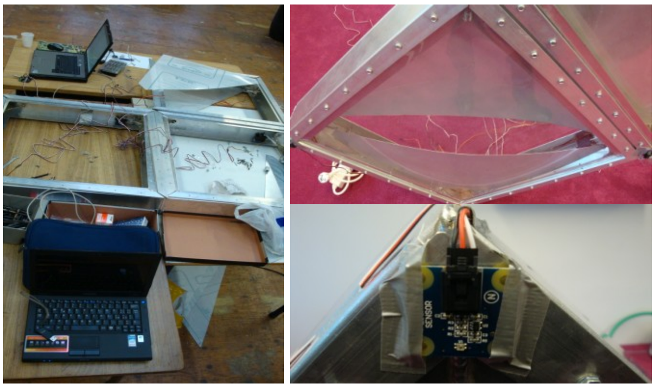

Fig 09. View showing the assembly details of the actuators and motors on the internal frame of the prototype and the mounting of touch sensors on the external frame of the prototype.

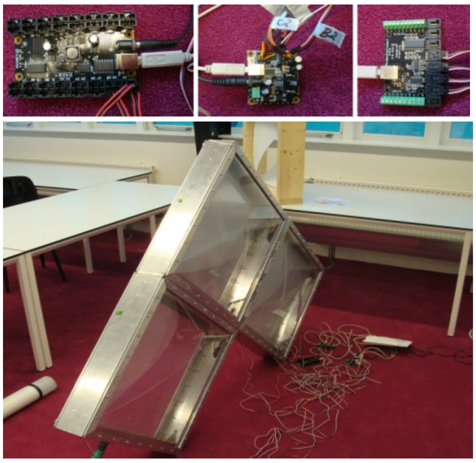

Fig 10. The finished skin as an assembly of three interactive components with built-in micro-controllers and sensing (proximity, touch and light- above) and actuation systems per component.

Users from the inside of the building, on the other hand activate the ultrasonic range sensor and the touch sensor. The ultrasonic range sensor can sense the movement of people in close proximity of the skin. This sensed data after being processed by embedded micro-controllers per component triggers corresponding components to open their internal PET flaps as an immediate response thus providing playful ever-changing skin patterns.

All component on being touched, register this touch via the embedded touch sensor. This reading overrides the aforementioned external light response based actuation and instead via the embedded micro-controller sends a direct response for the motors to open the PET foil membrane to its maximal extent as well as induce a light electric charge for changing the opacity level of the electro chromic film from opaque to transparent. The skin can thus become fully transparent or become a mirrored glass (with a transparency of 30%). The touch sensor operates on a time frame basis: the duration of time for which the touch sensor is pressed the more or less transparent the electro-chromic film becomes. The system also has an inbuilt clock (scripted using MAX/MSP/JITTER), which it uses to reset itself in the default configuration (depending on the light sensor) after being out of use for an hour.

In this way, a direct relation between users and the external skin is created at any point in time thus resulting in emergent opening patterns of the entire skin. The HHH group worked consistently at the Buitink manufacturing plant, where engineers from Buitink helped mount the internal PET system with embedded actuators and sensors to be encased within a pressure pump inflated ETFE cushion thus creating one skin component.

The component thus developed (Figure 9) is an excellent example displaying how fundamental research and praxis can collaboratively develop a meaningful environment based on the idea of performance.

The Hyper Human Heart Project, after developing a physical real-time interactive prototype (Figure 10) undertook a rigorous analysis session conducted by one of the research members, Valentina Sumini [5]. Computer-based analysis using Ecotect© and Radiance© [6], of daylight performance and Day light factors using climatic data for simulating sky conditions for the months of June and December were conducted (Figure 11). The component was populated (southward facing) over the entire façade of a room with the simulation developed by placing the work plane at a desk plane level (0.8 m) the grid values are thus located at this height.
It was found that the illuminance distribution in the two simulations results for the month of June and December is very different. In June the solar altitude is higher than in December and this fact results in a lower value of the external illuminance on the south façade as compared to the results in June where the highest value of external illuminance is on the roof of the room and not in the south façade. The internal illuminance distribution due to the sun position shows that in June, since the sun is much higher, the solar penetration is lower and is thus concentrated in the first part of the room (close to the façade) than in December.
The analysis eventually concluded that this smart component can be considered as successfully serving its performative cause only if its user based interactive aspects are considered as an integrated feature of the entire system. This innovative façade element could also be simplified possibly in the façade's highest areas, which people cannot access. A possible simplification could consist of inserting just one instead of two movable PET membranes with an electrochromatic film overlay (this could also be in the form of a non-movable membrane with an electrochromic glass). This electrochromatic membrane could change transparency according to the external illuminance values and with some iteration in the software system could also develop interaction abilities similar to the current prototype.

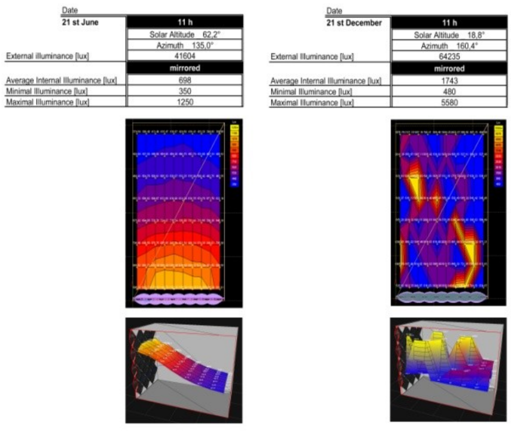

Fig 11. An example image of the extensive analysis showing the results of the daylight analysis on the 21st June and 21st December at 11 a.m.

4. CONCLUSION

The paper exemplifies a paradigm shift in the architectural context by embracing inter-disciplinary approaches towards architectural space making. Conceptualizing and appropriating architecture as an open systemic network provides the designer with opportunities to explore creative methods pertaining to dynamic data flows as well as real-time information processing in order to achieve an intelligent response from the designed entities. The future of architectural space is thus visualized as a transient, real time behavioral body, by means of the illustrated projects.
Information flow becomes a continual process in such real-time interactive spaces, hence converting them into executable processing and reacting systemic entities. Such architectural constructs eventually acquire the characteristics of living entities, sending and receiving information, processing this information locally and producing optimal interactive output. The intrinsic design decision of enriching the nature of architectural detailing and acquiring an inter-disciplinary work process thus has significant impact on the nature of architectural space and its structuring principles.
An intuitive interaction, opinionated towards seamless information exchange is thus initiated through these research experiments, hence transforming everyday utilitarian space into an inter-activating network of spatial correlations. What is also evident throughout the projects is the degree of responsiveness and interactivity, which, via the medium of design driven technological thinking results in multi-modal real-time spatial response. The central idea of developing Interactive morphologies, which inverse the subject-object discourse in architecture is thus successfully experimented with via these selected experiments.

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UNDERSTANDING THE EMPLOYMENT OF DIGITAL DESIGN TOOLS IN ARCHITECTURAL EDUCATION IN TURKEY

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TAYYİBE NUR ÇAĞLAR[1]

ABSTRACT

With the Global developments and technological advances in the rapidly changing world, some alterations to the higher education system are inevitable. In Turkey, there has been a fast transformation in the higher education system with the establishment of foundation universities and spending of the significant amount of resources. In particular, as of 2013, there are eighty-three design schools offering bachelor of architecture degree in Turkey. There is no evidence of whether those schools offer up-to-date curriculum, which complies with the international standards and contemporary education models. We also do not know how the information and communication technologies, which have the growing impact on architectural education worldwide, are implemented in the curricula. The aim of the paper is: to understand the current architectural curricula in Turkey, to investigate the changing trends in education and to understand the role of advance information and communication technologies in architectural design education. The results of the project can be used to develop models for the future program developments.

Key words: Architectural education, digital tools, digital design environments

1. INTRODUCTION

In the past twenty years, the information and communication technologies have become affordable in all segments of the building sector. Architecture-Construction-Engineering industries push the boundaries further to facilitate design and communication in order to have efficient working environments. There is a trend towards using advanced integrated virtual building information systems (BIM and other virtual environments) (Rajala and Penttila, 2006) in the design profession. With the recent developments on computer technology, working without CAD is hardly possible any more (Nordic, 2002). Although most of the architectural work is still documented in CAD-based 2D documents, the evolutionary trend in developing digital CAD-drawings towards more augmented visual representation with data management capabilities has extended increasingly during the last ten to fifteen years (Gül, et al. 2007). Computer technology has been increasing its expressive

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and,geometric power to enable the design process in which a digital model can be used throughout the whole process for realising the design (Achten and Joosen, 2003). In these new design processes, the digital models are considered as new design representations that have a consistency and long life-span which does not require continuing reconstruction, in contrast to sketches and physical models, which involve considerable redrawing, tracing and scale-model-making (Achten and Joosen, 2003).

Parallel to the developments in the practice, a change, which is the integration of communication and information technologies into architectural curricula, is observed in the academia all over the world. This integration offers substantial possibilities for architecture schools within their capacity to enable designing and communication in the new learning and teaching environments, enhancing research and developments in learning theories (Gül, et al. 2007).

In line with the developments and technological advances experienced worldwide in the recent decades, the higher education in Turkey saw substantial changes in its structure. In parallel with the growing number of foundation universities, significant amount of resources have been canalised into the tertiary education in Turkey. As of 2013, there are eighty-three architecture schools in Turkey. Despite this spectacular increase in the number of architectural schools in Turkey, there is no data available whether those intuitions follow the international standards, contemporary education models or using advanced design technologies.

In this paper, we discuss the existing content of architectural curriculum in Turkey. We, in particular, are interested in the employment of the advanced digital tools in architecture schools. In order to analyse the changing trends and situation of the architectural education, a thorough investigation of the curricula of the architecture schools has been performed together with an online and face-to-face surveys with the students and teaching staff of the universities. We focused on the following three areas:

- The identification of the curriculum contents;
- The investigation of the role of the advanced digital tools and techniques in design education; and
- The perception of the students and the academics towards to education and the role of advanced digital tools.

Twenty-five architecture schools out of thirty-seven that have the call are volunteer to participate in the survey study. We present the results of the survey and discuss the role of the information and communication technologies in design education. The findings of the research summarised in this article aims to offer a base for the further research on the architectural education, in particular with the interests of the adaptation of information and communication technologies in the existing education system.

2. ARCHITECTURAL EDUCATION

In general, the educational approaches for design disciplines consist of the following models: (1) coming from a fine-arts background and broadly adapting a studio-based Beaux-Arts educational model; (2) evolving from a technology framework and mainly following an applied science educational model; and (3) those who have sought alternative hybrid approaches, generally being combinations of Beaux-Arts and scientific models (Gül, et al. 2008).

Since the Bauhaus experiments of the 1920s in Germany and their "migration" to America in the post-war years, there has been an interest in alternative design educational approaches throughout the world. The "Reflective Practitioner" philosophy of Donald Schön [1983] of the University of Wisconsin (Milwaukee, USA), had an emphasis particularly on architectural and engineering education, was adapted from Bauhaus principles and led initially to the introduction of "Problem-Based Learning" by Donald Woods (1985) of McMaster University (Hamilton, Ontario, Canada) for undergraduate engineering design education. Woods' approach was a form of experiential learning focused on integration of diverse knowledge and skills, and problem-solving praxis to meet "real world" relevance expected by employers, all brought together through reflection (Gül, et al. 2008).

A variation on a combination of Schön's and Woods' themes was a "cognitive apprentice" model (also called "Problem-Based Learning") developed by Howard Barrows (1986)' for medical education. This, in turn, was further adapted to architectural and other design education domains, including particularly a "Block" model in architecture and related design programmes at TUDelft (Westrik, J. & De Graaff, E. 1994), Netherlands and an "Integrated Learning" model and a "Research-Based Learning" model in architecture at the University of Newcastle (Maitland, 1985), Australia. The outstanding success and acceptance of Woods', Schön's, Barrows', Delft's and Newcastle's models led to further adaptations across a wide range of design education disciplines (Gül, et al. 2008).

Many design educators reacted against these innovations and entrenched themselves in "scientific" design education approaches based on rigorous analytical design routines. A majority, however, adopted various combinations of scientific and studio-based approaches, with studio-based tutorials and master classes for some parts of their programmes, and analytical, procedural approaches for the other parts, often using parts of Schön's and Woods' theories to justify existing conventional studio-based tutorial and master-class design teaching practices (Gül, et al. 2008).

2.1. Architectural Education In Turkey

The art and architectural education starts with the establishment of the 'Sanayi-i Nefise Mektebi' in Turkey. The school established in 1882 by Osman Hamdi Bey who was an art historian, archaeologist, painter and museologist. The school which had the department of architecture, department of painting, department of sculpture and engraving arts was given the name of the fine Arts Academy in 1928. The school was converted into an university, Mimar Sinan University, in 1982 and lastly it was named as Mimar Sinan Fine Arts University in 2004. In the department of architecture, the school adapted the Ecolé des Beaux-Arts approach in which the atelier or the studio were at the heart of the system. Each atelier operated under the supervision of a patron who was a master architect expected to be knowledgeable in the arts and sciences of architecture, but also to be able to model the intellectual and social qualities required of an architect (Ostwald, MJ and Williams, A, 2008). This dimension is very significant because it recognises that architectural education has always involved a mixture of education and enculturation (Ostwald, MJ and Williams, A, 2008).

Another important school of architecture in Turkey is the Istanbul Technical University, first established as an engineering school (Bahr-ı Hümayun) in 1773. In 1844, with the additional architectural subjects into the engineering curriculum, the school started to educate engineers with architectural background. With the establishment of the Law of Higher Education dated 1944, it became an architectural education institution delivering the 10 semester long curriculum, named as the Istanbul Technical University (ITU). Established by Walter Gropius in 1919, Bauhaus model was adapted in ITU (Aliçavuşoğlu and Artun, 2014). According to the Bauhaus model, workshops where unify the artist and craftsmen together in a partnership of equality are the backbone of the system (Harimurti et al., 2011). The main objective is to train and produce partners for the world of industry and handicraft producing the standard products for the industrial purposes (Harimurti et al., 2011).

2.2. Digital Environments in Design Education

Integration of digital tools into design curricula offers significant potentials for design schools, through their capacity to facilitate design learning through the simulation of design context and situations. Perkins (1991) classified constructivist paraphernalia that are information banks, symbol pads, construction kits and task managers. In this view, digital environments serve as the new learning platform that includes all necessary learning materials. Such digital environments facilitate human memory and intelligence to interpret experience to refine their mental model.

There are a series of potential areas in which digital activities expand design education. Following are some ways in which can contribute to design learning (Williams et al., 2011):

Distant Learning: 3D virtual worlds are the cutting-edge form of distant learning environments. Previously, the most common tools for distance learning are web-page-based platforms such as Blackboard and WebCT. These learning platforms are basically networked databases that have a collection of course materials (lecture notes and assessments). Users access the databases through a graphical interface similar to a web page. They are most useful for recapturing what have happened in the physical learning environments.

Collaborative Learning: Collaborative virtual environments used for educational reasons are often named as Learning Virtual Environments (LVEs) or Educational Virtual Environments (EVEs). 3D virtual worlds evidently have the capacities to facilitate innovative and effective education, including debate, simulation, role-play, discussion, problem solving and decision-making in a group content, etc. Many researchers have pointed out the importance of collaboration and communication and experiment with currently available communication and information technologies.

Virtual Design Studios: Since mid 1990s, Virtual Design Studios have been established by architecture and design schools around the world aiming to provide a shared "place" where distant design collaboration especially synchronised communications can occur. The forms of virtual design studios differ from the initial approach of digital design data sharing to the more recent 3D virtual world approach where the design artefact and the designers/learner are simulated and represented in the virtual worlds. Kvan (2001) argues that while design education has traditionally focused on the product, virtual design studios allow students to learn more about the design process. Dickey (2005) suggests 3D virtual environments can provide "experiential" and "situated" learning. Clark and Maher (2005) examine the role of place in 3D virtual learning environments that encourage "collaboration and constructivism". Wyeld et al. (2006) assess the use of 3D virtual learning environments for supporting social awareness among design students and focus on the cultural aspect in virtual learning environments where students from different backgrounds design and learn collaboratively.

3. UNDERSTANDING THE CHANGING TREND IN ARCHITECTURAL EDUCATION IN TURKEY

In order to understand the changing trend in architectural education in Turkey, we conducted a comprehensive research, which includes quantitative and qualitative data. The quantitative data of the study includes the architecture schools' profiles and programmes: The curricula of the schools that are accessible in their websites have been investigated. The qualitative data of the study includes surveys and interviews of the academics and the students. With the completion of the collection of the data, the surveys and programmes are investigated and the data is analysed. The results of the study is presented into three sections as follows:

- Scope and limitations,
- Mapping curriculum content, and
- The assessment of the role of digital tools in design education.

3.1. Scope and Limitations

A series of important developments have occurred in the higher education during the last few years in Turkey. Since the foundation of the first foundation university in 1984, there is a large number of universities established; by 2013, 83 schools of architecture both public and foundation exist in Turkey. In this study, having the graduates of architecture is the key to make a call for participation. Thus the research is focused on only 37 schools of architecture out of 83 who have the graduates.

In order to gather information on the preferences and the employment of digital environments/tools in architectural education, a set of separate surveys (of the students and the academics) were conducted. In general having enough response to the survey calls is the main difficulty in the qualitative research. To overcome this problem, we conducted two types of surveys: face-to-face and online surveys. 25 out of 37 schools of architecture accepted to participate in the study. Table 1 shows the number of the students and academic staff who participated in the surveys.

Table 3 Participation to the study

University	Academic S.	Student
9 Eylül	6	-
Abant İzzet Baysal	-	4
E Anadolu	2	10
Bahçeşehir	1	-
Balıkesir	1	-
Beykent	1	-
Çukurova	5	15
Doğuş	-	9
E Osmangazi	8	19
Gazi	5	21
Gebze Yüksek Teknoloji	7	29
Haliç	5	10
İTÜ	6	22
İzmir Ekonomi	5	-
İzmir Yüksek Teknoloji	-	7
Karabük	1	-
Koca□li	8	5
Kültür	-	4
Maltepe	2	-
MSÜ	6	13
ODTÜ	2	9
Selçuk	4	18
Uludağ	6	30
Yaşar	3	7
Yıldız	5	-
Non-identified	9	20
Total	**98**	**252**

The student participants of the study (64.8% female) were not freshman students; only 3.2% of them were the first year students. The 41.4% of them were second year, 20.3% of them were third year and 35.1% of them were final year students. The academic staff who participated in the study was mainly female (80%). The 32% of the academics were studying in the post-graduate level (PhD, graduate students or attending a course).

3.2. Mapping Curriculum Content

Architecture schools report their curriculum content in a range of forums and formats. Although the terms and the terminology change over the institutions, it is possible to classify the key components of the architecture curriculum and to quantify the weighting of the components. Six study areas adopted for the current analysis are design, technology, history-theory, communication-presentation, practise-management and environment. In addition to those areas, elective subjects also exist, as shown in Table 2.

Table 4 The study areas of architecture curriculum

Design:	Includes all of the compulsory and elective design related courses;
Technology:	Includes building technology, material, construction and building services and building science;
History-Theory:	Includes architectural and urban history, and theory;
Communication-Presentation	Includes all kind of architectural and verbal presentation techniques, computer-based drafting, presentation and documentation skills;
Practice–Management	Includes project management, building management and economics, building codes and regulations;
Environment	Includes sustainability, ecology, landscape and energy;
Electives	Includes all kinds of elective subjects

The Figure 1 shows the percentages of the quantifying the weighting of the six study areas in the architecture curricula (only the architecture departments complied with the criteria of the study are chosen). The total hours per week of each study area are calculated and the average weighting is determined. As expected, the design studios consistently occupy the largest time slot of the curricula, followed by technology, history-theory, and communication related subjects. Elective subjects keep almost 10% of the time in the curricula studied.

There is a degree of overlap between those study areas that can encumber by the interpretation of the data. For example, some of the subjects in the technology such as building science may cover some areas of construction and environment. Similarly, it is also very common to merge some areas into design studios. For example, it is possible to have construction, ecology, drafting and communication related issues discussed in design studio. In fact, this is very common pedagogical approach over the world (Ostwald and Williams, 2008), but it makes the mapping more difficult.

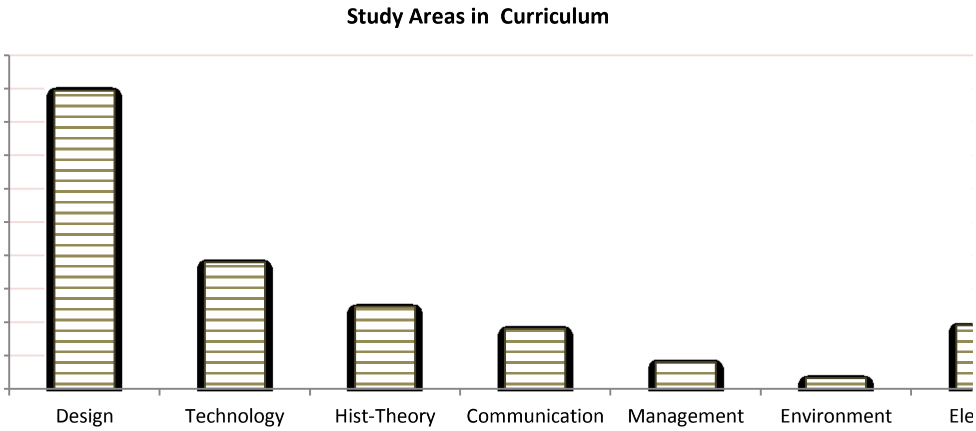

Figure 18 The perception of the average weighting of the study areas

3.3. The assessment of the role of digital tools/environments in design education

In order to understand the perception of digital tools in design education, we asked the students and academic staff to rate the tools in terms of the common use in design education. Figure 2 shows the comparison of the perception of the employment of the digital tools in design education. The 3D modelling tools have the highest percentage followed by the photo-realistic rendering tools and the 2D drafting tools. The consistent awareness across the participants is observed in those three tools. Other three digital tools, which are the communication tools, the collaboration tools and the virtual environments have the highest percentage rate among the academic staff.

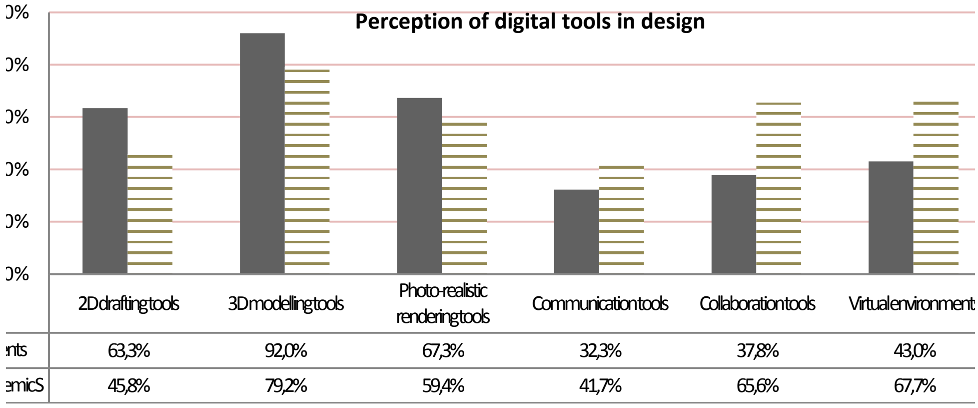

Figure 19 The comparison of the perception of digital design tools

Although, 97,9% of the schools has a computer laboratory, 84% of the students consider the computer laboratories as insufficient. The most common shortcoming of the laboratories that the students mentioned is the lack of recent technology (insufficient RAM and hard drive capacity, very slow computers etc.), lack of staff and lack of software. Most of the students commented on having not enough time to learn the knowledge and skills of using computer mediated design tools. Some comments are:

'We have the subject in the second year, two hours per week I think…one week was for Photoshop, two weeks were for AutoCAD, three weeks were for Max…it was very much overview approach.'

'We don't have the computer mediated courses in the laboratory; we are taking our own laptops to the class. In general, the instructor teaches the commands, gives us some homework and we apply those knowledge and skills to our homework…I think the hours for that course is not sufficient. They try to squeeze three software in two hours, it is bad.'

The most common used software is AutoCAD, 93% of the students specified that they are knowledgeable about and using this software during their education. The other most commonly used software are (74.5%) Photoshop, (63.5%) SketchUp, (35.8%) 3D Max, (26.7%) ArchiCAD, (23.9%) Revit, (16%) Illustrator, (15.2%) Rhinoceros, (7.4%) Premier, (6.6%) Grasshopper and (5.3%) Corel Draw. The 95.7% of the academic staff identified that the students are allowed to use any kind of digital media and tools in the design studios.
The academic staff commented on the employment of digital tools in design studio which has a great potential to improve the design studio teaching and learning experience. Particularly, the staff emphasised that the employment of digital tools in the conceptual phase of the design process ought to be supported. By using the digital design tools, the free-form exploration and creativity through moving away from the Cartesian forms can be obtained.

'Information and communication technologies are the tools which can be facilitated in the every phases of the design process. A designer should have enough knowledge and skills to employ those tools in the design activity.'

'To employ the digital design tools in the early phases design process, there must be out of the framework of computer-aided design…There is nothing new about using the digital tools for the representation of the design concepts…But we don't have enough infrastructures and resources to do more than that.'

'There could be some problems because of the lack of software that supports the fuzzy phases of the design process. It is very necessary to develop applications that facilitate the liquid mental processes'

The use of the virtual worlds among the academic staff is very low; only 9% of them visited a virtual world before. Those are respectively Active Worlds, Second Life and Open Sim Grid. The 91% of the academic staff specified that they have never employed a virtual world / virtual environment in their design teaching. In the open-ended questions, we observed that there is confusion about what a virtual world would be. The academic staff mixes the concept of virtual worlds up with the animation and simulation. The 25.7% of the participated students, on the other hand, have visited a virtual world before, that were Active Worlds (26%), Second Life (17%), Club Penguin (14%), Free Realms (5.2%) and Open Sim Grid (3.4%). The curiosity (18%) and gaming (15%) are the most popular two answers given as the reasons of the visit.

The virtual environments (some forms of Web 2.0- social media- blogs, Facebook and local intranet) are used as the communication and discussion media in most of the time (51% of the academic staff). Particularly in design studios, groups employ the social media for the discussions platform and as the storage of shared information. Some comments include:

'Particularly the blog pages are visible and accessible virtual environments so they would be perceived as a stage that enhances the productivity of the students.'

'Of course it depends on what you would share there. In general we share some tutorial materials during the process, in some cases we are sharing some architectural precedents to help them to gain knowledge on the architectural history.'

4. DISCUSSION AND CONCLUSION

In the last decade there has been an increasing demand to establish new universities at every city in Turkey. Mirroring this demand, by 2013, there are 83 architecture schools established, with 5000 students entering the education system to become an architect each year. This research is an early attempt to gather information about the current situation of the architectural education in Turkey. As noted above the research focuses on: The identification of the curriculum contents; the investigation of the role of the advanced digital tools and techniques in design education; and the perception of the students and the academics towards to education and the role of advanced digital tools.

In order to analyse the above points the curricula of the schools are investigated and the detailed surveys are conducted. Based on our observations and the results of the analysis of the collected data, we summarized our findings as follows:

First, while it is very difficult to capture every nuance that exists in the schools' curricula, we collected and characterised the structures of the education programme. Our analysis shows that in terms of the resources and the curricula, the schools are fragmented and competitive. Several hybrid models, which commonly have the architectural design studio in the centre of the education, exist. The academic staff, who qualified in the well-established public schools, generally takes the leading position to establish new foundation schools. In many cases those academic staff could not go beyond what they gained in the public schools in their new roles, thus they have disseminated the smaller replicas of the architectural curricula.

Second, the digital tools are integrated in the design curricula of the schools and mainly used in form of CAD programs for documentation and graphical

representation programs such as AutoCAD and Photoshop. In many schools, the computer laboratories exist although their quantity and quality are not always at desired level.
Third, the virtual environments, virtual reality and collaborative virtual environments are mainly perceived as some kind of social media. Particularly, the employment of those systems in education as the representation and communication tool (for making the movies and documentation of the design concepts) is very common. There are only a limited number of schools which employs those tools and environments for design teaching in the spatial and visual reasoning of the 3D space and design concept, and as a computational/generative design tools.
Finally, the results of the study show that the architectural education in Turkey, similar to the common educational approaches around the world, concentrated to design studio that is the backbone of the curricula. It is also observed that the employment of the advanced digital design tools in education is far behind the level of the world's leading architectural schools. However, we believe that the use of such technologies in architectural education will be enhanced to support new generation of architects in Turkey in near future.

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FORM-FINDING WITH EXPERIMENTATION ON NATURAL PERIODIC FORCES: THE SOUND MOTION STREAKS PROJECT

PINAR ÇALIŞIR[1]

ABSTRACT

Today, many computational techniques of form-finding use the term “design” with the term “research”. So that, architectural studios become more and more like laboratories for design experiments. This paper proposes The Sound Motion Streaks Project -done by the author, Ines Gavelli and Wei Weiwei during the research course in Bartlett MArch GAD in 2012- where the sound can be used as a generative computational data and applied to digital form finding experimentations. This process relies on an idea that sound as an external force can produce or deform shapes according to its influence. The first phase of the process is to make physical experiments on the sound and see its influences on granular and fluid materials. We can say that, in these physical experimentations, there is a knowledge transmission from physical to digital medium that we can use as design parameters on a software. In digital software, sound can be a force field and manipulate digital matters such as particles, curves and meshes. This form-finding method is constituted by all physical and digital experiments, and applied in an urban area in order to discuss its architectural potentials. For instance, all material events in the area depend on duration and movement of digital tools, thus the notion of form and/or space become kinetic. This kinetic reactions bring out a new understanding of space and form which consists of motionless boundary, translatability, rhythmicity, differentiated densities and heterogeneity. Also this generative approach gives architects many potential solutions for architectural forms.

Key words: Form-finding, Kinetic Form, Sound, Experimentation

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1. INTRODUCTION

Experimentation is the most important parameter for a scientific discovery. What about discoveries of forms in architecture? Nature has a lot of novel forms and patterns and produces new ones without stopping a moment. Thus, it is not a coincidence that the novel ideas in architecture usually come from experimentation procedures copying the processes of nature. To do this, architects need to understand how nature finds her forms and what her rules during the process of form generation. Our motivation in this paper is a desire to create a form finding process which is called “the Sound Motion Streaks Method” in terms of experimentation on natural forces in order to find novel ideas in architecture. Sound is the force that we used in our study. The main objective of using sound is to see what sound looks like through interaction with matters. By doing this, we can produce a new notion of space which negates with the traditional Euclidian space and create a kinaesthetic experience on users with the help of sound materialization. While reading this paper audience will see that there is no starting shape in this process but there are different materials reacting the sound influences. Therefore, this kind of formation processes will lead us to create a variety of topological geometry. Spaces emerging in this process are no longer static but dynamic, and this dynamism in the structure brings some kinetic properties to the form. In an animated form, the notion of kinetic reveals with a continuous motion through immovable structure of form. We can see the history of material movement under the influence of sound through transparent and overlapping structures of form. This illusion of movement called as “frozen moment” and the designer becomes a person who “orchestrates” the whole process (Terzidis, 2003).

The design process in this study is developed in four stages. First stage is to gain a general knowledge about the notion of form-finding process and physical sound properties. In this stage, additional to the literature review, we repeated physical sound experiments from the precedents -such as Cymatics- in order to strength our understanding of sound properties and material interactions. The second stage is to using this general knowledge coming from the first stage and constitute various digital experiments to examine the nature of digital materials and their reactions to the sound. Third stage is to generate our form-finding method and test it with different parameters in order to find a way for creating an urban scale prototype. Our final stage is to test this method in an urban area and discuss its architectural potentials through this way

2. UNDERSTANDING THE TERM FORM-FINDING AND THE SOUND PHENOMENA

2.1. Form-Finding

In 1806 Goethe introduced the term “Morphology”. He has a unique understanding on how forms emerge in nature and how the constant formation and transformation of forms related to environmental forces (Menges&Ahlquist, 2011).

According to him generative processes in nature affect both organic and inorganic systems with the help of natural forces. He invented “Ur-forms” in order to explain “the foundational programs” in nature. These programs determine differences and similarities between forms in nature which is to say that similar forms (Urforms) should share a common foundational program (Aranda&Lasch, 2006). These foundational systems actually refer environmental forces which affect all forms in nature and cause a constant transformation throughout its lifetime. For instance, imagine different cracking systems in nature. The foundational program behind dry mud and dry paint is the same, therefore these cracking systems looks like identical. They are “Urforms”. Both are shaped by same environmental force which is “fluvial erosion” (Aranda&Lasch, 2006). D’Arcy Thompson explained similar ideas with Goethe in his book “On Growth and Form” in 1917. He proposed that there are environmental (external) forces in nature affecting shape of things. More importantly, he believed that we can solve this process with mathematics (Menges, Ahlquist, 2011). Similarly, Philip Ball (1999) stated that patterns and forms in nature are not only generated through biological coding, but also there are simple physical laws behind them. Therefore, we can repeat complex forms in nature by repeating these rules. From all these ideas, we can say that there are some natural forces in the world and they are acting on organic and inorganic things and determine their appearances. These external forces cause similarities and differences and we can repeat their effect on forms by repeating these physical forces. In the Sound Motion Streaks Project, our departure point is to use sound as an external force and find sound patterns and structure by means of form and force relations. Therefore, in the next chapter we examine some precedents works on sound phenomena and repeat some of their experiments in order to find the foundational program behind sound patterns and forms.

2.2. Sound Properties

To understand periodicity of sound we should understand the properties that create rhythmic vibrations. Sound is a kind of wave which passes through the air effecting particles back and forth and change their equilibrium positions, but it is the disturbance which travels not the individual particles in the medium [1].

The frequency is the number of occurrences of a repeating event (period) per unit time. The amplitude is the measure of a magnitude (energy transported) of oscillation of a wave [2].If we find a sound analysis of a particular sound, we can see that, both amplitude and frequency reflects the periodicity of sound and rhythmicity.

2.3. Sound as a Natural Phenomena

Nature consists of complex systems constantly changing one assemblage of conditions to another, opposite one. These changing systems –animate or inanimate- create their own repetitive patterns and forms and their formation reveals hidden periodic forces which lay beneath them. A continual state of “vibration, oscillation, undulation and pulsation” give these forces periodicity (Jenny, 2001). On the basis of vibrational phenomena sound can be seen as another example.

Taking information from its nature cannot be done with an eye or other senses except hearing. However, this does not give any visual data on the periodicity of the sound. Thus, since the eighteenth century, scientists have worked to make sound visible in order to explore its nature (Jenny, 2001). Ernest Chladni (1756-1827), who was one of the first physicist musicians, tried to simulate the vibrations of sound and make it visible. Chladni used a violin to vibrate metal plates covered with powder, and made the sound vibration process visible (Jenny, 2001). After Chladni, the most important person working in this area was Hans Jenny, a physician and natural scientist who founded Cymatics, which is the study of the vibrational character of sound and its hidden force on matters. Jenny's (2001) experiments, by putting matters such as sand, fluid, powder or salt on a metal plate, showed the hidden force of the sound on materials. He observed that in a kinetic-dynamic process based on sound vibrations, all patterned formations are generated and maintained by sound periodicity (Jenny, 2001). Overall, according to Jenny (2001), sound is physical force that can create vibrations and finally systemized pattern forms.

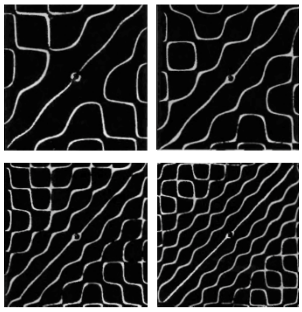

Figure 1: Chladni Experiments in Cymatics (Sand on a steel plate). Same topology of patterns emerge but number of patterns are growing as the pitch goes up (Jenny, 2001).

2.4. Physical Experiments to Make Sound Visible

In this phase of the study, multiple physical experiments were generated from the Cymatics experiments, in order to deeply understand which parameters of sound actually create forms, deform shapes, or produce patterns. Water, non-Newtonian fluid made from water and starch and salt were used for physical experiments. In experiment 1 and 2 (Figure 2), 40x40cm steel plates were used in order to materialize sound wave patterns. The left image shows the 1mm thick plate and the right image shows the 0.5mm thick plate. These square plates were clamped by the center with a speaker connected with an amplifier. Salt was sprinkled onto the plates vibrating with the sounds in different frequencies starting from 20Hz and gradually increasing to 80Hz with the help of an amplifier. As the plate vibrates, the salt begins to travel along the surface and salt particles interact with each other until they reach points along the plate that salt particles are not vibrating. We can see these accumulation zones as white lines. When thickness of the plate increases, patterns on the surface blur, so that in the right image in Figure 2, we can see clearer patterns (0.5mm thick plate).

Ultimately, every frequency has its own 2d pattern because of its unique vibrational character. In experiment 3 (Figure 3-left image), we used corn-starch and water to experiment on a viscous fluid affected by a sound vibrations. This Non-Newtonian fluid behaves against the gravity and dances with the frequency played on the speaker. By the means of material behavior, viscous nature of the fluid tends to provide its surface continuity but irregularity of fluid molecules help to create 3d forms and patterns. Thus, this material have the capacity to create volumetric forms and patterns. In experiment 4 (Figure 3-right image) we repeated previous experiment with water. Water maintains it surface continuity thus, it does not produce split patterns or 3d forms, instead the sound only can deform its surface. The higher frequency brings out the more complex wave-patterns.

These experiments are important in order to understand different material behaviors against sound vibrations and find a process to materialize sound. For fluids, viscosity determines the embodiment of matter. On the other hand, granular materials are more interactive inside because of their particular nature. In the most general sense, sound frequency and amplitude stimulate matters, which cover a plate connected to a sound generator. However, the time and material features are also minor effects in producing the overall shape. Because materials have either viscosity or a granular system, they continue to change through more complex and heterogeneous formations over time until the process is over. From these physical experiments, three fundamental issues can be observed. First one is the behavior of natural force, the second one is material behavior and the third one is material capacity.

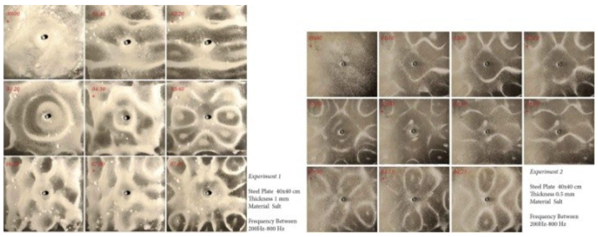

Figure 2: Experiment 1 and 2, Chladni Experiments. 1mm thick plate on the left-0.5mm thick plate on the right. In both images, each pattern belongs particular frequency.

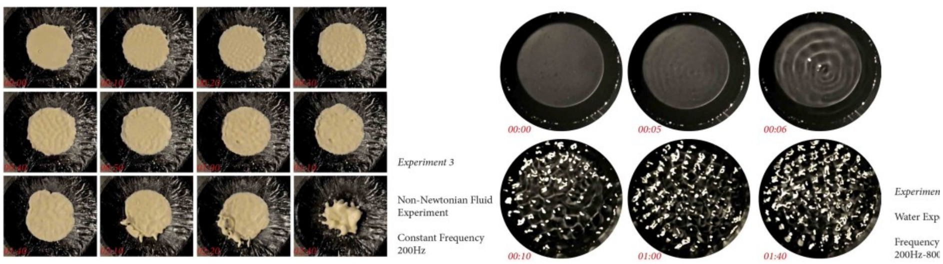

Figure 3: Experiment 3, Non-Newtonian Fluid on the left image. Experiment 4, Water on the right image. Both experiments illustrates different frequency patterns.

The digital medium is a place for representing natural world, obviously with the control of a human. Therefore, digital materials are always open to manipulation and sometimes we cannot foresee material behaviors. Thus, in order to build a form-finding system digitally, we have to create simulations and understand same principles in physical experiments in terms of digital matter. Therefore, findings coming from physical experiments become a guide for digital ones.

3. DIGITAL EXPERIMENTS TO SIMULATE PHYSICAL DATA

From physical experiments, we know that sound spreads in the environment as a wave. Also, sound source produces rhythmic and periodic vectorial forces when it meets a surface. If there are particles upon the surface, they react to the sound force. These findings help us to constitute digital models of physical experiments in Autocad Maya. In order to create an influence of sound amplitude or frequency as a dynamic force field in the Autodesk Maya, the AudioWave node, which can read sound amplitude per second, was used. A dynamic force field is a force that manipulates digital matters such as particles, fluids, or polygons by pushing, pulling, splitting and so forth. Through the HyperShade, which is a relationship editor on Maya, dynamic connections between materials and forces in the scene can be controlled during the time.
Unlike physical experiments, both particles and fluids can be simulated through this process at higher level because the unpredictable behaviors of both materials can be kept under control. Hence, the digital process allows further evolution of forms and assemblies. From this understanding, the first digital experiment (Fig 4-left) was built in Autodesk Maya. There was a sound source in a container producing sound waves according to sound amplitude and particles in this container reacted to this periodic force as well as each other. Therefore, this system produced well-organized and regular patterns. The more interaction between particles and the higher amplitude caused more complex patterns. Second experiment (Fig 4-center) illustrates the surface deform behavior of sound from physical experiments and applies it upon continuous surfaces such as a sphere. Thus, sound active surfaces emerge.

Third experiment (Fig 4-right) demonstrates the form generator features of the sound wave and produces volumetric forms within the harmony with sound amplitude.

Figure 4: Digital experiments. Left image: Sound becomes a Pattern Generator when it interacts with particles. Center image: Sound becomes a Surface Deformer with a continuous surface. Right image:Sound becomes a Form Generator with viscous fluids. We can see sound effects on different digital matters.

According to these experiments, we can say that in digital medium (Maya) sound can generate patterns and become “Patterns Generator”, deform existing shapes and become “Surface Deformer” and finally generate forms and become “Form Generator”. Analyzing and synthesizing both physical and digital experiments helps to create our own system which is the sound Motion Streaks Project.

4. CONSTITUTING THE SOUND MOTION STREAKS METHOD

Learning from physical experimentation provides a deep understanding of sound and its nature. On the other hand, digital simulations of physical experiments provide a deep understanding of how digital matters react the sound when it is simulated by a dynamic force field as a wave. From these experiments, we construct a knowledge on digital material behaviors and capacities and create our form-finding tool with the integration of different kind of digital materials. There are several ways to create forms by taking information from sound and manipulating time. For instance, the AudioNode can be connected to particle emitters in order to change the quantity of particles released per second or manipulate their directions and scale. On the other hand, this process can be stated in terms of the logic of constructing linear elements produced by particle tracing and apply particle releasing based on curvatures. In order to get more control over the particle systems, each particle converted into polygonal meshes, therefore, this new converted matter creates multiple structural formations. This mesh form is much more characteristic than the other, which is only created by particles. In the Sound Motion Streaks Method, three different digital tools are regulated together: the particle system, the linear curve system and the polygonal mesh system. Together the entire system fulfils its performative capacity with regard to these three systems. Spatial conditions have different levels of density. More articulated and characterized spatial shapes can be produced.

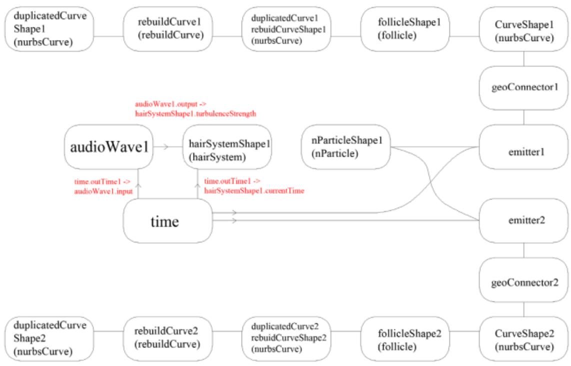

Figure 5: HyperShade-Dynamic Relationship Editor- Connections for the Sound Motion Streaks Method on Autodesk Maya. We can change relations between digital matters and dynamic force fields through HyperShade.

In the Sound Motion Streaks Method, three different digital tools are regulated together: the particle system, the linear curve system and the polygonal mesh system. Together the entire system fulfils its performative capacity with regard to these three systems. Spatial conditions have different levels of density. More articulated and characterized spatial shapes can be produced. Additionally, for the larger scale, architectural systems have the ability of response to multiple functional requirements in the site context. As hinted above, there are several ways to simulate sound driving forms in software applications, and it is a broadly acknowledged fact that software applications can cause coincidence results during the design process. To prevent this, it is necessary to understand the logic of the tools used and parameters that affect digital models. Hence, the following will focus on settings for 'the sound motion streaks method' in order to deeply understand the system, its architectural quality and make it a design tool.

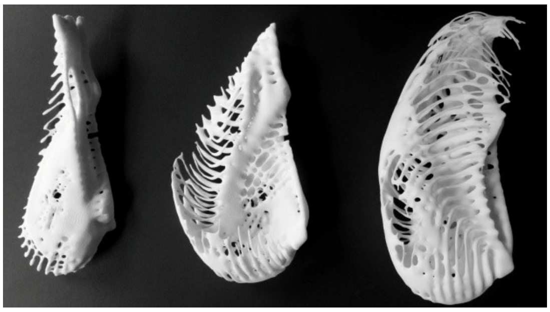

Figure 6: This image illustrates 3 different phases of form evolution. Time manipulation gives us a chance to freeze the moment and materialize a specific time.

4.1. Settings for Form Generation Method

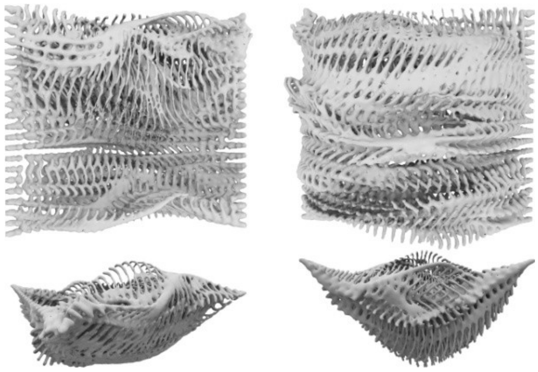

Figure 7: Elevations of the Sound Motion Streaks Project. In this test, a square boundary is created for the system. We can see the whole process of animation along the form.

As introduced above, the sound motion streaks method is based on three criteria: particles, curves and polygonal mesh. Particles are basically points that represent a collection of dots behavig like granular systems. Force fields such as air and gravity manipulate and organize this system based on the expressions or parameters.

Similarly, a curve system lets one create dynamic curves so that natural movements and collisions can be created. Finally, polygons are a geometrical type that can be used to create three-dimensional structures in order to produce surface or architectural skin covering the systems. The whole system behaves like natural forms and like all forms in nature, they assemble themselves and also have the ability to gather their matter and interact with the environment under gravity or different fields. On the other hand, in order to produce these forms, the system must be run in a simulation. Simulations are essential for laying out complex architectural systems, in software applications and examining their behavior over extended periods of time. Also, simulations provide generative design processes (Hensel et al, 2010) and take advantage of motion movement and time. We can control dynamic relations between digital matters, dynamic force fields and time through HyperShade Editor (Figure 5). In order to discuss the potentials of the Sound Motion Streaks Method by the means of space and form we apply this method in an urban area.

5. AN URBAN SCALE PROTOTYPE

For an urban scale prototype, an old bridge in Limehouse in London was chosen. The bridge is a kind of extension for Dockland Light Railways(DLR) but now is neglected and separated from DLR from a barrier. The whole area is affected by the rhythmic noise of DLR. In order to make visible the sound-scape of this area-a sound that is unique to an area- and produce sonic awareness, the sounds of this particular site in London were recorded and translated into an architectural proposal.

The idea is to "see what the sound looks like in a particular place" and through this, to provoke a synaesthetic experience in the user. The proposal is an urban path and connector between two different "sound areas", and making use of an abandoned rail bridge, this construction crosses a busy road to a quiet area behind the new railways. To make possible the sound visualization, the sound was captured and recorded on real time. It means that the sounds used in this proposal, present the exact differentiation of the noise/calm areas as they were captured along the path. For the urban prototype we do not fix curves in the space, instead, the sound curves travel following the path, and are influenced in accordance to the area they are passing. This form extends in a linear site, and unfolds as a canopy that varies with the urban sound. The resulting form is dynamic with differentiation of spaces, densities and textures. The linearity is broke were the sound is higher because higher sound creates voids between the layers that could be used to accommodate internal spaces. The spaces are articulated with the continuity of the shape, as a linear and kinetic space, encourages the user to flow along it. The sound as the creator of the space is frozen in time and allows the user to witness and become aware of the acoustic environment.

Wall, roof, and floor are all blend together, giving a sense of continuous space and enhanced perceptual experience. Nothing in this form is predictable, everything is opened to be discovered by the self-experience.

Figure 8: An Urban Scale Prototype. Voids break the linearity of the path and create internal spaces.

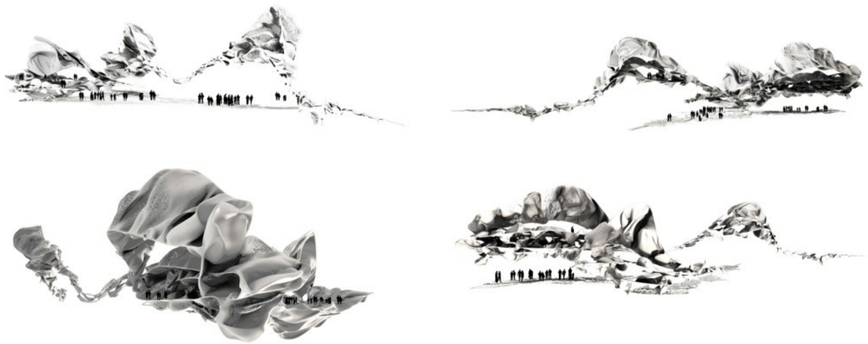

Figure 9: An Urban Scale Prototype. Elevations. Different elevations shows the whole path adaptation to the different sound areas. Linear parts are in the calm areas and volumetric parts reflects areas with higher voice.

6. DISCUSSION/ARCHITECTURAL CONSEQUENCES

It became clear that all kinds of patterns and forms are being manufactured by not only frequency and amplitude but a generative design method which also incorporates time and the site context.

All these parameters pose advance settings for digital control systems which evoke three-dimensional and responsive architectural forms (Lally and Young, 2007). Therefore, this kind of digital production of form is more sufficient and yields a variety of topological geometry.

Also, what is worth noting here is the creation of kinetic space in addition to time and to give more architectural features to forms. Before going further, it is necessary to define the term kinetic. Kinetic is a term that can be expressed with the word motion in most cases. The term “motion” is a process of changing position or place over time (Terzidis, 2003). According to Terzidis (2003), "while time is involved in motion as a measurement of change, the form itself does not involve time. Thus, the kinetic form represents a motionless boundary and an extension of the notion of architectural form."

6.1. The Term Kinetic in Art and Architecture

Before architecture, the kinetic had a long history in the art, especially after the 1950s when it was used in the movement of kinetic art (Terzidis, 2003). The history of kinetic art begins with the realist manifesto published in Moscow in 1920 by Gabo and Pevsner. They proposed that the traditional elements of plastic and pictorial arts are denied and that in these arts, a new element, the kinetic rhythms, will be claimed as the basic forms of our perception of real time (Rickey, 1963). Marcel Duchamp's sculpture Mobile wheel and his painting Nude Descending the Staircase can be given as examples. These art pieces are not three-dimensional but four-dimensional which is time as an interpretation of the actual movement. (Rickey, 1963).

In architecture, on the other hand, the representation of motion is usually achieved with an abstract formal arrangement which depends on the relation between "cause and effect". Cause and effect relations can be created by different digital tools and simulations. Digital tools can be animated in simulations which are essential for not only designing kinetic processes but also for designing complex material systems and for analysing their behaviour over extended periods of time. Air, sound, wave and nuclear physics are commonly available simulations (Hensel et al, 2010). Another simulation that has been mentioned so far is sound. The movement in the sound motion streaks process is provided by AudioNode and its connection with time. Small variations in the AudioNode in each sequence may produce changes in the development of each component at many different scales. Hence, as time goes on, architectural form continues emerging through much more complex and articulated space. Terzidis (2003) posited that in this complexity of form, users' eye can catch the virtual movement and the physical stimuli which forms have. Furthermore, from all digital experiments, it can be said that apart from the complexity of kinetic form, all shapes driven by sound have in common rhythmicity, motionless boundaries and changeability over time, no matter their different materials, causes or functional mechanisms. Therefore, in this design process, form is literally a product of matter. It is actually an abstract entity to which process gives certain geometric and kinetic characteristics (Terzidis, 2003). Kinetic form evokes generative processes and the concepts of interactivity, modifiability and continuous evolution with the help of time (Tierney, 2007).

In terms of time, kinetic forms produced by sound change over time and this motion either freezes the moment or makes complete. In both ways, kinetic form has great architectural value because it consists of agitated surfaces, compressed planes and penetrated spaces in both ways.

Even though movement is frozen, the unique characteristic of architectural space remain; that is both dynamic and static (Terzidis, 2003). According to Terzidis (2003), it is dynamic because the design process provides an elastic essence and manipulation of entities. It becomes static when it has to freeze in order to be built. Therefore, it contains a large collection of forms from which architects find the most suitable in terms of function, architectural space and environmental context.

6.2. Conclusion

This paper propose a method to create forms and patterns in a dynamic-kinetic process by using sound as an external force. To create this method, first physical, then digital experiments are done to understand the sound phenomena and its influence on materials. After these phases, we construct our method with 3 different tools in Autodesk Maya-curves, particles and polygonal mesh-. Sound affects this hybrid material system and we manipulate time-sound and material properties through HyperShade. The ultimate form emerging in this process depends on time therefore we can track the whole process along the form and this brings kinetic properties to spaces created in the Sound Motion Streaks Project. The value of this kinetic process is its changeability and endless topology. Moreover, in this animated space, users discover sound with their eyes and become aware of the sound-scape of the area. Through this kinesthetic experiences, users can not only hear the sound in the environment but also see and touch therefore, the perceptual experiences are enriched and enhance.

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-[1] http://www.acs.psu.edu/drussell/demos.html
-[2] http://www.physicsclassroom.com/class/sound

PRELIMINARY DESIGN THROUGH GRAPHS: A TOOL FOR AUTOMATİC LAYOUT DISTRIBUTION

CARLO BIAGINI, VINCENZO DONATO, DAVIDE PELLIS [1]

ABSTRACT

Diagrams are essential in the preliminary stages of design for understanding distributive aspects and assisting the decision-making process. By drawing a schematic graph, designers can visualize in a synthetic way the relationships between many aspects: functions and spaces, distribution of layouts, space adjacency, influence of traffic flows within a facility layout, and so on. This process can be automated through the use of modern Information and Communication Technologies tools (ICT) that allow the designers to manage a large quantity of information.

The work that we will present is part of an on-going research project into how modern parametric software influences decision-making on the basis of automatic and optimized layout distribution. The method involves two phases: the first aims to define the ontological relation between spaces, with particular reference to a specific building typology (rules of aggregation of spaces); the second entails the implementation of these rules through the use of specialist software. The generation of ontological relations begins with the collection of data from historical manuals and analyses of case studies. These analyses aim to generate a "relationship matrix" based on preferences of space adjacency. The phase of implementing the previously defined rules is based on the use of Grasshopper to analyse and visualize different layout configurations. The layout is generated by simulating a process involving the collision of spheres, which represents specific functions of the design program. The spheres are attracted or rejected as a function of the relationships matrix, as defined above. The layout thus obtained will remain in a sort of abstract state independnt of information about the exterior form, but will still provide a useful tool for the decision-making process. In addition, preliminary results gathered through the analysis of case studies will be presented. These results provide a good variety of layout distributions over a short time for medium and large-scale problems.

Key words: graph representations, parametric design, automated layout distributions

[1] This article has been co-authored by: C. Biagini, Prof. Dr. at University of Florence, Dept. of Architecture, Florence; Vincenzo Donato, International PhD Candidate at University of Florence and Technical University of Braunschweig; Davide Pellis, M.Eng. in Building Engineering, Florence.

1. INTRODUCTION

In the design process understanding which layout distribution is suitable for a particular context is a complicated task, especially regarding the design of complex buildings that are highly influenced by the functional types (such as airports, hospitals, industrial factories, and so on). Obtaining an optimized distribution in terms of minimization of connections between spaces in advance could give the designer an important advantage.

In the literature different methods have been shown that bring the designer towards an automated layout distribution. Many of them are based on algorithms that lead to abstract solutions in terms of architectural quality; they also generate very complicated numerical results which require a great deal of effort to decode the output data.

One possible approach is to implement an algorithm that can automatically produce an abstract representation of a possible optimized layout distribution. In our work we intend "optimal solution" to mean a layout that presents the minimum distances between functions and spaces. Subsequently this abstract representation can be used as a reference to generate a conventional architectural representation.

To achieve an automated layout distribution it is possible to use the analogy of the cinematic system where spaces, represented by circles or spheres, are inserted in a specific universe governed by dynamic laws. These cycles are attracted or rejected in accordance with the strength of the springs that connect the barycentre of the circles. Once the analysis begins, these circles assume an equilibrium configuration. Grasshopper, a plug in for Rhinoceros, allows the automatization of this task.

The calculation of the optimal design solution is a function of specific mathematical criteria, based on the transformation of qualitative factors into quantitative parameters. The ontological relations between spaces or functions are expressed through a relationships matrix that considers the adjacency preferences (adjacency, proximity, inclusion separation, and so on). These preferences are converted into different forces of attraction or repulsion, through a dynamic system.

In the article we will present a method to achieve a set of possible optimized distributions starting from a relationship matrix. In addition, we will also show a case study based on the urban distribution analysis of the layout distribution for a complex urban distribution of the Hospital of the city of Florence.

2. STATE OF THE ARTS

According to Kalay, design can be considered as a problem-solving activity and "the problem it sets out to solve arises from the inability of a current situation to satisfy some needs" (Kalay, 2004). He continues by proposing a series of questions: " How can we tell if a proposed design solution will achieve them? How can we measure the "goodness" and uncover its undesired side and after-effects before constructing the buildings? How can we begin the search for design solutions in the first place?" (Kalay, 2004 p. 205).

An answer can be found in the history of architecture. In particular, research into "best practice in design" has perplexed philosophers and architects since Ancient Greek times. In the first century BC, Vitruvius offered some answers to this question, giving a "good solution" through specific geometrical proportion. Since then, architects and researchers have tried to formulate theories, methods, and tools that will help the designer to "predict" the results (Edwards, 1979).

In recent eras, the starting point for many design methods has been the notion that design is a process of searching for a solution that satisfies a given set of goals and constraints. One possible tool to use in architecture (or indeed in any field that requires similar design activity) is to represent the problem through graphs and diagrams. In fact in the work of Hellen Do and Nigel Gross they explain "graphs and diagrams are the essential representations for thinking, problem solving, and communication in the design disciplines in an abstract form" (Do & Gross, 2001). This abstraction allows the designer to "distil the meaning of the message, focusing attention on its salient characteristics […] which details are preserved, and which ones are omitted, depend on the subject of communication, on its purpose, on the knowledge of the receiver, on the connect of the commutation, and on the medium used for its transmission" (Kalay, 2004, p. 88).

If we refer to a layout distribution, for instance, it is possible to represent the same floor plan in two different types of encoding, as depicted in the figure below (Figure 1.1).

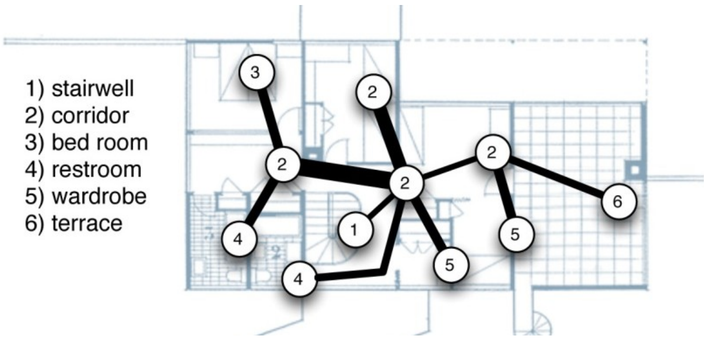

Figure 1.1. Second floor plan of the Gropius House

A high degree of abstraction, therefore, makes communication more efficient, though not necessarily more effective. Abstraction can help to highlight certain specific features to capture the receiver's attention. Clearly the balance between the loss of information and abstraction has to be decided in accordance with the knowledge of the receiver, because this form of representation omits a series of information that must be completed by the receiver.

In the Information Technology (IT) age this abstraction was catapulted and converted into a machine language and explored in different forms.

3.1. IT tool for design process solving

In the early sixties, Christopher Alexander published the influential book “Notes on the Synthesis of Form” (Alexander, 1964). As a mathematician, he introduced set theory, analysis and algorithms as tools for addressing design problems. At the time, these were only partially implemented through the use of computers, due to the high cost of the technology.

Following this research, in the late ‘60s, scientists and academics began to experiment with computerized algorithms in the field of architecture. “One of the areas where the computer can be helpful to an architect is in space allocation, in finding a large number of possible schemes at a sufficiently early stage of the design process, and choosing the best one for further development” (Terzidis, 2001). But the main problem was the “[…] high number of constraints that have to be simultaneously taken into account in solving a design problem, and it was difficult to find a method to consider them all. Moreover, the only way to arrive at a conclusion was to break down the problem into sub-problems and use a non-deterministic approach” (Terzidis, 2001).

After a few years, new ways were sought to approach design problems using “linguistics” and “logic”. In this instance, the designer confronts the problem through decomposing its structure by grouping constraints into thematic areas (e.g. zoning, circulation), and then considering each group of constraints more or less independently. This information, converted into sentences, allows for the consideration of not only singular elements but also the rules and relationships for achieving a meaningful composition.

For Coons, the design process is a complex phenomenon consisting of intricate nodes in which intuitive imaginative and analytical, mathematical and rational processes are in dialogue. In his work he explains that human reason always shows a great ability for invention, building, comparison and judgement; but is extremely inefficient in executing rational processes that require the manipulation of a large quantity of interrelated data in a complex way. On the other hand, computers are particularly efficient on an analytical level, but completely free of the ability to create. The most logical thing seems to be to find a way of merging the creative capability of the human brain and the analytic and computational capability of the machine (Coons, 1964).

The way in which the human brain differs from the computer is precisely what makes it more efficient during the design process. In terms of learning ability, memory, precision, and operation of an algorithm, the computer is more efficient than the brain. But the brain will always be superior any time it has to make a judgement of value, recognition of form or association of ideas. In other words, the most efficient design process is one that is able to use the brain and the computer in a symbiotic relation (Broadbent, 1970).

Another type of approach that was experimental and partially implemented through experiences with the computer has made it essential to use “heuristic approaches”: “Design synthesis methods are typically inspired by the analogies and guided by the architect’s own or another designer’s previous experience” (Kalay, 2004, p. 255). Techniques of trial and error are usually the basis for a heuristic approach to a

solution. In fact, this technique is closer to the “search-and-evaluate” process used in architectural design than any other type. For synthesizing the design solution, one of the most common heuristic methods is to “borrow” from other knowledge areas, which appear to hold some relevance to the problem. Philip Steadman in 1974 was the first to propose borrowing the metaphor from electrical networks to guide the computational synthesis of architectural form. He found a surprising similarity between a specially constructed graphical representation of architectural floor plans and the physics of electricity, as expressed by Kirchhoff’s law of electrical flow.
A similar metaphor was presented by Arvin and House, which made an analogy with mechanical springs, applying “the principle of dynamic motion and geometrical deformation to rigid and non-rigid objects for the purpose of simulating realistic behaviour and visual effects” (Arvin & House, 2002). Topological design objectives such as adjacencies between spaces and relationships between them could be expressed by the strength of a spring that is linked into the barycentre of a space.
Instead, many researchers affirm that the most common approach to the synthesis of new design solutions is by looking at case studies because it is believed that the current problem under investigation is not fundamentally different from a similar problem that has been encountered in the past.

3. METHODOLOGY

Usually the preliminary design phase begins with a careful analysis of the preliminary requirement documents, which make it possible to define the number of functional spaces needed. Moreover, the designer has to think of a solution which is compatible with the standard laws, both architectural and urban, and convert the idea into a “boundary condition volume”, in which it is possible to allocate the spaces previous defined.
In this moment the process of searching for the best design solution starts, by proposing several layout configurations. One possible method is to define a relationship matrix that allows a systematic evaluation of the relation between functions and spaces.
The designer assigns a value to a specific spatial relationship. This spatial relationship could, for example, be subdivided into a five-point scale such as “close proximity essential”, “close proximity desirable”, “separation desirable”, “high separation desirable”, and “no spatial relation”. The value is indicated in the intersection of the rows (Fig. 3.1).

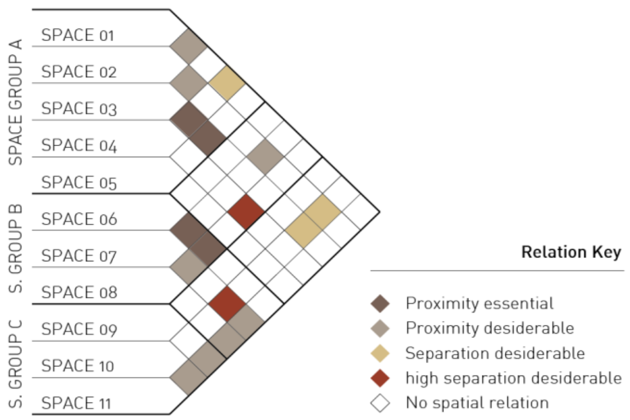

Figure 3.1. Example of a relationship matrix

The matrix is reviewed for its critical relationships and is represented graphically through a diagram created to illustrate these relationships spatially. In addition, the "mathematical relation" (adjacency) can be represented in a graphical form through a diagram as shown in the figure below (Figure 3.2).

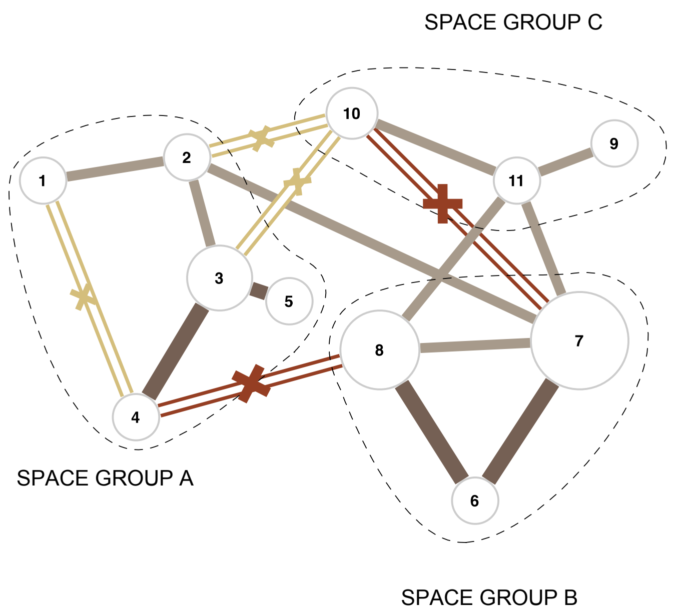

Figure 3.2. Example of a graph

Through this method one can study different issues related to the preliminary design. It is possible to represent the geographical exposition of spaces (north, south, east and west), the access to daylight or different type of user flows. In this last category, for instance, different types of flows within the building can be identified, subdividing them into public or private users, suppliers, workers, hazardous materials, and so on. Through the graphical overlapping of all of these, it is possible to highlight design criticism and intervene in the decision-making process to achieve a better design solution.
Additional steps could be taken to implement this system and achieve an automated distribution. Referring to the work of Arvin and House (Arvin & House, 2002), we can employ a method based on the analogy between dynamic motion and space distribution for solving the problem of layout (using specific CAD software), as shown in the following chapter.

3.1. Implementation through Rhino, Grasshopper and Kangaroo

The tools used for the implementation of the method are Grasshopper and Kangaroo. The former, Grasshopper, is a graphic editor for programming that is integrated in the CAD software Rhinoceros. In Grasshopper we can define geometrical algorithms by connecting pre-compiled instructions with "wires" that define the operation flux. The latter, Kangaroo, is a Grasshopper plug-in that allows us to simulate cinematic behaviour of physical particle systems. With Kangaroo we can define linear springs and non-linear attractive or repulsive forces.

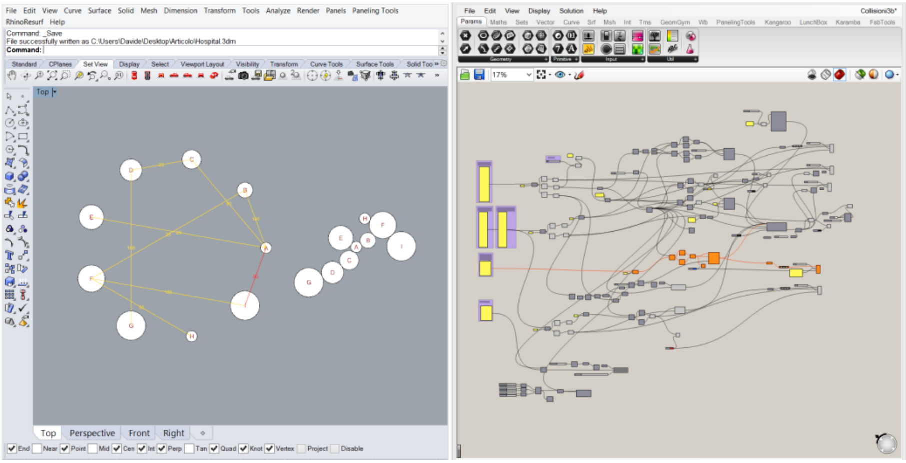

Figure 3.3. Implementation with Grasshopper

The general idea consists of associating a "space" (depicted in the relationship matrix) with a circle, with a proportional area defined in the design requirement document. Moreover, each of these circles is connected to others through springs with specific features of attraction or repulsion according to the relationship matrix previously defined. The final layout distribution is achieved from the collision of multiple circles.

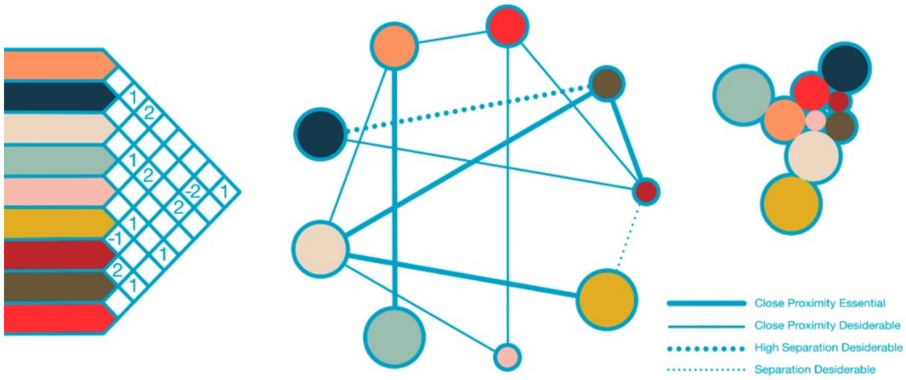

Figure 3.4. Relationship matrix, starting configuration and one possible layout

The process is subdivided into two phases: the former is the modelling of circles and the latter is the modelling of spatial relationships through springs.
In the first phase, circles have been modelled with a specific procedure in Grasshopper: each circle's centre has been connected to all the others with a spring whose *rest length* and *upper cutoff* (defined as the distance over which the spring is deactivated) are equal to the sum of the two radii of the circles. The stiffness of the spring must be more than one order of magnitude higher than functional connecting springs.
In the second phase, spatial relationships that are represented through springs are modelled as linear springs if attractive, or inversely proportional to the distance if repulsive. The stiffness of springs is proportional to the level of connection or disconnection relationship. In our test the stiffness of the springs is in the ratio -3:-1:0:1:3 corresponding to the five criteria previously shown (high separation desirable, separation desirable, no spatial relation, close proximity desirable, and close proximity essential).
The simulation considered so far is strictly planar but it is possible to extend it through multiple floors using constraint parallel planes. The procedure involves the definition of the floor position for each circle. It is not possible to link spaces that belong to different floors. A vertical core (stairwells and elevators for instance) must be modelled for each floor and then linked to represent this vertical connection. These links are modelled as linear springs with a lower cutoff equal to the distance between constraint planes. The stiffness of these springs must be in the ratio of approximately 40:1 with the higher value of spatial relationship springs to guarantee the strict vertical alignment through the tiers.

3.2. Influence of the initial position

The collision simulation starts from a circular disposition (Figure 3.4 - b). Initial position influence can be avoided using a “trick” that consists of reducing and increasing the radii of circles during the simulation. Different speeds of increasing and decreasing during this simulation can be tested to achieve a “shaker” effect. To improve the result it is advisable to increase and decrease radii with a linear function that starts from zero and reaches the actual radius length.
If more than one layout configuration exists, different optimized layouts may be achieved in increasing and decreasing cycles with different radii of the circles.

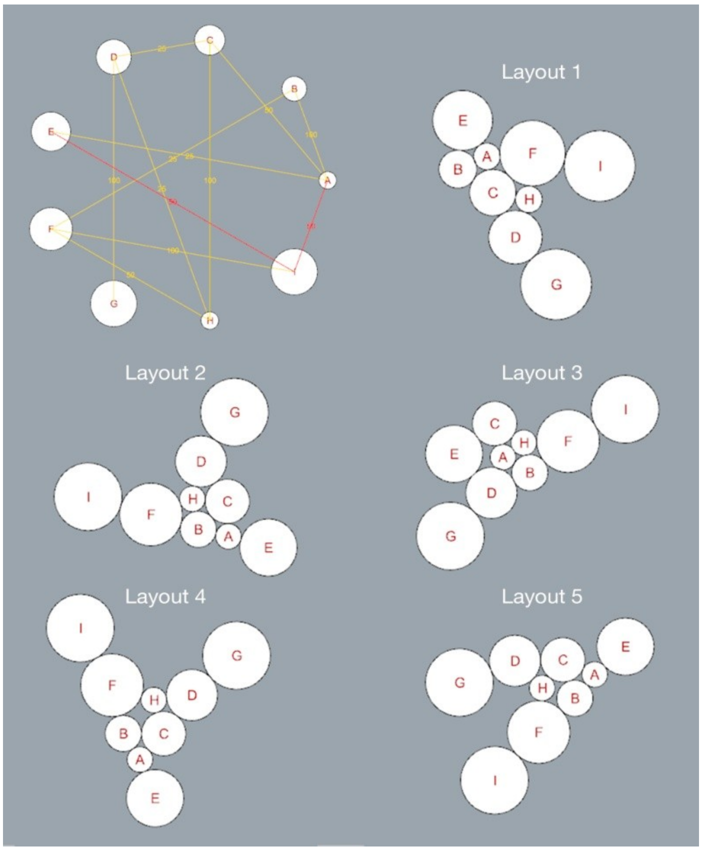

Figure 3.5. Different layout configuration

In Figure 3.5 we can see an example of this simulation. From the same initial configuration it is possible to achieve different optimized layouts.

4. CASE STUDIES

The case studies taken into account are related to a particular typology: the hospital. We have analysed different layout distributions on different detail scale (urban, architectural, department scale) and compared them with the theoretical model.
The theoretical model was gathered from the available Italian literature [1] concerning the definition of the ontological relations occurring in a hospital with particular reference to the "Guide to technical, organizational and managerial principles for the construction and management of high-tech hospitals and assistance - Final Report". In this document it is possible to extract important information for assembling the relationships matrix, according to the scale of the object that we would like to study.
As an example we will report a case of the layout achieved from the implemented method. The following analysis will compare the optimized layout achieved from the theoretical relationship matrix with the urban distribution of the main Hospital in Florence: A.O.U. Careggi. Careggi is one of the biggest health centres in Italy and it has a structure composed of a spread pavilion, situated in a unique district of the city. Recent masterplans have commissioned a partially completed general renovation process that provides, in addition to the substitution of some of the old pavilion, the realization of an underground tunnel that allows most of the pavilions to be connected.
The relationship matrix involves four connections: close collaboration, frequent collaboration, occasional collaboration and no relationship. These relationships have been implemented as attractive springs with a stiffness in ratio 3:2:1:0. For the simulation, circle areas have been set equal.

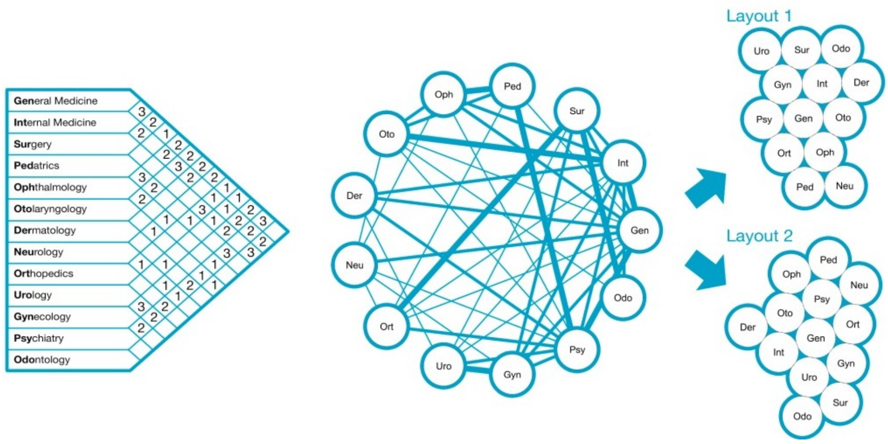

Figure 4.2. Process of generation of layout for A.O.U. Careggi

Figure 4.2 shows the relationship matrix, the initial graph and two of the possible optimized layouts. In figure 4.3, we performed a comparison between the actual

[1] The following books and data were used and compared to extract a relationship matrix: Neufert, E. (2007). Architects' data. John Wiley & Sons, 2012; Campolongo, S. and Angeli, F. (2013). Architecture for flexibility in healthcare

layout configuration and one of the possible optimized layouts.

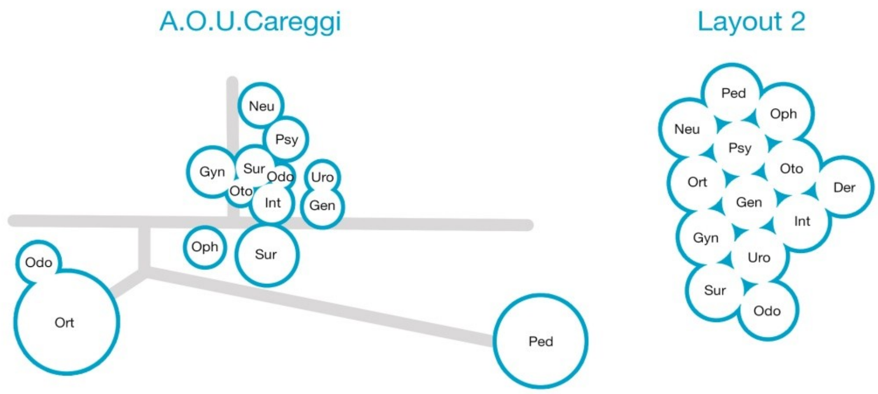

Figure 4.3. Comparison between the existing layout and an optimized layout for Careggi

The comparison between the two layouts shows some similarities regarding the central core, and some differences mainly due to the position of orthopaedics and paediatrics, whilst the latter includes several internal departments.

5. CONCLUSION

In addition to being an important tool in driving the decision making process for the preliminary step in architectural design, the tool presented in this paper can be used for analysing criticism of any layout distribution and can be a valid method for re-designing existing configurations.
Although the method elaborated is in a preliminary version of development, it shows interesting results and contributes to the automated assessment of layout solutions.
Currently this method allows a free-form layout, dependent only on spatial relationships links. Further development will be on implementing alternative methods that address the optimized layout, towards an architectural-specific shape. Moreover, the development will be oriented towards implementing solar preferential orientation and achieving a multi-floor layout optimization, without specifying the level in advance for each space.

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SESSION 5

21 November 2014 Friday, 09.30-10.30

THE CURRENT STATUS, ROLE AND FUTURE OF URBAN DESIGN

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Introduction

Over the past three decades, the advent of a post-industrial economy, the rise of the environmental movement, and the critique of top-down government decision-making have called for new approaches, both conceptually and methodologically, to the design and construction of urban environments. In this context, there appears a need for a critical urban design framing the increasingly contested terrain of urban resources and environments that addresses the emerging global trends, complex urban patterns, and evolving challenges of urbanization (UN Habitat, 2009).

Though urban design is historically embedded in the development of cities, urban design, as a contemporary theoretical and professional discipline, is relatively new compared to the associated disciplines of architecture, urban planning, and civil engineering. Urban design's close connection with these allied disciplines has also been the reason for its ambiguous nature, and its muddled definition. Accordingly, it is claimed here that a re-examination of the definition, status, and role of urban design is essential for the future directions of urban design and that of cities.

The Current Understanding and Position of Urban Design

As defined in *By Design,* a guidance manual commissioned by the UK Government for local authority planners incorporating the conventional approach to good urban design (ODPM - UK, 2003), "urban design is the art of making places for people… it concerns the connections between people and places, movement and urban form, nature and the built fabric, and the processes for ensuring successful villages, towns and cities".

On the contrary to its position in the 1980s, the value of urban design has been widely acknowledged over the last three decades. In the West, it is now well integrated in the planning system. Urban designers increasingly occupy a central role in the development and redevelopment of cities. Design professionals with good urban design knowledge and skills are much sought after by private consulting firms, development organisations and local and state governments – where they are required to prepare and evaluate urban design policies, strategies, frameworks, guidelines, concepts, master plans and programs, as well as be involved in the more detailed design and management of urban spaces. Urban design knowledge and skills also assist in designing for specific sites by providing a better appreciation of urban structure and context.

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However, only fairly recently has urban design been identified as a specific discipline. It encompasses practices which have always had a central place in urban planning and urban development, though with new techniques and different points of emphasis related to contemporary issues. The need for such a discipline has arisen as a result of the fundamental cultural, political, social and economic changes. These have focused attention on environmental issues and the quality of life, on the nature of the city and on how urban form can best be adapted to our current and future needs (Lloyd-Jones 1998).

At present, there are problems with the manner in which urban design is conceived, practiced and researched. Owing to the emphasis on morphological aspects (physical aspects of the urban environment), that is the result of the stress on the problematic effect of negative space, urban design is often regarded as an ambiguous combination of architecture, urban planning, landscape architecture and civil engineering. In this context, the qualities of the physical environment are perceived as being detached from urban use and appropriation as they would be discussed, for example, by Jacobs (1961) and Alexander (1976), who regard the city primarily as a place of human habitation. Concentrating on the abstract concept of the spatial experience rather than on actual day-to-day life has ignored the users and their functional, social and emotional needs. Thus, although the city is examined and designed on the implicit basis of human experience, this experience is never discussed or considered specifically enough to make a difference (Kallus 2001).

Another problem with current urban design thought and practice is the sense that it has become almost synonymous with 'architecture at a larger scale' made up of building facades or building complexes, or designing 'objects' rather than creating 'places'. In line with this approach, there is too much emphasis on the visual and contextual dimensions of the townscape, an over-emphasis on the architect as urban designer and an obsession with design of individual buildings, and not enough consideration of 'urban context' (e.g. how cities work) (Lloyd-Jones 1998, Inam 2002) and building and urban space relationship. Accordingly, the profession has become very 'product' oriented, and the resulted urban environment has failed in terms of liveability and sense of place.

Even when architects want to take the city into consideration, what precisely they take into account are mainly the visual aspects; however, it is just as important for the design to fulfill the physical, social, emotional and spiritual needs of the people who use the environment. In this context, there are some architects like Ralph Erskine, Lucien Kroll, Herman Hetzberger who are worth mentioning as they have contributed through their architecture and writing to designing with people in mind, through their idiosyncratic approaches to making healthier and happier places for people to live in.

Another useful distinction of urban design lies in the relationship between the designer and the designed object. All designers (architect, interior designer, industrial designer, etc.), except contemporary urban designers, have a direct relationship with the object that they design, as schematically depicted in Figure 1. These designers make the decisions that dictate and directly shape the object. However, as depicted in Figure 2, contemporary urban designers have only an indirect relationship with the designed object. They shape the designed object by influencing decisions made by other designers who then directly shape the object; they design the decision environment within which other designers (both professional designers and non-designers whose decisions shape the built environment) create the designed object. In this context, there arises a problem of lack of control on the designed product, an issue highlighted by George (1997, 150) by using the term 'second-order activity' when describing urban design.

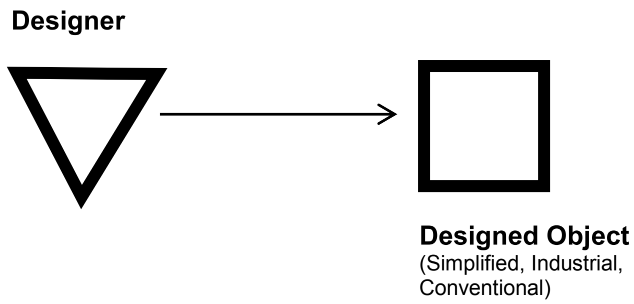

Figure 1. The relationship between the typical designer and the designed object.

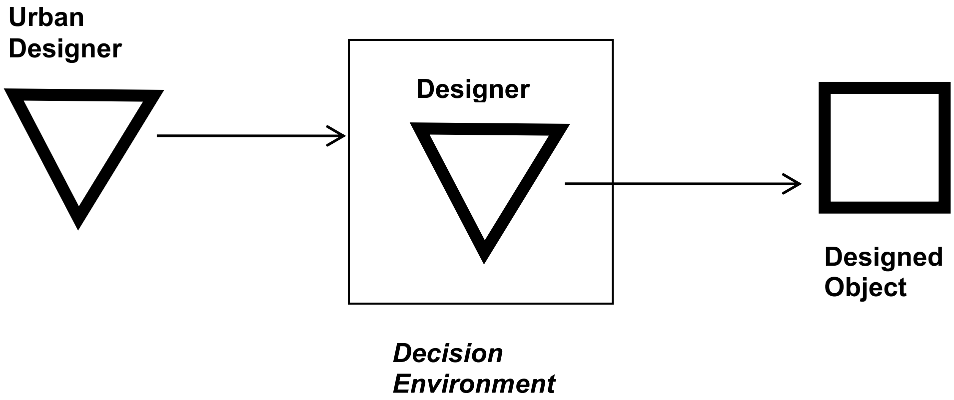

Figure 2. The indirect relationship between the urban designer and the designed object in contemporary cases (George, 1997).

In terms of the knowledge-base, like architects, urban designers must be knowledgeable about forming and manipulating spaces, and must be sensitive to the quality of spaces. This is the only area of knowledge where the two fields completely overlap. The second area of the architect's knowledge-base, knowledge of user characteristics or the relationships between people and the built environment, is also shared by the two fields. However, urban designers need additional skills and knowledge of the urban context; they must know about urban systems and processes of change in urban areas. Further, there is a need for urban design to be informed by concepts, methods, and lessons from sociology, anthropology, cultural landscape studies, environmental psychology, geography, climatology, the management studies, and even art, in addition to obvious disciplines such as architecture, urban planning, landscape architecture, and civil engineering. As no single person can encompass all this knowledge and bring it to reflect on decision making and design, urban design will and should remain a collaborative task.

One question that has often been a point of discussion is "who are urban designers?". In the prevalent paradigm of urban design pedagogy, urban designers are primarily trained as architects, planners or engineers, each having one's own design bias. Architects see design as formal orientation in space. Planners conceive design as regulatory framework and implementation of policies reflecting social and economic value. Engineers understand design as efficiency in production. These divergences imply a problem of communication and the necessity of language of urban design to have a role of bridging.

On that front, a higher level qualification in urban design following an undergraduate degree in architecture is crucial. In this way, as depicted in Figure 3, the architect - urban designer can take the lead in a multi-disciplinary team and direct the urban design process in a decision environment informed by a variety of disciplines, such as politics, sociology, anthropology, cultural landscape studies, environmental psychology, geography, climatology, management studies, public art, and so forth.

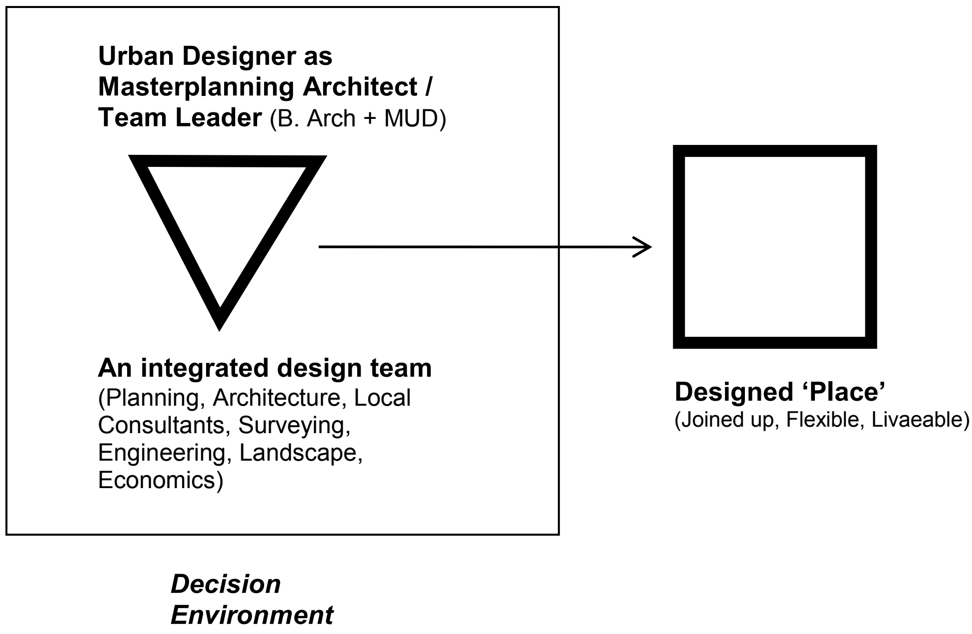

Figure 3. The proposed formation for the urban designer and his/her relationship with the designed object.

As for the institutional framework, how urban design best fits into the professional world is an area of continuing debate. There are (as yet) no professional bodies to dictate what should be on the curriculum of an urban design degree program, nor what sorts of specific expertise and knowledge are needed to practice as an urban designer. This is not a coincidence; it is generally agreed that urban design is not a distinct profession in itself so much as a way of thinking, or, to paraphrase Britain's Urban Design Group, as common ground among a number of professions and/or the wide range of people involved in urban change. To practice urban design, however, an individual should be a registered member of professional regulating bodies in architecture, landscape architecture, and/or urban planning.

Roles of Urban Design

Understanding the role of urban design is essential for providing positive orientations in its future directions. Traditionally, based on the most common understanding that urban design is the interface between urban planning and architecture, it plays a mediator role between two major disciplines involved in the urban realm, but at different levels and scales.

The following objectives of the contemporary mainstream approach to urban design based on the contributions of a number of European and American academics, theorists and practitioners from the 1950s onwards make it clear what roles a responsive urban design activity may play: (Lloyd-Jones 2006)

- *Character and identity*: to promote character in townscape and landscape by responding to and reinforcing locally distinctive patterns of development, landscape and culture.
- *Continuity and enclosure*: to promote the continuity of street frontages and the enclosure of space by development that clearly defines private and public areas.
- *Quality of the public realm*: to promote public spaces and routes that are public spaces and routes that are attractive, safe, uncluttered and work effectively for all in society, including disabled and elderly people.
- *Ease of movement*: to promote accessibility and local permeability by making places that connect with each other and are easy to move through, putting people before motor car and integrating land uses and transport.
- *Legibility*: to promote legibility through development that provides recognisable routes, intersections and landmarks to help people find their way around.
- *Adaptability*: to promote adaptability through development that can respond to changing social, technological and economic conditions.
- *Diversity*: to promote diversity and choice through a mix of compatible developments and uses that work together to create viable places that respond to local needs.

In a widening context, urban designers are now being given new roles being called upon to address development issues in all types of context, greenfield, suburban and inner-city and brownfield regeneration, as well as the city centres. ‘Anti-sprawl’or ‘compact’ city models of sustainable, higher-density, mixed-use, permeable neighbourhoods and centres with well-structured, pedestrian and public-transport orientated features have been developed for most, if not all these contexts. Conventional urban design contributes greatly to the policies required to achieve the sustainable development of rich world cities, most of which are not growing very much in population but continue to eat up land and natural resources. The established urban design principles have also proved quite robust in addressing other aspects of sustainable development in the cities of the developed world, including quality of life, social inclusion and social integration and identity issues.

Conclusion

Urban design lies at the intersect of the interests of the three main professions concerned with the layout of the environment – architecture, landscape architecture and urban planning, and civil engineering. However, urban design while overlapping these fields has developed its own area of expertise.

Since current urban design thought and practice have recently been dominated by the visual and contextual understanding of the townscape, and in many cases has become almost synonymous with 'architecture at a larger scale', there is a need for a paradigmatic shift in the focus of urban design from the current model of urban design framework, where the social control, economic efficiency, and spatial order are compartmentalized. The focus on understanding urban, on the contrary, requires an adaptive inclusive model that addresses relational issues among multiple dimensions of urban design and the urban environment. In brief, a dynamic multi-dimensional viewpoint is required which combines political, environmental, economic and cultural aspects of urban design and development in the changing of the city.

As these deliberations suggest, we should be aware of the fact that "urban design is different from architecture!". It requires additional skills and knowledge of the urban context. Further, there is a need for urban design to be informed by concepts, methods, and lessons from sociology, anthropology, cultural landscape studies, environmental psychology, geography, climatology, the management studies, and even art, in addition to obvious disciplines such as architecture, urban planning, landscape architecture, and civil engineering. As no single person can encompass all this knowledge and bring it to reflect on decision making and design, urban design will and should remain a collaborative task.

The problem of communication between architects, who see design as formal orientation in space, and planners, who have problems with the language of design, compels the necessity of language of urban design to have a role of bridging. On that front, a higher level qualification in urban design following an undergraduate degree in architecture is crucial. Such a formation would also enable the architect to develop interdisciplinary critical skills to build better places, and acquire the role of the 'masterplanning architect' within an integrated design team.

If urban design is to have any impact at all on ill-planned sprawling development in many world cities in a fast changing context, it needs to look to a wider landscape understanding of character and identity, to relationships between built form that are not exclusively focused on continuity and enclosure; to consider more accessible and communicative city and legibility beyond the street environment, roads and public transport interchanges; to give much greater concern to the legibility of the urban and suburban landscape; and to focus on the requirements of sustainable urbanism for safeguarding the natural, built and cultural values in our cities.

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UN Habitat (United Nations Centre for Human Development) – www.unhabitat.org

THE REDEFINITION OF THE CITY IN THE SLOW CITY MOVEMENT: THE EXAMPLE OF AKYAKA IN TURKEY

DERYA ADIGÜZEL ÖZBEK[1]
SELCEN NUR ERİKCİ[2]

ABSTRACT

Slow city is a way of life that cultural richness and quality of life are preserved and defended in the city's local scale. Also, it is an urban model which may prevent in the standardization of lifestyles to achieve environmentally-conscious and tourism-based local development. Thus, its purpose is to improve the quality of life in cities and it is opposed to the homogenization of cities. Contrary to the global, the forefront of locality is to support the local production and producers. The slow city movement, which is basically included the critique of rapid consumption in cities, is required to query with a critical perspective that the process of getting of the title and developments after this process for the accurately detected and implementation. In the context of this study is discussed as a case study of Akyaka in Turkey which is the slow city title in 2010. The situation before taking the title of a slow city, the process of getting the title and subsequent developments of the Akyaka will be analyzed with the critical bibliography method by the review of the literature, the visual and written media news. The processes of slow city and after the changes/improvements of Akyaka are discussed.

Key words: Environments, Slow Food, Slow City Movement (CittaSlow), Speed, Locality.

1. INTRODUCTION

Cities are organisms into their social, economic and cultural dynamics. Today, they are becoming undefined places that have lost cultural, local and environmental values rapidly under the rule of advancing technology, globalization processes and the capitalist system.

Countries that have disappeared the boundaries between the other ones with the globalization process and advancing technology form the cornerstones of the economic system with their big cities. This issue needs to emphasize clearly with its advantages and disadvantages that new concepts and formations are sitting instead of changing milestones in the transformation process. From now on, the examples are increasing such as city economies that are independent and cosmopolitan concepts. A change in the balance is considered as a transformation of globalization

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process such as power not coming from the country, coming from the city-owned. However in economy a structure, occurs outside of based on the industry or agricultural, based on the global information technology and accordingly cities transform to focusing on production/consumption spaces.

As a result of constant change and development of consumption patterns, cities become a part of these changes and transformations continuously. These structures that are forced to enter into the one distinct mold especially by the globalization process and constitute more places than all other economic and political activities, has been faced various problems such as the loss of local-cultural characteristics. All these city structures cause to perceive a single space, culture or center assessment of the planned formation of the world. However, each city's has own socio-cultural structure, historical process, residents, local amenities and activities. Combination of conventional production methods and unconscious consumption is emergency for today's world/cities. Communication types such as media convey the destruction by fast life and in parallel with excessive and faster consumption than ever seen.

Improving the quality of urban life and local properties taking place into urban spaces outside of global structures should be the priority targets. Precisely at this point on a global food brand, which is considered the world's largest cities in the main square in Rome, was born as a reaction to a shop that started as a continuation of slowfood Cittaslow movement occurred in the organization. Cittaslow refers to "Slow City" that consists of an Italian word Citta (city) and an English word Slow. Cittaslow is a city union born from Slow Food movement that prevents to standardize of the texture, calmness and life style of cities and eliminate the local characteristics by globalization (Miele, 2008; Radstrom, 2011). In this respect, the slow life aims to protect and remove the local. Increasing the access conditions to future generations what we have in world order and adopting the sensitive understanding to nature and environment are basic goals and principles.

2. THE MOVEMENT OF CREATING AN URBAN INITIATIVE: CITTASLOW

Environmental issues and correspondingly source problems are known at the top rates. The increase in imbalances between production and consumption reduces the constructs of self-sufficient city. At this point, a Japanese approach "Kaizen" can be given an example for evaluating all the world as a whole, further support of production and paving the way for the improvement of urban spaces. “Kaizen” means small but steady steps to progress. The main objectives of member cities in the Cittaslow movement are based on it. "Slow" is not a trend, contrary should be a philosophy. An effort must be permanent and meaningful identity which melting in pots of the changes' and transformations' state of being "slow" in developing world.

The main goal of "Slow City Movement" is blending today's and tomorrow's opportunities by taking advantage of the prior cultural heritage and knowledge. In this goal, the city's air, water, soil cleaning, the food’s local and organic and distinctive local architecture of the city are listed as being environmentally friendly. Especially in harmony with nature and eco-friendly systems is very important to use without causing damage. The application to the urban fabric should be based on taking advantage of technology and keeping in mind the historical and ecological structure. Happy structures can be obtained by constructing more humane and livable spaces in slow cities unlike the chaotic and stress-installed metropolitan ones and own their own value and features.

Slow City movement is created in the framework of saving us into the mold that the globalization forced us as a single type of person model and protecting the local values. (Eskicioğlu, 2009) For these purposes, cities have to set goals to achieve in 7 topics 59 main criterias and 3 specific conditions listed below and begin working in these areas (Web 1). These are the main 7 topics classified by criteria:

1. Environmental Policies
2. Infrastructural Policies
3. Activities for Increasing the Urban Quality Benefiting from the Technologies
4. Supporting Local Product and Production
5. Hospitality
6. Awareness
7. Supporting the Slow Food Activities and Projects.

Each city have its own internal dynamics and a structure of life. It is just a kind of machine that has melting the wheels inside and not capturing the interventions such as adding, editing etc. However, each settlement, ideally as part of a whole, in accordance with basic principles of CittaSlow movement provides;

- production is primarily local, but globally connected
- quality is maintained by feedback, ratings and reviews
- mechanisms for public reputation are the principal means of social control
- ‘real costs’ – social and environmental – guide people’s consumption (Alexander, 2002).

All of these transformations are considered important in the realization of the public to embrace within the Cittaslow movement. Chaotic and complex states will breed as a result of any kind of discourse or activism secretive by the public. In this respect, Cittaslow is a movement to fed by a contemporary municipalize through a common platform for all activities in the public's conscious. In this movement an understanding should be based on the word of Hz. Mevlana Celaleddin-i Rumi. "Be patient, because how countryside laugh if not clouds cry? Do not be hasty. Accessed to purpose patiently, not in a hurry. Ordinary herbs grow within two months, but red rose grows in a year. Even food is cooking in pot slowly and subtle more delicious than simmering crazy.” It must be associated with not slowness, laziness, weakness and inability, on the contrary, with calmness, production and use on-site. Due to base on human and humane life in basically, sustainability should be ensured by controlling every single step's tightly and constantly.

The location of cities surveyed in slow motion is also important. The factors that determine this location are;

- The city's local networks
- Trading links with the city/ turnover
- Daily lives of residents and way of life.

All these sub-factors come together, when considered as a whole, will reinforce the basic structure of the city by moving slowly existing studies.

These factors include "Slow City Movement" scale should be supported by a variety of inferences. In this way, life and philosophy are blended together. Production constitutes one of the main points of the moving-consumer relationship and the local-global balance should be determined by a variety of preliminary research. Life planning within the city-campus problematic, "slow" should be considered and should be adopted within the framework of the concept of living people. Things to propose and experiment with "local" concept underlining, priority should be listed principles to create Akyaka example.

3. A CRITICAL APPROACH TO SLOW CITY: AKYAKA EXAMPLE

Turkey met to this movement for the first time in November 2009 with the announcement of Seferihisar's being Cittaslow. In 2010, the town of Akyaka, Muğla started to increase with the number of members. Cittaslow movement for the implementation of the right may not be detected until after the title of the developments in the process of getting a critical need to inquire. One of the main criticisms of Cittaslow is that the criteria have not been carry for country's specific features. In this context local-cultural, social structure should be much stronger by adding country-specific criteria. Studies have been started to be carried out to determine what criteria would be for Turkey (Web 13). Akyaka was given the title of Cittaslow in 2010, Turkey examined as a case study both for contributing the determination of these criterias and the implementation its' local level perception and contribution to the city. The most significant features of Akyaka are being Special Environmental Protection Area and its biodiversity. Also wooden houses make Akyaka special that were designed the typical Muğla-Ula architecture by Nail Çakırhan and have traditional lines.

The study was structured in two phases. In the first step; Akyaka cittaslow state before taking the title, title-making process and review of the literature relating to developments in the post, were analyzed by the method of critical biblografy over the news in the visual and written media. In the second stage; analysis of the data by going to the region in line with the results of observations were made.

3.1. Location and physical properties of Akyaka

Akyaka, located in the north-eastern corner of the Gulf of Gökova, is a fertile plain between Kadın and Akçapınar River Branches. At the same time it has a specific geography with isolated bays opened to the Gulf of Gökova. It is in a natural protected area next to the Statute of the Special Environmental Protection with these features and hosted the variety of life. One of the two rivers in determining position of geography, Kadınlar River Branch constitutes a natural aquarium for diving with its under water plant population and high flow rate. Akçapınar, other stream, creates a long coastline between the sea. Alternative extreme sports are also popular such as kona between two streams, kite-skiing, paragliding double, motorized water sports (Bilgi, 2013; Sungur, 2013). Akyaka's vision is respect for nature, protecting of architectural structure, strong infrastructure service, sustainable and alternative tourism-oriented, acting together in unity and solidarity of people (Web 2) (Figure 1).

Figure 1: An overview of Akyaka

Nail Çakırhan is the only person without architectural education took the Aga Khan award. Çakırhan took this award in 1983 by designing a house for himself based on a traditional Ula style resident between 1970 and 1972. Home has been considered worthy of a successful example of local architecture. (Ekinci, 2011; Bilgi, 2013 ve Sungur, 2013) The jury of the Aga Khan commented that this Akyaka House brings a great exclusiveness by its pure and elegant design going beyond the simple occurrence, noting the extraordinary harmony with nature and the usage of a multi-purpose indoor atmosphere (Er, 2011). Being a universal model to ground by preserving the context of the local architectural features of the house and after the use of residential development scheme almost turned into a town planning and present Akyaka architecture identity was born (Ekinci, 2011).

3.2. Akyaka: was a slow city?

The first stage; analysis are made by a method of critical bibliography.Accordingly, Akyaka is a successful example of slow cities in terms of the slow city criterias with the above mentioned features. Not just only being a slow city, also the conversion and development process are important. It causes the discussion "What is the Akyaka's member of Cittaslow? What broughts or leads? Simpson, wrote in “The future of Turkey’s environmental legacy”, 2011, praised Akyaka's natural and architectural beauty after telling that they decided to live here and stood out the destruction of the environment. He made suggestions about still being able to recover the environment. After writing this article, but in the meantime, everythings go from bad to worse.

The most important criticism on this issue is the process of transformation to a fast city after being a slow city. The other significant criticisms do not constitute the city council by public and a functionless extension of the municipality (Web 3, Web 6). Habitants protested the municipality in 2012 to fill trash and debris in valley for making a way (Figure 2) (Web 3, Web 4). At the same time in 2013, they opposed to a town planning law, allows tall buildings, for concretion (Figure 3) (Web 5, Web 14).

Figure 2: Garbage action in Akyaka (Web 4)

Figure 3: A signature campaign “Do not let Akyaka Being Concrete” (Web 14)

On the other hand, on 7-8 November 2010, the "Cittaslow Akyaka, Slow City Symposium" was a successful study to reach the online study summaries. (Web 6, Web 7) As a result of the symposium, meeting was held on 21 October 2011 about the projects of "A Slow City Case Study of Akyaka and Local Participation" and "Pedestrian-friendly Traffic Regulations in Slow City, Akyaka" (Web 8, Web 9). It is aimed to be decided together for the traffic regulation through participation. In this respect the study is being carried out and presented to the municipality but the results were not applied. Project coordinator stated "when the project was started, Akyaka inhabitants think that they are willing to be a slow city. But there is no belief during the project and then he thinks that Akyaka is not ready yet to this process". (Web 9) The municipality of Akyaka has started to application to UNESCO for the protection of the biological diversity of Akyaka through the Ministry of Foreign Affairs within the tension of all these positive and negative developments. The mayor mentioned to aim to protect the architecture, nature, history, bird species, sea and biological diversity of Akyaka as a world heritage and be transferred to future generations in the information meeting against some of the concerns with the Metropolitan law. (Web 10, Web 11, Web 12).

The Cittaslow membership of Akyaka is an expected result while evaluating with the projects about Akyaka's biodiversity, geographic location and architectural features through the above-mentioned studies. However, Cittaslow membership of Akyaka cannot provide a self-regulatory mechanism. Fast city converts to a slow city by losing the function of city council, not taking into account the wishes of people by the municipality and an excessive increase in tourism after Cittaslow membership. On the other hand, applying to UNESCO and the studies are encouraging.

The results given above observations in Akyaka were made in August 2014. On the same date, and coincided with summer holidays observation reveals how much negative impact that tourism in the city life. Users all the empty spaces to slow city makes them prefer to come by car parking and traffic problems transformed noise resort uninhabitable (Figure 4). At this point, the user must be informed about the short-term slow city is also the region with the introduction of a special vehicle control inputs and outputs can be presented as a precaution.

Figure 4: Private vehicle use

Another problematic; after receiving the Cittaslow title is that it has opened a branch in the region of large supermarket chains in the global tourist attraction in that (Figure 5). Opening of branches of the supermarket chain is a network of member of the local manufacturer's development is intended to create a negative attitude. In addition, instead of supermarket products to increase the energy consumption of consumer products come from their centers. As soon as it is necessary to take measures in this regard.

Figure 5: This global supermarket chains against local production

Natural vegetation cover in the region is the best-preserved architectural features. In addition, local architecture preserved, two-storey houses many architectural features intact and damage to the hostel spatial value is converted into cafes. This favorable situation and the awareness of the people of the region are promising. The managers and of the same consciousness seems important to gain short-term experience to users. These positive circumstances and people in the region are promising level of consciousness on the issue. The managers and of the same consciousness seems important to gain short-term experience to users.

4. CONCLUSION

Cittaslow is a process, not a result. Cities should have a philosophy that is more important to be aiming in continues development for human life rather than to fulfill all of CittaSlow's criterias. Because human life is in constant development and change. In this context, CittaSlow is a "quality journey" for city members. Slow cities have so important issues such as supporting local production and resources, increasing the slow life and sustainability, avoiding homogenization and reducing the materialist culture. Increase in traditional handcrafts, orientation to local producers and rise of tourism can be evaluated as advantages and disadvantages according to economic dynamics. Slow cities' consumption meta can be observed by reviving as a result of all economic activities, increasing of awareness and becoming a popular tourist destination.

Akyaka's slow city membership should be evaluated as a whole at every single change and flow. It should provide a better quality of life throughout the evaluation of the positive and negative aspects of the region, local people and the country. Just in charge of one person or local government is the wrong attitude if being a situation of "good" does not occur or slow city quickly converts into "fast" city. These actors are;

* Seen as a means of profit – Akyaka
* Brandization of slow urban concept corrupting
* Remains silent to misleading practices for their own interests
* Users with the mentality of "The snake, which touched to me, thumbs up thousands"

But getting the title of slow city and ensuring the continuity are seen as important steps despite all faults and criticisms. Also applying to UNESCO will contribute to the resolution of issues quickly. Also gaining experience in Akyaka is an example for other slow city candidates in our country. Thus an increase in the number of slow cities in our country contributes to urbanity in terms of social, economic, cultural, spatial, ecological and so on and cities that have high quality life.

Enough knowledge and understanding for the improvement of sustainable development and local tourism and local production are one of the priority issues. Also they are expected to improve in the scale of Turkey's Slow City Movement. Component and knowledge that come from history, supported by new technological applications, are expected to articulation to this movement. The factors such as food security, development of local markets, environmental compliance, orderly and safe traffic flow, energy saving planning can be listed at the first-stage and separate themselves from other metropolitan cities. At this point, a situation occurs such as these Slow City spaces' connecting to global without any need of metropolis. A separate economic, law and management mechanism system within the progressive process are the most stunning developments for these small spaces. This development is not valid for most of the governments, but will have the opportunity in the future.

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A NEW APPROACH TO IDENTIFY THE LOCATION AND INTENSITY OF PHYSICAL ACTIVITY IN URBAN AREAS: THE USE OF ACCELEROMETER AND GLOBAL POSITIONING SYSTEMS DATA

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ABSTRACT

Recent studies showed that physical inactivity leads to chronic diseases and death. Various practices and policies, which have been discussed to promote physical activity, require information about the barriers of physical activity. Research focused on not only biological, social and psychological characteristics but also physical environment characteristics as barriers of physical activity. Yet, which and how physical environmental characteristics affect individual’s physical activity is still unknown (as research on physical environment characteristics produced contradictory findings). Methodological differences may have led to such contradictory findings. Subjective and objective methods have been used to identify people’s physical activity levels. Subjective methods (such as self-report, face to face interviews and telephone surveys) tend to produce semi-reliable data which is based on personal declaration. Objective observation methods, such as physical activity monitors, have been acknowledged to produce more reliable data. Accelerometer, a kind of physical activity monitor, sorts and stores intensity of physical activity (sedentary, light, moderate and vigorous physical activity parameters) with reference to date, time and activity counts. Although, accelerometers fail to reveal information about the location of the activity, combined data of accelerometer and Global Positioning Systems (GPS) provides this information. The present study aims to introduce a new methodology to map the location where children are active and inactive. 51 children (9-12 years old), who were attending sportive activities in a private Sport School in Izmir, volunteered to participate. Information about the intensity of their physical activity was collected via accelerometer (Actigraph wGT3X-BT) and information about where their activities took place was collected via GPS (Qstarz Travel Recorder XT). Participants were asked to wear the devices for 7 days (5 week days, 2 weekend days). Accelerometer data analyzed with ActiLife software, and the GPS data analyzed with Qstarz Data Viewer software. The data were matched and combined via ArcGIS. Based on the combined data participants’ physical activity intensities were mapped.

Keywords : Physical activity, accelerometer, global positioning systems.

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1. INTRODUCTION

World Health Organization announced that childhood obesity is a global public health problem (WHO, 2014) that could penetrate to next generations. Childhood obesity causes chronic diseases and death (Stettler et al., 2002). Sixty minutes of moderate to vigorous physical activity at least 3 days per week (USDHHS, 2008) is recommended to prevent obesity. However, research showed that high proportion of population could not achieve this recommended amount of physical activity in their daily life (CDC, 2002). Therefore, identifying the barriers of physical activity is necessary.

One barrier that prevents a child to be physically active is physical environmental characteristics (Burdette & Whitaker, 2005; Ewing et al. 2003; Frank et al. 2004; French et al. 2001; Hill et al. 2003; Lopez, 2004; Saelens et al. 2002; Saelens et al. 2003). *Presence of mixed land use in the neighborhood* (Dunton et al. 2013), *presence of urban parks, playgrounds, and sports clubs in the neighborhood* (Brodersen et al. 2005; Coombes et al. 2013; Dunton et al. 2013; Mackett et al. 2007; Quigg et al. 2010; Timperio et al. 2004; Tucker et al. 2009; Van Sluijs et al. 2011; Wheeler et al. 2010;), *distances between the house and various amenities* (CDC, 2002; Hume et al. 2007; Kemperman & Timmermans, 2011), *the level of traffic safety on the neighborhood streets* (Hume et al. 2009; Timperio et al. 2004; Trapp, et al., 2012; Ziviani et al. 2004) and *presence of active trasportation opportunities in the neighbourhood* (Cooper et al. 2005; Tomson et al. 2003; Ford et al. 2007; Davison et al. 2008; Loucaides & Jago, 2008; Southward et al. 2012) have been listed as the physical environmental characteristics that may effect the level of children's physical activity. Although majority of research showed a significant effect of those variables on physical activity, few did not. This contradictory findings may stem from methodological differences in measuring physical activity. Thus it is necessary to discuss the potential advantages and disadvantages of various measures of physical activity. Recent studies investigated children's physical activity intensity via either subjective or objective measures. This study used both measures to compare advantages and disadvantages.

Moreover, majority of research focused on the physical environmental characteristics in the close vicinity of the child's house (or the neighbourhood). However, common knowledge suggests that a child could be active beyond the neighborhood unit. In paralel, Yin et al. (2013) highlighted the fact that children's physical activity cannot be limited to close vicinity around their houses or well defined bordered areas. Given that, this study aims to discuss a methodology to map the locations where children are active and inactive. Such methodological improvements would pave the way to analyze the physical environmental barriers of physical activity not only in well defined bordered areas but also in the whole city.

2. MEASURES OF PHYSICAL ACTIVITY

2.1. Subjective Measures of Physical Activity Intensity and Location

Subjective measures of physical activity intensity and location refers to self-reporting techniques such as the use of diaries and surveys. These methods are low cost and easy to apply to large populations in a short amount of time. Various structured survey forms have been developed and widely used. For example, the survey form developed by Active Living Research (a program of the Robert Wood Johnson Foundation) and titled as “Active Where? Parent-Child Survey” collects information about the children's physical activity intensities and locations. A similar survey form is used in this study to derive information about children's tendency to be active or inactive and where do they tend to be active (indoors or outdoors) (Table 1). As children may reveal inaccurate and unreliable information due to misunderstanding, this survey form is filled by parents. Yet, as all other survey forms, data derived via such reporting techniques are not free from systematic or random errors. Subjective measures usually involve recall bias (Ward, et al. 2005).

Table 1. Subjective measures of children's physical activity

Survey question type	Question	Evaluation
Children's activity behavior	Does your child attend to a sport club regularly? Does your child involved in unorganized sportive activities regularly? Does your child attend to other activities regularly?	Yes, No
Children's sedentary behaviors	Does your child interact with electronic instruments often (TV, VCD/DVD player, PC/tablet, etc)?	Yes, No
Children's activity location	Generally my child is active at home. Generally my child is active in closed areas except home. Generally my child is active in opened areas.	Agreed, Uncertain, Disagreed

2.2. Objective Measures of Physical Activity Intensity and Location

Activity monitors are claimed to produce more reliable data to understand the intensity of physical activity (Ward, et al. 2005). There are 2 kinds of activity monitors: (1) pedometer and (2) accelerometer. Pedometers are sensitive only on step counts. Thus, pedometers could provide information on distances, but not on exact location of routes. Accelerometers can sort and store the intensity of physical activity (sedentary, light, moderate and vigorous physical activity parameters) with reference to date, time and activity counts. Compared to pedometers, accelerometer data collects information about all kinds of activities (not only walking or running).

Figure 1. Accelerometer: Actigraph wGT3X-BT

Similar to pedometers, sole use of accelerometers fail to reveal information about the location of the physical activity. In the last decade, researchers began to use accelerometer with global positioning system (GPS) devices. GPS is a kind of global navigation system and provides information about the exact location of any place on the Earth based on satellite data (Kreen et al. 2011). It also sorts and stores location data (latitude, longitude) with reference to date and time. The number of studies using accelerometers to measure children's physical activity levels has been rapidly increasing (Cooper et al. 2005; Hume et al. 2005; Salmon et al. 2005; Treuth et al. 2005; Sallis et al. 2002; Cooper et al. 2003; Cradock et al. 2007; Hume et al. 2007; Baquet et al. 2007; Brockman et al. 2010; Craggs et al. 2011; Pabayo et al. 2011; Toftager et al. 2011; Van Sluijs et al. 2011). Yet, there are limited number of studies which used GPS and accelerometer simultaneously (Yin et al. 2013; Jerrett, et al. 2013; Dunton et al. 2013). In this study, accelerometers (Actigraph wGT3X-BT, ActiGraph LLC, Figure 1) were used to measure the intensity of the physical activity and GPS (BT-Q1000XT Travel Recorder XT, QStarz International Co., Ltd., Figure 2) were used to identify the location where each type of activity (sedentary, light, moderate and vigorous) took place.

Figure 2. GPS device: QStarz BT-Q1000XT Travel Recorder XT

3. A CASE STUDY TO MAP LOCATIONS OF PHYSICAL ACTIVITY INTENSITIES VIA COMBINED ACCELEROMETER AND GPS DATA

3.1 Equipment Acquisition

The cost of an accelerometer-GPS pair is about 400 $ and the cost of software to transfer accelerometer data to a personal computer is about 5000 $. Given that, objective measures of physical activity costs encourage researchers to apply for funding their research. Moreover such costs, determines limited sample sizes for such research. On the other hand, low costs of subjective measures (survey forms) make such measures more preferable for short term research. This study was funded by Dokuz Eylul University, Department of Scientific Research Projects. 40 accelerometer-GPS pairs and related software was obtained via this financial support.

3.2 Participants

This study was approved by Dokuz Eylul University Ethics Committee. All participants (child-parent pairs) signed an “Informed Consent Form”. This form informed participants that; (1) the devices (accelerometers and GPS) have no effect on users’ health, (2) they have no responsibility for the device damages or lost, and (3) they can withdraw anytime they want without any penalty. The participants were supposed to devote themselves to use the devices for a week (which may be uncomfortable for some) and our experience showed that people were reluctant to volunteer in such kind of long term studies in Turkey. 56 people were informed about the study with permissions from a private sports school administrators.4 people declined to participate and 52 child – parent pairs volunteered to participate in this study. All children were either attending to basketball classes or swimming classes.

Moreover, such kind of research inherits the risk of participants’ failure to return the devices as is. One would expect higher probability for a device to be lost, when the research focus group is children. In this study the devices were distributed to 52 children, and one participant lost a pair of accelerometer – GPS.

The procedure followed in this study aims to diminish the methodological biases. First the researcher (first author of this study) provides information about the study to all child – parent pairs who accepted to participate. Then the devices were distributed and children were helped to adjust the elastic belt (which carries the devices) to their waist. Parents were warned to re-charge the GPS batteries via a USB cable every night when child sleeps. They were also warned not to turn off the GPS devices. The devices were collected after 7 days. Since there were only 40 accelerometer, the study was held with two groups in two weeks. 33 basketball class members worn the devices for one week and 19 swimming class members worn the devices the other week. The weather conditions in two weeks did not show substantial differences. However, it is necessary to note that the number of devices determines the sample size as the research could not be extended in time due to the seasonal variations.

3.3 Data Management

The accelerometer data was transferred to a personal computer via ActiLife software (Actigraph, LLC). Children's height, weight and age information (which was provided by the sports school teachers) was entered to the software. Each child's physical activity level per minute intervals was calculated via Freedson (2005) algorithm as below:

METs=2.757 + [0.0015 x counts/min] - [0.08957 x age (year)] - [0.000038 x counts/min x age (year)].

Then, for each minute each child's physical activity levels were classified in three groups as: (1) sedentary (1 METs), (2) light activity (1 - 2.9 METs), (3) moderate to vigorous activity (more than 3 METs) based on METs (unit of metabolic equivalent). Moderate to vigorous activities are called MVPA.

GPS data was transferred to a personal computer via QStarz software. The GPS data contained date, time, latitude, longitude, altitude, and speed information for 1 minute epochs. Accelerometer data were aligned with the next closest GPS data via ActiLife's GPS Correlator. This matched data involves information about the intensity and location of physical activity for one minute intervals. The data was coded as "missing value" when activity counts were zero (the participant was not wearing the belt) or when the longitude-latitude information was missing. Missing values were eliminated from the analyses.

3.4 Mapping

The matched data was transferred to ArcGIS 10.0 by adding longitude-latitude information as XY data and converting the data to a shape file. For each one minute interval the intensity and the location of the physical activity was showed with a "point" on the map. "Data Management Tools" were used to define the coordinate system as Geographic Coordinate System WGS 184. The raster image derived from the "ArcGIS basemap library" was used as the base map. The activity points perfectly matched with this base map (Figure 3). Besides, for each child the location of their house, school, and sports school were represented as points on the maps. Figure 3 shows the activity map of one child. This is repeated for all participants. "Red" dots represents MVPA, "green" dots represents low physical activity, "yellow" dots represents sedentary behavior. Note, activity maps involve information about activities in mobilized vehicles as well as walking, running and other types of activities. To eliminate the mobilized data from the sample, the activities for which the speed is higher than 5 km per hour were eliminated. In general, activity speeds of 5 km per hour or above are assumed to be mobilized activities (Cetintahra & Hepguzel, 2014). Figure 4 represents a closer look to the child's activities and shows that majority of activities were achieved in the close vicinity of the child's home and school and on the route between home and school (Figure 4).

Figure 3. One child's physical activity location's map

Figure 4. Activity route

Note, when the base map is converted from raster image to a vector map (showing street network and land use) more analyses are on call. However, production of a vector base map is time consuming and labor intensive. For the study area, vector data (information about street network and land use) have been produced by Izmir Metropolitan Municipality; however, it has been rarely shared. In order to use this data for academic research, funding is necessary. In brief research as such could be costly in developing countries even when the data is available.

4. CONCLUSION

In order to collect data about physical activity intensity and location, two types of measures could be used: (1) subjective and (2) objective (Yin et al. 2013). Subjective measures may involve biased data but easy to apply to larger populations (Ward et al. 2005). However, data on exact location of physical activity could not be collected only via subjective measures (Dueker et al. 2013). Objective measures that depend on accelerometer and GPS devices may provide more accurate data about the physical activity and provides information about the exact location of physical activity with some deviation in distances. This deviation in distances could influence the results if sensitive analyses are aimed for outdoor environments. For example, data from objective measures may fail to differentiate indoor and outdoor activities (Figure 5).

Conducting a research using objective measures of physical activity could be troublesome in certain populations that are not used to these methods. First of all, our experience showed that a few people volunteered to use accelerometer and GPS devices for one week. More over people who volunteer fails to complete the full session. For example in this study among 52 volunteers, one child lost the device and 7 children use the devices less than two days. Although the devices were too compact (accelerometer is about 19 grams with a size of 4.6cm x 3.3cm x 1.5cm and GPS is about 64.7 grams with a size of 7.2cm x 4.7cm x 2cm) to carry on, three children failed to carry on the devices for a full day and two children reported that carrying such devices feels uncomfortable. However, to date the technological developments could not offer more ergonomic devices for children.

Given the advantages and disadvantages of objective and subjective measures, it is better to support objective data with subjective ones. GPS devices could have bad connection with satellite (and produce biased data) in closed spaces; in areas of high building density and height (Quigg et al. 2010; Kreen et al. 2011), and cloudy weather condition (Almanza et al. 2012). In such conditions, the data achieved from the device is unreliable. For instance in this study, according to parents survey, one child was usually active at home. However, when his / her accelerometer and GPS data were analyzed and the locations of activities were mapped, the child seems to spend time in a park which is in the close vicinity of his / her house (Figure 5). Given that, one may claim that this study fails to differentiate the reliable and unreliable data. This limitation could be eliminated if data from GPS and accelerometer could be checked (and proved for accuracy) with data from travel-diaries which focus travelling to a destination (Handy et al. 2002). A better extension of this study should use diaries as well as survey forms to improve the data quality.

Figure 5. Physical activity counts closer to child's house and school

In brief, it is important to understand the relation between the built environment and people's (as well as children) physical activity behavior. Thus it is necessary to uncover where children are active and inactive. The simultaneous use of accelerometers and GPS devices could provide such information with some expense (such as high cost of using these devices for a long time and biased location information due to deviations in distances). Yet, this study aims to introduce a new methodology to map children's activity. Future research which develops this methodology to improve data quality (decrease distance deviations and find a better way to differentiate indoor and outdoor activities) would be a better extension of this study.

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SESSION 6

20 November 2014 Friday, 11.00-12.15

EVOLUTION IN REGIONAL PLANNING: THE ITALIAN PATH

Giuseppe De Luca[1], Valeria Lingua[2]

ABSTRACT

Focus of the paper are the models and practices of regional spatial planning activated in Italy in the most recent years, in order to evidence the innovation occurred and the challenges that regional planning institutions are facing.
Compared to a theoretical and legislative framework that tends to separate the different types of regional planning (spatial, landscape, development planning), the experimental framework is characterized by pluralistic approaches in which a balance between a normative and a strategic nature of the territorial plan is searched, in order to introduce perspectives of economic and social development.
In a continuous process of institutional reflexivity and learning, the regional institutions have now achieved that the notion of 'region' has become more about social interaction than geographical location. For that, interesting experiences of intraregional and interregional cooperation are developing, as called *Interregional table of Padano-Alpine-Maritime Macro Area* in Northern Italy, a place-based approach generating supra-local shared visions that are of a certain interest.

Keywords: Regional spatial planning, cooperation, regional strategies

1. INTRODUCTION

This paper focuses on the models and practices of regional spatial planning activated in Italy in recent years, in order to evidence the innovations that occurred and challenges that Regional planning institutions are facing. Just after the devolution of local power in Italy in 1977, spatial planning competences began being organized into Regional Institutions. Each of the twenty new Regions must make a Territorial Regional Plan (Piano territoriale regionale) together with a Regional Landscape Plan

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(Piano paesaggistico), possibly in connection with a Development Regional Program (Programma regionale di sviluppo).

The first experiments in regional planning, carried out in the 1980s and 1990s, have led to the formation of territorial plans with an indicative planning setting, the development of special regional areas, and the planning of infrastructure, such as road networks and railways.

The new millennium opened with two important changes that have considerable influence on the nature and form of regional planning:

- the amendment to Title V of the Constitution (2001) that, by incorporating the principles of subsidiarity, adequacy and differentiation, has reversed the institutional hierarchy in favour of municipalities, making it urgent to reflect on the role of the Region and its planning territorial instruments;
- the approval of the National Landscape Code (2004), which has modified the landscape issue in the statutory of national and regional regulation.

These changes have generated important revisions of legislation at the regional level. A review of the regional spatial plans reveals that although the plans have different forms and work according to different timelines, they address one common need: to overcome the traditional approach to regional planning system with a set of innovations.

In this direction, the latest experiments abandon the traditional approach to regulatory coordination, turning to a regional cooperative plan. A mixed model, characterized as strategic, structural and operational at the same time, the regional plan is required to convey an idea of the future, a common goal, and a shared vision. It is supported by a set of guidelines for the protection and enhancement of the elements of identity in the region and is made operative in specific territorial projects. From a multilevel governance perspective, the local and provincial bodies are called on to share and specify both the regional scenario and the operational scenarios. This specification must also be accomplished through the coordination of bottom-up and sector-based planning in terms of coherence and conformity to the directions defined at the regional level.

Focus of the paper are the models and practices of regional spatial planning activated in Italy in the most recent years, in order to evidence the innovation occurred and the challenges that regional planning institutions are facing.

Particularly, in a context of global crisis, and driven by the most recent trends of Europeanization of regional policies and the diffusion of European Spatial Planning practices, the challenge for the Italian regional territorial plan lies in the difficult implementation of coherent spatial strategies, oriented by strategic vision focused on the socio-economic development and by operative regional projects, and regulatory and statutory measures for the protection and enhancement of the environment and landscape.

Moreover, the relationship between regional spatial planning and economic programming is still not resolved: it has been treated differently in many years and experiences, but it always expresses the indispensability of linking economic development to the territory and vice versa. This need has emerged with greater urgency during the formation of regional policy frameworks for the previous course

of EU Cohesion Policy 2007-2013, and certainly has important effects on regional spatial planning tools of the last generation.
Through the analysis of some recent regional territorial plans, the paper provides an outline of recent experiences and reflections, to highlight issues, problems, common questions.
Compared to a theoretical and legislative framework that tends to separate the different types of regional planning (spatial, landscape, development planning), the experimental framework emerging by the most recent experiences of regional planning is characterized by pluralistic approaches in which a balance between a normative and a strategic nature of the territorial plan is searched, in order to introduce perspectives of economic and social development.
Together, various cases of recently formalized planning (Veneto, Emilia-Romagna, Lombardy, Tuscany, Piedmont), some in-progress cases (Friuli Venice-Giulia, Liguria), and the case of an interregional experience of coordination of regional spatial strategies carried out by eight Regions under the name of *Padano-Alpine-Maritime Area,* can provide a framework for these reflections.
The paper addresses these innovations.

2. NATURE AND FORM OF THE PLAN IN THE ITALIAN REGIONAL PLANNING

Through experiences in regional planning coming to fruition at the turn of the late 1990s and the new millennium, we can identify three major trends:

- the first, expressed mainly by Regional Territorial Plans of the Valle d'Aosta and Umbria, seems to still be strongly anchored to the model envisioned by the traditional Law no. 1150 of 1942: a unified plan to coordinate and address, giving an overview of the issues of territorial government, through a subdivision of land for fields and an explanation of the program lines in the region, in close connection with the regional program development;
- the second, a strategic concept of regional planning, is made explicit through the construction of shared vision and cooperation on the scenarios of perspective, as in the case of the Territorial Indicative Plan in the Marche Region and/or of the Piedmont Regional Spatial Plan;
- the third, a structural approach to regional planning, is one in which the regional plan is considered a real 'warranty' actor for all of the choices which are considered to be priorities for the land, landscape and environment. The indications of the plan are aimed to build consensus among the institutions in order to ensure resource quality and resilience of the reference system. This approach is developed in the experiences of the Tuscany and Liguria regions.

These three trends give rise to different forms and characters of the regional plan, as well as different modes of interaction, each having various limitations and opportunities.

All offer meaningful forms of interaction: the first, a hierarchical system, allows a clear distinction between regulatory apparatus, which enables public and private entities to have a clear awareness of their responsibilities, and the scope of their autonomy. The second involves the construction of a coherent vision of the region among the various institutions, reinterpreted in a unique strategic vision. The third identifies factors to be considered as spatial structures of territorial identity (be they physical or intangible resources, social or cultural capital) and, as such, be subject to rules and performance criteria to allow for protection and reproducibility over time.

In all cases, the interaction required to give form to the regional plan involves critical issues: the joint rules of the Regional Territorial Plans of Valle d'Aosta and Umbria assume that all of those involved in the governance of the territory are cooperative and willing to work together. This is because the objectives are not local, but are of general interest. It also requires that the regional and local authorities take an active and constructive role in the process of transformation and development.

In the case of strategic regional planning, the likely limits are related to present interests within the political market, without taking into account possible future interests. While moving away from more traditional territorial coordination plan, in fact, collective interest can be considered as pertaining only to the interests of so-called "strong actors", that is, those who are organized and structured.

Structural regional planning also tries to consider the interests of the weaker parties. This gives rise to an instrument consisting of a set of elements characterized by the nature, dynamics and different degrees of uncertainty and inconsistency. As a result, the instruments sometimes penalize the design aspirations, reducing them to tools for defining "structural invariants".

However, the latest plans, newly approved or soon to be adopted, appear to show a decided movement toward the reconciliation of these trends in the same instrument landing. A new trend may herald the desired formation of a mixed system of planning that contains within it both structural and strategic elements.

The "mixed" nature of the regional plan seems to resolve the dichotomy between strategic and structural planning which is highlighted in the experiences at the turn of the twentieth century and the beginning of the twenty-first century. Rather than being considered an element of incoherence of a structural plan, the presence of elements with cogency and different degrees of uncertainty creates a point of strength when inserted in a strategic plan. The term strategic refers to a sharing process which helps define a shared regional vision. It also refers to the product of such sharing, that is, a plan which is broken down into strategies, goals and actions to be followed accordingly, in a more or less prescriptive manner.

In this sense, it is possible to find consistency between a strategic vision which is more focused on economic development and visions which are more oriented to the protection and enhancement of the environment and landscape.

Most recent regional plans, therefore, are not only strategic or structural, they have a mixed valence in which there is predominant tendency towards a balance among the different natures. Balance that comes from "eclectic" (Fabbro, 2002) processes of formation of the regional facility, which offers some form of institutional cooperation, participation and inclusion of very different interests, Balance that

comes from eclectic processes and geometries, which provides for institutional cooperation, participation and inclusion, not just as the result of regional legislation, but also coming from the policy and technical interpretation of the regional plan.
In relation to inding a balance between the three dimensions of the regional planning (strategic, structural, land-use oriented), we will highlight some common issues and experiences in the emerging regional planning in progress, all converging towards the identification of appropriate forms of cooperation:

- the construction of strategic vision with multimedia tools and methods, as is reflected in a plan aimed at defining the vision, objectives and actions that revolve around the strategies outlined in the form of intriguing slogans (as in the case of Emilia-Romagna and Veneto) and involve the interests increasingly marked by experiment, in addition to traditional instruments (Lombardy), and modes of participation involving citizens in a broader sense (Veneto, Apulia, Tuscany).
- the relationship between spatial planning and landscape planning, which assumes very different shades because of how the two dimensions are conceived in the regional legislation. The regions, in fact, may choose to provide a landscape plan in addition to the regional spatial plan, or they may choose to merge the two dimensions (landscape and territory) within the spatial plan. In any case, to avoid the excesses typical of strategic planning (non-inclusion of weaker interests and future interests), the identification of identity elements (structural invariants) and the definition of strategies for landscape protection and enhancement (quality objectives and guidelines) involve a wide cooperation and the capability of acknowledging and addressing the complexity of territorial interests.
- finally, the implementability of the plan is resulting in the identification of design areas at the regional level (Lombardy, Marche, Campania, Liguria) which are able to stimulate public interest and private agencies, both in terms of the local practices of area-wide planning (inter-municipalities, unions of municipalities, etc.) and through the identification of possible areas of inter-institutional cooperation (Friuli Venice-Giulia, and Piedmont).

3. CURRENT ISSUES AND TRENDS IN RECENT REGIONAL PLANNING PRACTICES

In an up-dating process due to the new issues raised by the cultural debate and by the legislative changes, regional territorial plans show different forms and speeds of adaptation (De Luca & Lingua, 2008), but are united by the common need to overcome the traditional approach to territorial planning, through a plan of a strategic rather than structural nature: the regional territorial plan (Piano territoriale regionale - PTR) must provide an idea of the future, a common objective, a shared vision. Local and provincial authorities are required to share and to specify this scenario, also by coordinating lower-level and sectoral planning in terms of consistency and compliance with the regional guidelines.

Some recent territorial planning experiences in Northern Italian regions (Veneto, Emilia Romagna, Friuli Venezia Giulia, Piedmont) provide an advanced picture of this reflection, outlining some possible responses to the new regional planning challenges.
The scenario outlined in the PTR for Emilia Romagna, for instance, illustrates three main prospects: the networks of cities and territories, the knowledge economy and the ecological networks, with a number of related objectives. The PTR therefore defines objectives and guidelines for going towards the outlined scenario, while it is the task of the Provinces, with their territorial coordination plans *(Piano territoriale di coordinamento provinciale - PTCP),* to sediment and consolidate a series of prior norms specific to sectoral planning, outlining a comprehensive vademecum of the provisions which preside over the supralocal area, so that the rules are consistent with the regional scenario. To turn the strategic scenario into reality, the PTR will propose a new "social pact" with local authorities, which will stem from a shared vision of the future.
The Veneto regional territorial coordination plan (*Piano territoriale regionale di coordinamento - PTRC*) is also conceived as a social pact and its slogan, "a forward-looking plan from the human perspective" recalls an instrument that is not so much intended to impose prescriptive rules, but rather to construct meaning around a shared vision. This new conception of the nature of the plan derives from a broad debate between all the administrative, political and socio-economic components of the Region, which has led to the exclusion of the idea, now outdated, of a "master plan for Veneto", but also not to consider the PTRC simply as a territorial transposition of the contents of the Regional Development Programme (*Programma Regionale di Sviluppo - PRS*), but rather as the design of a vision. In the light of this intention, the definition of a planning process based on "visionary pragmatism", though it may sound like an oxymoron, makes it possible to understand the kind of plan which derives from it: a lean, technological and evocative instrument, which can be understood even by non-experts through a language including schematic tables of the development trends and objectives, films and multimedia descriptions, guidelines intended not to restrict but to guide lower-level planning.

The current experiments evince a new turn towards co-planning, and while the activation of widespread participation practices is still in an embryonic stage, there are episodes of great interest. In particular, the theme of the landscape seems to imply a close search for consensus on the resources to protect that, at the regional level, requires more consideration of both the weaker and more general interests. It should be noted, in light of the first experiments, that the regional level necessarily implies a selection of interests and actors through a process which can occur in several ways:

- through self-selection, when meetings, conferences, etc., are called, with the intention of involving ~~which involve~~ institutional entities, citizens and associations. As already noted for conference services, the very act of attending the conference and presenting the plan would entail the consideration of its contribution, while non-attendance has the value of self-exclusion

- randomly, when the process is based on the extraction of a larger representative sample of participants, as in the case of the town meeting
- through a combination of the aforementioned approaches, for cases in which sample-areas and pilot projects are identified, and the use of localized participatory practices is activated.

Finally, the attempt to make implementation planning instruments is one of the main characteristics of the newest generation of the regional territorial plan. This involves implementing strategies which more and more oriented to the identification of contexts for regional, subregional or thematic projects.

In most cases, the regional level foreshadows programs and integrated projects covering a range of topics and areas of particular weaknesses and particularly problematic. If, at first, this orientation to the project seems more evident in those plans that promote a strategic approach to planning, it is now an integral part of most more recent regional plans. Already, the 1990s regional territorial plans of Liguria, Marche, Umbria and Campania provided for an extensive use of operational tools with multiple definitions and objectives ("regional initiative projects", "pilot projects", "integrated projects", "project areas" in the Regional Territorial Plan of Liguria, "shipyard projects" in the Marche region, "field projects" in the Campania Regional Territorial Plan, and "plans and programs" in the Umbria Region). Today, the latest plans make extensive use of tools and programs that include character design, as well as inter-institutional cooperation and the intervention of the private sector.

It is clear that the identification of areas of subregional planning involves the activation of a direct relationship between the region and the specific interests that focus on the design theme identified on the scope or area defined in the plan. Strongly related to this way of understanding the operation of the plan, through thematic or territorial projects at the regional level, is the identification of areas for intervention or co-planning above the local level.

In some regions, in fact, there is an evident link between territorial cooperation and the operation of the regional plan, for which the identification of geographical areas based on historical characters, and socio-economic identity is not only aimed at the specification of objectives and policies of the plan, it is also the basis for how to activate co-planning and institutional cooperation. It is the case, for example, in the Piedmont and Friuli Venezia Giulia Regional Territorial Plans (PTR).

The Friuli Venezia Giulia Region, with its special statute, is in a different situation, both in terms of territorial governance and of its relations with the local and provincial authorities. Regional law n. 5 of 2007 and the regional territorial plan adopted in the same year endorse the abandonment of a purely conformative dimension of territorial planning, associated with the 1978 Regional Master Plan (*Piano urbanistico regionale generale - PURG*). Though that plan was paradigmatic for that period and enabled urgent problems to be faced (such as reconstruction after the earthquake in 1976), today much effort is needed to adapt to the current territorial governance requirements. Compared with a traditional type of plan therefore, the PTR adopted in 2007 and the amendments made by the new regional

government[1] are aimed at defining a more strategic perspective for regional territorial governance and at outlining new relations with local authorities.
The PTR perspective considers the provincial level not to be feasible and intends to give the municipalities a scenario with general and specific objectives within which they can have full autonomy in the governance of their territory, also through inter-municipal cooperation.
In this situation, there are new common issues emerging from the regional planning experiences underway: on the one hand, the relationship with lower-level and sectoral planning requires a reflection on the nature of the regional territorial plan and invokes the need for a strategic and political dimension, with the aim of enabling the contents of PTCP, inter-municipal planning instruments, as well as the municipal plans, to converge and also of providing the focus around which the current and sectoral legislation - in itself already substantial and often conflicting - can be coordinated.
On the other hand, the strategic vision conveyed by the PTR necessarily requires an effort for integration among inter-municipal policies.
The Piedmont Regional Territorial Plan (PTR), approved in 2011, goes in this way, by identifying 33 Areas of Territorial Integration (AIT) and defines them as supra-regional systems. These areas represent the aggregation of systems against economic social, and territorial decline.
To these areas, the plan takes an compliant approach to urban spatial planning , in order to provide for "government guarantees" (environmental protection, standards, monitoring tools, etc.). This is a multilevel governance which activates a process of interpretation-design-decision to be implemented both in each regional system and at the local level. Decisions may result from governments' specificity, from traditions and from values expressed by local communities.
In summary, the current experiences show a common issue related to the possibility of implementation of the regional plan: the strategic vision conveyed by the spatial plan necessarily requires an effort of integration among policies for large areas, including financial policies. The Regional Spatial Plan, in fact, suffers from two problems. Firstly, it needs to include estimates of regional development in a framework that offers increasingly globalizing trends. On the other hand, the regional plan is affected by difficulties affecting some industries more than others, difficulty reconciling the need for effective correspondence between the policies of the regional plan and the provisions of the Regional Development Plan (PRS). The political will to implement certain actions rather than others still determines the emergence of the strongest themes (mobility, living, renewable resources, etc.), since they are better funded and supported at the political level, as opposed to issues such as weak rural areas and the landscape.
In this case, the experiences in Tuscany and Piedmont seem the most interesting while the regional program development one developed in Apulia is more strongly bound to the political landscape with.

[1] Adopted with presidential decree n. 329 of 16th October 2007, the PTR for Friuli Venezia Giulia is now under review by the new regional government.

The years 2007-2013 were marked by a strong period of hybridization between the two dimensions in the construction of regional strategic frameworks. While in some regions (Emilia Romagna and Lombardy), the strategy was built through policies and actions related to the programming of resources to planning, in other cases (as Tuscany, Umbria and Marche) the strategies were built together, so there has been a real territorialisation of policies. Throughout this last experience, however, the relationship with the State has been inconsistent and sometimes it did not take into account both the national strategies and the possible interregional strategies.
Despite being characterized by advanced tools, spatial planning systems (Plans and regional) of the regions of central Italy failed to generate a collaborative process. Collaboration was not possible even when the Ministry of Infrastructure and Transportation had proposed "regional platforms" as strategic areas of cooperation, within the *National Strategic Framework 2007-2013*.
The possible solution, in relation to the management of inter-municipal and subregional issues based on interaction and cooperation amongst local authorities, necessarily involves a reflection both on the nature of the PTR (from conformative to performative, from advisory to strategic) and on the type of plan that could derive from it, as well as the need to interpret regional dynamics on all levels: not only sub-regional and regional, but also on a macro-regional scale.

4. HORIZONTAL FORMS OF GOVERNANCE: THE INTER-REGIONAL TABLE OF *PADANO-ALPINE-MARITIME AREA* OF THE NORTH ITALY

The definition of an interregional experience of coordination of regional spatial strategies was mainly driven by the need to shift some weight away from the European context. The approach can be considered a particular and significant one for the evolution of the regional plan in Italy: the process of collaborative governance organized around an Interregional Table which aimed to develop a Padano-Alpine-Maritime Zone in Northern Italy.
The Interregional Table was created in 2007 and included the regions of Veneto, Emilia-Romagna, Friuli Venice-Giulia, Piedmont, Lombardy, as well as the autonomous provinces of Trento and Bolzano. It served as a moment to capitalize on the institutional learning conveyed by their participation in the EU's Metrex network. This new cooperative form was intended as a technical working community, firstly aimed to build a shared cognitive framework within which strategies could be generated for the sustainable development of the first so called "Adria-Po Valley".
The Interregional Table is a committed that was designed to identify a system of coherences and to promote the competitiveness of the regions concerned, both in the new context of European development and within the media planning. In practice, it was created as a space for discussion and exchange of knowledge in the process of construction of instruments of regional planning, with the aim of promoting, on an ongoing basis, initiatives for the comparison of relevant inter-regional issues.

The Interregional Table also aimed to acquire a role as a forum for the sharing of a common position regarding the construction of the Territorial Agenda of the European Union, an agenda which is also based on the sharing and dissemination of results of trans-national and trans-border cooperation activities.
This committee, politically motivated, is supported by a technical committee which prepares materials and activities for the Interregional Table itself: in fact, after the signing of the Charter of Venice, it soon became clear that the real promoters of the Table were those of the technical regional administrations, appointed for the formation of governmental instruments for the territory (regional territorial plans and regional landscape plans).
The Interregional Table for Adria Po Valley was then immediately established for a “technical discussion”, in which the revision of spatial planning instruments became the common theme of the exchange. Many regions were preparing the new regional territorial plans and this forum facilitated comparison during the meetings, as evinced by the themes for discussion: ‘the protection and enhancement of the natural environment and the strengthening of the economic system and the networking of excellence; the development of cities as engines of the future; strengthening the connections and intangible assets; the promotion of innovation activities and research and the promotion and enhancement of best practices to reduce energy consumption and combat climate change’ (Interregional Table, Venice Charter, 2007).
The first results of this experience, presented in July 2008, led to the creation of three landscape- related charters for a shared vision of the Padano-Alpine Area, concerning the system of ecological structures, the layout of infrastructure networks and the system of urban polarity.
This vision was built expressly to form an intermediate level of knowledge between the European level (usually borrowed from the ESPON program) and the regional level. For this purpose, there has been an analysis of the area of the relationships and influences of some urban centers and infrastructure systems and systems of other nuclei and, in general, the spatial contexts of belonging, which often go beyond the regional borders. The vision, which has been defined as a ‘gentlemen's agreement’, was inserted directly in the planning tools through a sharing process at the technical and political meetings, which were held in each region. Between 2008 and 2009, those regions with more active participation have formalized their instruments: Veneto, Emilia-Romagna and Lombardy have received approval, and Piedmont has adopted the plan. In all cases, the scenarios prepared have been incorporated into the plan, particularly in the cognitive frameworks.
The year 2009 is considered a stagnant period, due to a change of legislature in almost all regions which led to a lack of sharing at the political table. After launching a committee which emphasized balance between politicians and lobbies at the European level, the political participation (and therefore the interest) seemed to slowly wane. The technical component, however, continued to meet regularly, both for the promotion of initiatives in cross-border and transnational cooperation (participation in tenders ESPON and Interreg), and for the sharing and dissemination of the results of project activities. In addition, interregional coordination (in its

technical component) has been indicated as a reference for the ministerial committee appointed to integrate the requirements of the Leipzig Charter.
The technical component has thus promoted the continuity of the committee, which first took the political path on 12 October 2010 through the signing of the *Pact for Sustainable Development of interregional Padano-Alpine-Maritime Area*, and then through the signing of *Bologna Agreement*, on 27 January 2012. In fact, a new program of committee activities is set to begin under the new administration , based on the following objectives:

- promoting the area of the Mediterranean basin as the most important macro-region for central Europe (with its 120,000 square kilometres and 27 million inhabitants, the production of more than 54% of Italian GDP, the largest share of research and for its innovation)
- sharing policies for the regional territory and the landscape, through the definition of strategies and objectives for the recognition of the importance of macro-alpine region of the Po Valley in the European context and at national level, in particular relating to landscape matters
- implementing coordination in the strategic planning of large areas, which comprises development, environment, landscape, location of major functions and infrastructure, defining common rules to ensure efficient use of resources, and the containment of land consumption
- building a map for landscape identity in order to link the policy of protection and enhancement of landscape with strategic environmental assessment
- spreading good practices.

The final goal, therefore, is the certainly the need to transform a common vision (at the time, more oriented towards knowledge than to projects) in a model of self-representation and of a strong and valid territorial marketing in order to compete in the European space.
It is necessary that this vision be reinforced by other Italian regions, especially those of Central Italy, even if it is not yet fully realized.

5. CONCLUSION

The focus of the paper are the theories and practices of regional spatial planning activated in Italy in the last 20 years, in order to evidence the innovation which occurred and the challenges that regional planning institutions are facing.
Compared to a theoretical framework and regulatory landscape planning, that tends to separate the different areas of planning (landscape, land, cultural heritage), the evolving experimental framework outlined by the most recent experience of regional planning is characterized by pluralistic approaches in which, in the face of the

widespread use of strategic rhetorical orientation, different aspects of planning seem to prevail at various times (alternatively, strategic, structural, or both).
The new regional plans, therefore, are not only strategic or structural, but have a mixed valence in predominately striving for a balance between the different natures. The balance comes from eclectic training processes of regional facility, which offer some form of institutional cooperation, participation and inclusion of very different interests, resulting not only in regional, policy and technical legislation, but also from the political and technical imprint given to the plan.
The problems of consistency of views on the one hand, and social equity and distribution on the othervhand, seem to find a synthesis when the following elements are identified within the same regional territorial plan:

- a vision for the future with fewer strategic objectives, so the nature of the regional plan has a long-term time horizon
- structural elements which are required for performance and quality criteria, with medium to long- term horizons, especially in reference to the system of landscape protection understood as a cultural and identity product;
- operative projects and programs that collect instances of the territory, by stimulating public interests and private actors, and therefore involve a feasibility of short-medium term.

In a context dominated by globalization, the future vision, as well as operational programs and projects, necessarily require:
- a co-operative attitude in regional planning processes.
- a leap in scale that allows for movement outside the regional boundaries and into to macro-regional areas located in a specific European space.

Concerning the first need, last generation regional territorial plans outline a strategic rather than a structural scenario, around which to build a shared vision of the regional development processes. Structural contents mostly concern sectoral planning and landscape and environmental issues, in particular when the regional plan also has the value of a landscape plan. This strategic, purely performative character determines a plan typology that is very different from the traditional conformative plan: with diagrams and scenario tables the region is placed in macro-regional analytical contexts and development goals and directions, instead of rules and constraints, are defined in a schematic and appealing way. The plan drafting procedures themselves require complex scenario-sharing processes involving regional and local stakeholders.
In this framework, the distinctive features of a regional territorial plan of a cooperative type can be summarised as follows:
- the strategic nature of the plan, both in the form and in the process, which is expressed in the construction of territorial visions that are defined and shared in the setting of discussion and interaction panels;
- the definition of regional planning domains as opportunities to measure the operationality of the strategic options of the plan;
- the necessity of identifying the relevant actors, at the regional level, it does not seem possible to involve the general population, therefore owing to its strategic nature the plan should be able to identify and interact with the most relevant actors involved in the issues at stake (so that processes which are not only selective but

sometimes more inclusive are generated, precisely on the basis of the vision to which they refer);
- the encouragement of cooperation among municipalities and, in general, of cooperation within the relevant actors, to work on problems in a given territory rather than within an institutional territory;
- the openness toward an even wider, inter-regional dimension .

In this sense, regional authorities have already recognized that the notion of 'legal region' is weak; and that a new "soft" association is the future strategy. In this context, interesting examples of intraregional and interregional cooperation are maturing: the example of the Interregional Padano-Alpine-Maritime Area in Northern Italy is one that has possibilities.

The experience has provided a unique opportunity to activate a process of co-planning at the supra-regional scale- planning that is characterized as bottom-up and not imposed from above. The simultaneous preparation of spatial plans in each region allow for the representation of the area as macro-region through a shared vision and common indicators. At the same time, it allows regions to work together on common themes, translating them into a set of skills and strategies that have a common language for all the regional instruments.

However, the potential of this approach does not seem to be fully explicit: the regional planning documents, for the most part, treat the vision as a piece of a cognitive framework, without a real inclination to the project. This is due to the lack of an approach geared to action, which will lead to an effective coordination expressed by the various plans, if not an actual strategic plan. While this coordination is indicated in the objectives of the new cycle of the Interregional Table, it should have emerged earlier during the phase of drafting the instruments-instruments that are by now institutionalized and, therefore, not subject to revision.

If this weakness emerges at the national level, within the EU, it is likely to be amplified. The degree to which weakness will be amplified will depend on the nature of cooperation, the size and characteristics of the partnership, and relations with the European Union.

To free itself from the characterization as a community-based project and really project itself in Europe, against the local marketing done by creating a shared vision, there should be a strong political marketing operation of the committee, to boost its value and capability as an instrument of interregional co-planning in the broader landscape of European development.

In this sense, institutional arrangements for the partnership must be established. These may be based the European model of the EGTC, or even without creating new institutions, as envisaged in the recent macro-regional experiences. Such arrangements will give legs to the table, through formal agreements on inter-regional strategies that are able to project Northern Italy in the competitive system of the European Union.

The other regional experiences seem too weak and little prepared to set up macro-planning experiences in Central or South Italy. In this sense, only the Northern macro-region, which has already taken wing, can be a real example of competitiveness in the European system.

Competition must be built, nationally and across regions, through a substantial effort to integrate the regional spatial planning and development policies so that there is a profitable relationship between local-regional and global.

In this framework, the Regional Spatial Plan can play a key role in providing a regional development strategy for the next season of the Structural Funds (2014-2020). It is the tool that - when integrated with the Regional Development Plan - can provide a territorialized vision of development strategies, to meet the objectives of territorial cohesion with place-based strategies (Barca, 2009) and inter-regional strategies, based on shared projects and geographical areas that go beyond the institutional boundaries.

To take on this ambitious task, the Regional Spatial Plan can only assume a cooperative nature, made explicit through processes marked by inclusiveness and capable of:

- systemizing, the different options of the regional government, in particular the different interests and the different governing options they have pursued;
- projecting these options into the broader framework of the relevant macro-reference area (in Italy we can speak of north, central or south) through inter-regional planning experiences like that of the Po Valley -Alps-Maritime. A thorough national strategy based on its regional cooperation will facilitate entrance into the system of European territorial cohesion.

Stronger political support, as well as the development of innovative practices provided by operative interregional projects, can play an important role in improving and strengthening the interregional tables, leading to a real cooperation of a scope in which geography and economy converge to develop the necessary requisites of competitiveness and sustainability in an European and global panorama.

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THE PRESERVATION AND REINCARNATION OF SID-LIN MONASTERY

Li HAO

ABSTRACT

Side-lin Temple is located in the old city of Lhasa. Located 100 meter west to the intersection of East Beijing Road and Danjie-lin Road and enclosed by circumambient newer constructions, the remaining ruins is only accessible through some alleys to the yard.. The temple is believed to be relocated to the present spot from Ramoche area under the 7^{th} Dalai Lama's rulership. During its 260 years of history, the temple suffered from periodic destructions and reconstruction. As a result, the main temple fell from the majestic edifice of 5^{th} Reting Rinpoche to obsolescent ruins surrounded by a residence area. Dysfunction of religion, urbanization and transformation of districts' context all contributed to the decline of Side-lin Temple.

In 1984, peripheral underused monk dormitories were allotted to homeless citizens or families in bad dwelling condition. A unique remains-centered residential community was established. Similar transition occurred to other temples in the old city, such as Tsomon Ling and Moru Temple: parts of the sacred precincts were turned into secular places. However, with monks operating regular ceremonies and devotees continually worshiping idols, their main buildings retain the Buddhist functions. Side-lin Temple represents a different result. In order to carry on the preaching, the former Buddhist organization has to be resettled in other temple. With the demolished temple and the cease of religious practice, the site was given a completely different mission: to become to gathering place for the community life.

Dwellers tried to strike a subtle balance between their awe to the relic and their own daily convenience. Pine branches are burned each week in the antiquated stove as part of praying, but circumambience of the stove was barricaded by household garbage. Old people are garrulous about ancient taboos, while kids like to climb into the personal bedroom of Reting Rinpoche. All these conflicting phenomena prompt me to address a few questions in my paper. How can the spiritual layer of Side-lin ruins be restored and still preserve a balance between the religious and secular lives in this area? How to rejoin the temple site with the neighborhood? How can the adjustment of the site and neighborhood adapt to the city under significant transformation?

Side-lin Temple deserves better regulations instead of today's unsupervised situation. In the mean time, a simple rehabilitation would not be a great solution because of the intertwined relationship between the relic and the neighborhood developed in the last decades. Through intensive on-site research, interview, and speculative design, I try to shed a new light on the, history, current context, and future development of Side-lin Temple, which hopefully will lead to a holistic solution for preservation and revitalization of this important historic site.

Key words: Sid-Lin, transformation, different perspective

1. INTRODUCTION

1.1. Background Introduction

Tibetan Buddhism is the leading religion in Tibetan region of today. In the long course of its preaching history, there have been several alternations of extinction and promotion of religion. As the bridge linking the spiritual world and the material world, architectures of Tibetan Buddhism will be either demolished or reconstructed, depending on the trend of religion during certain time period. The nearest dstructive activities happened in the Great Cultural Revolution, 1966~1976. Then following Reform and Opening up since 1979 not only brought about economic boost, but also urged people to reflect. Consequently, there were a large number of temples being renovated or reconstructed. Some temples even begin to have a more magnificent and exquisite decoration than before. Among the renovated temples, there are many perfectly finished projects, in terms of architectural form, material selection, building technique and construction. This article focuses on Sid-Lin Monastery relics by analyzing the architecture from a new perspective, that is, from urban district to community and then back to the architecture itself. Sid-Lin Monastery is unique in every aspect. Its uniqueness is that although the main building has already been ruined, the auxiliary buildings and the courtyards have become the residence for ordinary citizens. This is accompanied by a subtle transition in terms of its relation with the urban district (fig 1). Therefore, for the protection on the relics of Sid-Lin Monastery, we should avoid the complete duplication depending on its original appearance, but to make it reborn by the merging with new environment.

1.2. Objectives & Methodology

How do we define the "rebirth" of Sid-Lin Monastery? What connects the "reborn" Sid-Lin Monastery and "this life" of the monastery? Is that the spirit? If the answer is yes, where does the spirit of Sid-Lin Monastery relics live? To resolve this question, we performed survey on the daily life of residents of the community and

pieced together the historical moments of residents' life. The ecology of Sid-Lin Monastery community, with Sid-Lin Monastery relics as the core, is constructed to provide some clues for the conception of these precious moments. Relying on these clues, a balance is struck between the "past" and the "present" of Sid-Lin Monastery, based on which we design the subsequent protective scheme. Through a comparison between earlier data and current data on a macroscopic scale, we can better look for a possible future of Sid-Lin Monastery.

Fig 1. A panorama from the roof of west residence, photoed by author, 2014.

2. SITE HISTORY

Through such comparison, we can know what has been annihilated and what has been reborn in Sid-Lin Monastery that has a history of two hundred and sixty years; we will also know what will return soon and what still dwells in this place even after the demolishment of physical buildings.

2.1. The First Rise And Decline

Looking back on the history, it is not difficult to see why the relics still preserve its majesty. As one of the largest and the grandest architectures in the old urban district of Lhasa, Sid-Lin Monastery was incomparable in 1930s to 1940s. The history of Sid-Lin Monastery can be traced back to the 7th century AD. It remained largely unknown until the middle of 14th century when it was called Reting Monastery. In the five hundred years afterwards, this monastery was closely associated with Reting living Buddha. This was once the place of residence, enthronement, and handling with daily businesses for Reting Rinpoch in history. The third Reting living Buddha, Ngawang Yeshe Tsultrim Gyaltsen, and the fifth Reting living Buddha, Thubden Jampal Yeshe Tenpai Gyaltsen, all had a profound impact on Sid-Lin Monastery. The two living Buddha once assumed regency during the theocratic period of Tibet, assisting Dalai Lama in this young age. However, their power soon declined during their prime years due to turmoils of factions. Sid-Lin Monastery underwent its vicissitudes as the destiny of the living Buddha went up and down.

During the period of the third Reting Renboqie, Sid-Lin Monastery was changed from the monastery of Ningma School to the monastery of Gelu School. It was during this period that Sid-Lin Monastery was renovated and expanded to the present scale. It consists of a courtyard covering 0.63 hectare, which is divided into the scripture hall in the north of the center of the courtyard, a Buddha Hall and the residence and kitchen for the monks. In 1862, which was the 7th year that the third Reting living Buddha assumed regency for the second time, he was drawn into the conflict with Drepung Monastery. The monks of Drepung Monastery and Gandan Monastery united together in their attack on Sid-Lin Monastery. Sid-Lin Monastery was seriously ruined, and Ngawang Yeshe himself was also punished because of this event. He died in the next year. It is without doubt that the early prosperity of Sid-Lin Monastery was owed to the sublimity of the third Reting living Buddha, who assumed regency twice. The Central Government at that time attached much importance to the third Reting living Buddha, praising and awarding him for several times. However, the first rising of Sid-Lin Monastery was suddenly stopped upon the death of Reting living Buddha.

2.2. Renaissance and Fall

After the ruining in 1862, Sid-Lin Monastery was only carelessly repaired. The monastery was not reconstructed on a large scale until 1935. This is what we see as the combined layout of Buddha hall and the surrounding residences of the monks. The fifth Reting living Buddha, like its predecessor, assumed the regency and possessed great power. Sid-Lin Monastery also reached its prime at this time. The bedroom of Reting living Buddha had 16 pillars, which was never seen before. As recalled by an old man in Lhasa, the fifth Reting living Buddha once held a dharma assembly that lasted for one month and four days in this monastery, as the teacher of Dalai Lama. More than two thousand monks attended the assembly, which is a great testimony for the important role of the monastery in the religious life of local people. The fifth Reting living Buddha also encountered the political crisis after seven years of regency, and had to resign. Seven years later, Reting living Buddha was arrested because of a political event in April 1947. After that, he died in prison. Since the main monastery was ruined, the religions functions of Sid-Lin Monastery came to an end. The entire Sid-Lin Monastery fell back to obscurity. But whether Sid-Lin Monastery was completely ruined is uncertain.

Some say that Sid-Lin Monastery was completely ruined during this "Reting Event". After the death of Reting living Buddha, Dazha gave an order to dress up the body and transfer the body to Sid-Lin Monastery. Reting living Buddha was libeled against, which triggered the anger of the mass. Then Sid-Lin Monastery was set on fire. That is how Sid-Lin Monastery was burnt to ruins". However, this version of explanation is hardly convincing. Sid-Lin Monastery was originally the residence of Reting living Buddha. The question is: why the mass public, who admired him, instead of taking actions against those who persecuted the living Buddha, invaded the residence of living Buddha? Others believe that Sid-Lin Monastery was not ruined during this event, but was only closed. The monastery was ruined in 1959. No matter which version is correct, there is one thing for sure, i.e., the attacks by wind and rain in the following fifty years are the main reasons for the current situation of Sid-Lin Monastery (fig 2).

Fig 2. Front of present Sid-Lin Main Temple, photoed by author, 2011.

2.3. Current Remains

Combining the above information, we can roughly restore the process that the main monastery was changed from the magnificent Buddha Hall to the ruins we see today. Sid-Lin Monastery was closed in 1947, and the monks were driven away. Sid-Lin Monastery might be only slightly ruined, such as the windows and the doors. The damage in 1959 and Great Cultural Revolution mainly occurred to the load-bearing components, such as beams, pillars and the stone-made outer wall. After that, Sid-Lin Monastery was fully exposed to the havoc done by the nature without maintenance for nearly 50 years.

The monks' residences surrounding the main monastery were repaired twice and preserved well. They are now the main site of aggregation for the residents. The remains of the main monastery are currently in a poor state, from which we can hardly recognize the original structure of the architecture. The large building located in the northernmost section of central axis of the entire courtyard can be divided into two parts, front and back. The scripture hall in the front was initially of a two-tier structure, which is nowhere to be found currently. What is only left is the fragmented stone-made outer walls on three sides. At the entrance, the wooden structure is already rotten, with a large part fallen off. The small components such as the cornices of the window are badly mutilated. At the back was initially the storage space, the residence and three Buddha Halls. The top of the Buddha Hall no longer exists, with only the partition wall left. The private balcony of Reting living Buddha only has the large part of rooftop and the beams and pillars, all of which are deformed to some extent. The structure in the east is on the brink of collapse (fig 3).

There is an one-meter-thick outer wall left in the main monastery. It is not completely made of bricks, but has stones and sand fillings in the middle, which are exposed after the surface brickwork has shed. Rain and wind will deprive the load-bearing capacity of the fillings, thus increasing the risk of collapse. Similar situation is also found with the wooden components. Timber will be deformed under the impact of wind and sunshine. The change of the load-bearing structure will spontaneously collapse even in the absence of human factors. We have collected some photos of the remains of Sid-Lin Monastery in different periods since 1980s. The above-mentioned situation mostly occurs to the outer wall in the east, the top of the wall in the north and the entrance of the main monastery. However, natural erosion is very likely to deteriorate (fig 4).

Fig 3 (left). Damages of Sid-Lin Main Temple, photoed by author, 2014.
Fig 4 (right). Deterioration in past 12 years, pics 2002 were photoed by Mao Zhonghua, pics 2014 were photoed by author, oganized by author.

The dual impact of human and natural factors finally leads to the badly ruined condition of Sid-Lin Monastery, which, nevertheless, still embodies the religious spirits. The immaterial remains are spread in various pathways, which further adds to its mystique. The old people in the courtyard will remind the young generation of the taboos in the monastery. For example, the young generation are forbidden to get close to the remains, not only from safety consideration. However, the young generation have their own opinions. History has laid down the unique tone for the courtyard, which is impossible to be erased. However, along with the modernization of the urban district, this grand Buddha Hall, which was once the skyline of Lhasa together with Potala Palace, is currently the rarely known corner of the protective zone of old district.

3. SID-LIN IN A MODERNIZED URBAN PERSPECTIVE

The location of Sid-Lin Monastery is at the northwest margin of the old urban district of Lhasa centering around Jokhang Temple. However, there is something interesting about the relative positions of Sid-Lin Monastery (fig 5). If a circle, with the radius of 590 meters, is drawn with Sid-Lin Monastery as the center, then the main buildings in the old urban district, such as Jokhang Temple, Ramoche Temple and Muru Temple are found along the circumference. That is to say, the working staff of Sid-Lin Monastery can reach these important sites after 6-8 minutes of walk. If the working staff of these institutes hope to visit Reting living Buddha, they can also arrive Sid-Lin Monastery within a very short time. Such a short distance not only shortens the time to arrive at different places from Sid-Lin Monastery, but also provides enough room for the formation of auxiliary plots under the influence of Sid-Lin Monastery. In its prime days, there was a relatively large area of private garden of Reting living Buddha surrounding Sid-Lin Monastery, except residences and spared land.

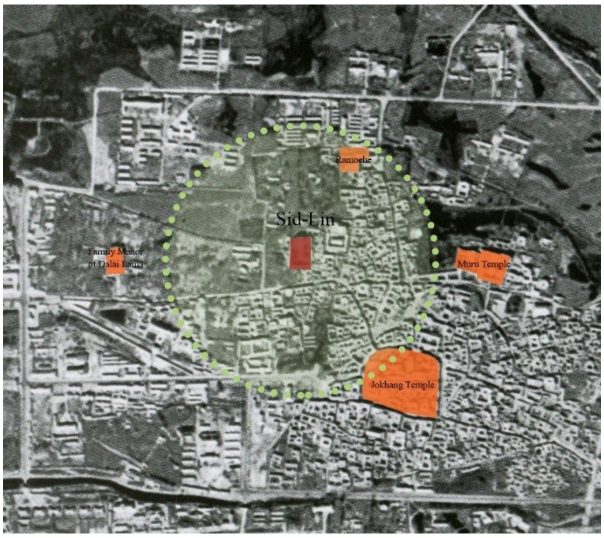
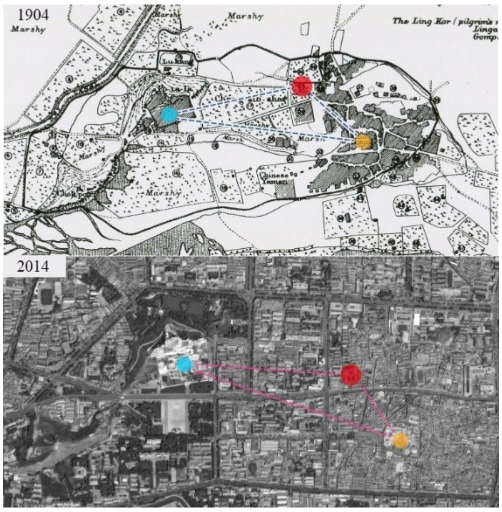


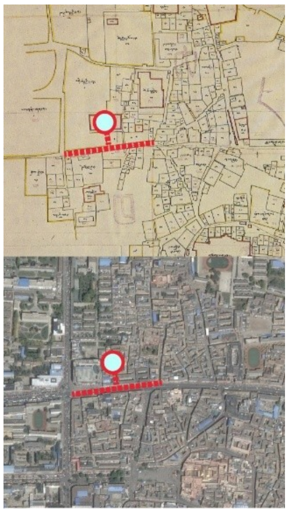
Fig 5. The context of Sid-Lin, based on satellite imagery, 1965.

3.1. Changes of Transportation System Around Sid-Lin

Ryder and Cowie drew the first plain view of urban district of Lhasa in modern times in 1904. This plain view is compared with the map of the present day (fig 6). It can be observed that the relative position of Sid-Lin Monastery in the urban district has not changed. Here we mean the historical continuity of urban texture constituted of the surrounding traffic routes. That is, the urban layout with blocks as the unit remains basically unchanged. However, some changes have been made to allow the vehicles to pass through. The changes are divided into two types: first, the original roads are classified by road surface and then subject to hardening treatment; second, the original roads are extended, so that they can form the transportation network.

In the first type, the typical case is East Beijing Road running in west-to-east direction. This road is actually one of the main trunk roads in west-to-east direction in present-day Lhasa. The east section of Beijing Road, if extended towards the west, is Middle Beijing Road in front of the Potala Palace. On the map drawn by a British in early 20th century, Beijing Road can be clearly seen. So the formation time of Beijing Road should be earlier than this. The existing data inform us that the width of East Beijing Road has not greatly changed. However, the buildings on the two sides of the road were mostly built in 1950s. The earliest satellite images shot in 1965 cannot tell us whether these buildings conformed with the original texture of the roads upon their construction. Therefore, the above can be only considered as





accurate speculation. What supports this speculation is the map of the central district of Lhasa drawn by Peter Aufschnaiter in 1948. On this map, the real estate marked out on the two sides of East Beijing Road basically conform to the urban texture of the current day. Especially, the position of Sid-Lin Monastery relative to the road has not changed. Its wall in the south is still 40 meters apart from the north edge of East Beijing Road (fig 7).

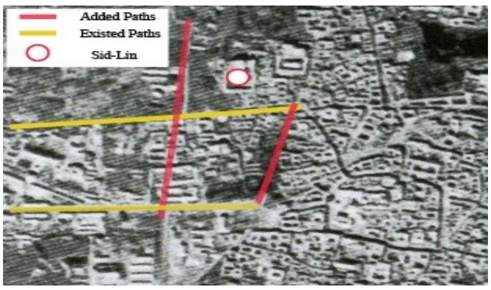
Fig 6 (left). Comparison of the relative position of Sid-Lin, based on map and satellite imagery.

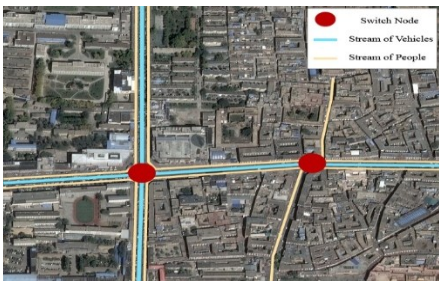
Fig 7 (right). Unchanged relationship between Sid-Lin and Beijing Road, based on map and stellite imagery

With a width of about 25 m, East Beijing Road could be called grand in the days of ox carts. However, as urban modernization is accelerating, East Beijing Road can hardly serve as the main trunk road of the city. Nowadays, East Beijing Road is divided into lanes of three types: four bidirectional vehicle lanes about 14 meters wide; non-mechanical vehicle lanes flanking the vehicle lanes with the width of about 5 meters; and pedestrian ways about 3 meters wide. But due to the large traffic flow and diversity of road traffic, East Beijing Road may not seem as wide as the figure indicates. Along the 3800-meter-wide street in west-to-east direction, there is

only Ramoche Temple Road that diverts the traffic to the south and north. East Beijing Road is more congested because of the distribution of buildings and temples on the two sides. Various forms of traffic are mixed together. We will provide explanation on how the congested traffic influences Sid-Lin Monastery.
For the second type of adjustment of urban traffic, we also take the two roads near Sid-Lin Monastery as an example. They are the middle section of Duosenge Road in the southwest and Danjielin Road in the southeast. The arrangement of the two roads directly influences the layout of west section of old urban district. Their north sides are connected with East Beijing Road; the south sides are connected with the east part of Yutuo Road in front of Jokhang Temple square (actually named as Bharkor Street, but to make a distinction from Bharkor Region of Jokhang Temple, referred to as east part of Yutuo Road). Thus, a new urban block is enclosed. The north side of Duosenge Road is a narrow dirt road, which is probably the west boundary of the garden to which Sid-Lin Monastery belongs. The south section of Duosenge Road is its extension. Early satellite images show that during the repair process, at least five large-scale courtyards were demolished. But since this region is situated on the brink, we cannot decide whether these buildings were once part of the old urban district of earlier times. The urban open space on the two sides of north section of Duosenge Road is occupied by various modern architectures. A street rich with commercial atmosphere is formed. The situation of Danjielin Road is similar to that of Duosenge Road. But the difference is that Danjielin Road is built on the original swamp. During the construction, the original buildings were not demolished in large quantity. Danjielin Road of the present day is a well-known place for purchasing souveniers. The buildings on the two sides of the road are still being renovated.
(fig 8)

The above-mentioned three roads are the closest links by which Sid-Lin Monastery are integrated into the modern urban transport. The noise and people flow do not bring substantial impact on the life in Sid-Lin Monastery. Since Sid-Lin Monastery is located in the central part of the plot, the noise is isolated by surrounding buildings. The highest buildings have four floors. They were either built or reconstructed in the 1980s to 1990s to meet the challenge of growing population density in the old urban district. The traffic flow forms the nodes of transition at the intersection between Danjielin shopping street and East Beijing Road. However, the traffic flow will not stop at the entrance of Sid-Lin Monastery, but continues by about 20 meters until reaching the next intersection between Duosenge Road and East Beijing Road. However, for the local residents of old urban district, the road with the width of about 5 meters in front of Sid-Lin Monastery is considered as the temporary parking site. The people flow is diverted by the three roads, and guided towards the Potala Palace or Jokhang Temple, rather than concentrated near the courtyard. There are sporadic visitors who come to the courtyard for its fame,





but they will soon leave within a few minutes (fig 9).
Fig 8 (left). Reorganization of roads near Sid-Lin, based on satellite imagery, 1965.
Fig 9 (right). Analysis of traffic streams, based on satellite imagery, 2014.

3.2. Impacts of Modern Urban Context on SID-Lin

Comparatively, the changes of the nature of urban blocks along the traffic line bring greater and more complex influence on Sid-Lin Monastery. Especially in the block where Sid-Lin Monastery is located, extensive green lands have disappeared. In the north is the newly formed modern community. The spare land in the west is gradually occupied by hotels, hair studios, restaurants and brand stores. The most typical is one commercial complex. In terms of modern urban functions and development model, this appearance is timely and appropriate.

In the west of Sid-Lin Monastery and on the 8.5-hectare land at the intersection between Duosenge Road and East Beijing Road, the original office building of City Construction Bureau was demolished. On this land, the largest commercial complex in the central district of Lhasa was constructed in 2013. This complex, called the landmark in the promotion, achieves a balance of modern style and traditional Tibetan style in its facade, in terms of color, material and element. Thus, compared with the surrounding urban landscape, the building is not out of tune. The local residents, including those in Sid-Lin Monastery, obtain benefits from the commercial complex: the supermarket provides a great variety of food and daily commodities; the middle and high-end restaurants and drink outlets are distributed on the 3rd and 4th floor; the cinema in the top floor shows the latest movies from the US. All these conveniences are necessities for the residents of Sid-Lin Monastery. When they are only five minutes' walk from the residents, most people would go to the commercial complex from time to time, which provides such a broad range of commodities and services. The commercial complex further pushes the bustling commercial atmosphere of the central district of Lhasa to a new height.

Although the existence of the commercial complex has its practical significance, the site selection is not proper. According to the Regulations on the Protection of Old Urban District of Lhasa, the "old urban district" refers to the west to East Dongkuo Road, the north to Jiangsu Road, the east to Duosenge Road, and the north to North Linkuo Road, covering an area of 1.33 km^2. The commercial complex is adjacent to Duosenge Road and within the protective buffer zone under the plan. There should be more room reserved for the ancient architectures in this zone. However, the outer wall in the east is only about 6 meters away from the west outer wall of Sid-Lin Monastery, which are the national first-level cultural relics. The limit height of the newly built architectures in the buffer zone is 12 m. But according to the published data of this architecture, the height is up to 23.95 m, which is higher by nearly one time. The catering of the facade to the local features as mentioned above is not extended to the internal space of the block. Sid-Lin Monastery is greatly influenced in such an environment.

The west outer wall of Sid-Lin Monastery is only 6 m away from the adjacent buildings, and the length of being parallel is over 30 m. Thus, a long and narrow space is created. The south of this space is used as the channel for logistics, where the vehicles delivering cargos will stop. This is also the place where the domestic garbage is carried away. The neighborhood committee in the north encloses a site for storing sundries together with the wall of Sid-Lin Monastery. Except for the working staff of the shops and the neighborhood committee, there are few other people accessing this place, let alone doing routine maintenance of the outer wall of Sid-Lin Monastery (fig 10).The outer wall, standing nearly 24 meters, nearly blocks the sunshine at noon. Although this situation is not serious at the moment, the dimness of the room is partially due to the existence of the Tibetan architecture itself, but can be remedied by artificial light source. Under the strong sunshine in plateau area, local residents may set up temporary shacks to block the parching sunlight. But the residents have complained, especially those living in the west, that the shadow of the commercial complex will cover the large part of the courtyard at about 5 in the after in winter when the solar zenith angle is low. It is about 2 hours earlier than the originally 7 in the evening. What also irritates the local residents is the vision inside and outside the courtyard. Before the commercial complex was built, one can see the Potala Palace from Sid-Lin Monastery in the west direction. From the perspective of urban landscape, the upper part of the main monastery can be visualized at the intersection between East Beijing Road and Duosenge Road. But at the present day, it is largely obstructed (fig 11).

The buildings inside and outside the blocks are apparently divergent stylistically. But the influence on the overall landscape of the old urban district is limited. One reason is that the architecture is located on the edge of old urban district. The continuity of traditional Tibetan landscape along East Beijing Road is partially interrupted before that. This region has basically completed the transition to modern commercial landscape. In addition, the streets of the old urban district are narrow. Near the east outer wall of Sid-Lin Monastery, one can hardly feel any incongruence of buildings in terms of visual effect. However, things get quite serious if one observes within the range of Sid-Lin Monastery. The west and south outer facades facing the urban roads are the combination of modern and traditional style. However, the east facade is simply the modern style, with large-area glass curtain wall decorated by deep gray strips, which poses a stark contrast to the traditional

style of Sid-Lin Monastery.
Fig 10 (left). Present situation of west exterior elevation of Sid-Lin,photoed by Lobsang Draga.
Fig 11 (right). Discordant modern elevation against Sid-Lin Courtyard, photoed by author, 2014.

Besides the commercial complex, the spare land in the north of Sid-Lin Monastery is allocated to Tibet Daily. The north wall of the remains of Sid-Lin Monastery has become part of the outer wall of residence for family members. This structure, with an area of about 6 hectares, is a confined space, leaving only one entrance at the north section near Duosenge Road. The Summer Palace Xidezhuokang, which is attached to Sid-Lin Monastery, is hidden in this structure. Initially, the main monastery had an entrance at this side, which is currently disused. In the process of our survey, we can only access the north wall of the main monastery by passing through the gate of Tibet Daily and the southermost section of the residence for family members. In other directions, such as the northeast, the channels are obstructed by simple barriers. The initial entrance close to the kitchen in the east has been completely obstructed by brickwork. Thus, the connection between Sid-Lin Monastery and Summer Palace is completely cut off. The connection with the channels inside this region is also weakened. But from another perspective, such closedness of Sid-Lin Monastery ensures its purity and independence. Sid-Lin Monastery is connected with the well preserved urban landscape on the east and regarded as part of the original texture. Moreover, the unnecessary relations with the surrounding are severed, so Sid-Lin Monastery can be singled out and considered as a unique element in the region.

3.3 A Recommended Attitude to Changes
On the macroscopic scale, Sid-Lin Monastery is subject to the vicissitudes of the surrounding environment. But these changes are irreversible within a short period of time, and may be aggravated over time. The changes are highly incompatible with the religious spirit and the splendid history of Sid-Lin Monastery. What position should we taken when talking about the protection of Sid-Lin Monastery. If we formulate and implement the plans to the restore the appearance of Sid-Lin Monastery only depending on the anger on deteriorating environment, does it mean that what we are doing to the on-going history as what we have done before.

If Sid-Lin Monastery is preserved intact, the above-mentioned problems will be ignored against our own will. The focus of this article will be also diverted to other aspects, such as restoration technique, restoration degree, demolishment of illegal buildings and the relocation of the residents. For Sid-Lin Monastery remains, we can attempt to justify the irreparable mistakes done to Sid-Lin Monastery. These mistakes can be transformed as the environment changes, just like Sid-Lin Monastery itself. Instead of redressing the mistakes, we should find ways to make these mistakes more acceptable to more interest groups. As stated in Nara Declaration, we should try our best to update realistic evaluation from the perspective of values and environment in evolution. Xi'an Declaration released on the 15th International Conference on Ancient Relics in 2005 also contained similar statements "managing the changes of ancient architectures and ancient relics and the changes of the historical environment does not necessarily mean preventing or obstructing such changes". If changes are inevitable, how to accept and utilize the good or bad changes is a more realistic subject when talking about the protection of Sid-Lin Monastery.

We should not be satisfied with managing the external environment on the city scale. The internal environment should be also viewed on the community level or even more microscopic level.

Fig 12. Sid-Lin Courtyard in 1930s,1992,2014. pics 1930s,1992 were quoted from The temples of Lhasa Tibetan Buddhist Architecture, pics 2014 was photoed by author.

4. IN A SECULARIZED SID-LIN COURTYARD

Sid-Lin Monastery was once a spiritual place for Buddhists' practice. But now it becomes a mundane community for residents (fig 12). As mentioned before, the main monastery of Sid-Lin Monastery had been a residence of Rezhen living Buddha for a long time. Its large-scale monks' apartments in the surroundings were established under such circumstances. Such unit is called Dratsang in the organizational system of Monasteries of Tibetan Buddhism. A Dratsang is similar to a school in universities nowadays. It can be an independent unit with its complete organization and its own property as well as working capital. Those who live in a Dratsang are almost all monks in Buddhist practice. Though they are different at Buddhist accomplishments, job title and social status, they all practice religious activities of the same nature in this yard. In a particular historical period, these activities endowed Sid-Lin Monastery with a strong spiritual attribute which was beyond physical space. This spiritual attribute will not disappear along with its material carrier, but will fade with time or be covered by new attributes. It is none other than the residents who bring new attributes.

4.1. The Reorganization of Sid-Lin Courtyard

Before the 1980s, Sid-Lin Monastery had always been an office-like unit which accommodated circuit teams and Tibetan opera groups. In 1984, two floors of Sid-Lin Monastery underwent a major maintenance. From then on, it started its transition to a residential community. Back then, in order to solve the increasingly more crowded population of old districts in Lhasa, the government renovated a group of shabby yards and rented to people in need at a low price. These people were the first offical residents of Sid-Lin Monastery. Some of them were homeless, some were pilgrims from Lhasa and some were residents around Sid-Lin Monastery. Their living conditions were all improved after moving here. Many of the first generation of residents have moved out or passed away. But some of their offsprings still live in here.

In 2003, the government organized another large-scale renovation on Sid-Lin Monastery. This renovation still focused on the improvement of its living condition so that no repair was done on the ruins of the main monastery. However, this renovation aimed not only at renovating monks' apartments which were today's residential houses but also at reconstructing the yard's layout. Shanties built in the yard by residents without permission were torn down. To fulfill residents' request of increasing the actual useable area of their houses, the original porticoes of the first floor were joined by walls but with the building elevation of monks' apartment basically reserved. In terms of the landscape, two public green fields surrounded by railings were added around the original arbors in the yard, while the rest of it was equipped with rigid material. In terms of infrastructure, a washing room was added in the east side of the residency and a new outdoor public toilets was build in the west side. In 2014, a relevant department set up railing around the main monastery to forbid unrelated persons from approaching in order to avoid accidents. The original wide public area was reduced by 43.7% due to the unreachable function of public green fields and the enclosed buffer space around the main monastery (fig 13). But the residents did not mind. It was widely believed that these measures made the original cluttered yard more organized.

Fig 13. New organization of Sid-Lin courtyard reduces the accessible public area.

4.2. Current Residents of Sid-Lin

The residents currently living in Sid-Lin Monastery were all normal Tibetans. A total of 77 households (5 of which were uninhabited), including about 300 people, lived in the original monks' apartment and servants' room attached to the west side of buddha hall. The earliest residents in Sid-Lin Monastery were both owners and tenants: they could rent their properties to others at market price as landlords. At same time, they had to pay the administrative department 0.5 Yuan per square meter each month as rent. The price was extremely low. In the Lhasa housing rental market, a less than 15 square meters house at the same area cost hundreds and even thousands each month. Therefore, the former poverty-driven families could receive a handsome extra income by renting their houses at Sid-Lin Monastery.

There are over 40 short-term tenants in the yard, who regularly pay rent to earlier owners at market price. They have a high mobility. Some of them stay for one or two years. Some only live for a few months. There people are mostly youngsters from places outside Lhasa living on commercial activities. With no families, they work in the day and return at nights, regarding this place simply as a temporary shelter. During the author's actual research process, never had I encountered this kind of residents. Their doors were shut closely and not much communication between neighbours. To Sid-Lin Monastery, they are even nonexistent.

The other over 30 permanent residents are the real owner of Sid-Lin Monastery. A small number of permanent residents, appointed as administrators, are responsible for the maintenance of the yard's hygiene and the coordination of neighbor conflictions. They also receive appropriate payment. Most of them have lived here over 10 years. A few of them even stayed for 40 years. Some inherited their parents' property and some moved in with their spouses. They have families in this yard and even some relatives. (fig 14)

Fig 14. Residents's modifications on Sid-Lin, photoed by author, 2014.
Fig 15. Four examples of living condition of the residents, photoed by author, 2014.

4.3. Current Residents of Sid-Lin

The resident nature and demographic structure of Sid-Lin Monastery were changed due to the abolishment of the main monastery, which weakened its religious characteristic of the place. When Sid-Lin Monastery was still a Dratsang, most of the activities happened in here had a group feature, which could be divided into three classifications: the first was purely religious activity, such as collective learning of Buddhist classics and holding religious ceremonies, etc. This kind comprised primary activities of Sid-Lin Monastery's spiritual place back then; the second was rather mundane activities to keep the Dratsang running, such as financial procurement from outside and reception of visiting followers, etc; the third was some purely mundane but necessary activities like daily dinning, sleeping and human communication, etc.

Now the first and second kind activities no long exist as religious organization moved out. Now public activities with religious features happened in here, such as burning aromatic plant on Wednesday and changing suspended prayer flags on New Year's Day, were more reasonably cataloged into folk custom. Pilgrimage and consecration are routines for residents. Nearly every family has its own Buddhist prayer room in a separate compartment or as part of sitting room. But these are just common features in Tibetans' daily life. They should not be considered as continuation of original Sid-Lin Monastery's religious characteristic. The third mundane activities become main activities happened in Sid-Lin Monastery with a wider variety. These activities add new place characteristics for Sid-Lin Monastery. Unlike the monks before, nowadays residents live with family as unit rather than organized group living. Children shuttle through families and play around; the young sometimes gather around the tables and chairs near the registration room at their door to play a particular Tibetan dice game; the old watch them on the side and chat with each others. These mundane scenes of life could not be seen when Sid-Lin Monastery was a Dratsang.

Besides changing the scenes of life, residents of Sid-Lin Monastery also respectively transformed their private areas basing on their needs, especially within the limited area before their door. Some families showed affection for plants. They set up a pergola in front of their house to put various plot plants on; some put things that could not fit indoor, like washing machine and abandoned old furniture. Second floor residents between the vertical and horizontal aisles could not utilize public areas in the yard like first floor residents so they use simple board to close the second floor aisles. There are also families who extend their means of sustenance to the wider public area within yard. These reconstructions mentioned above may be too random some times and leave the yard in disorder but they have added strong smack of everyday life for Sid-Lin Monastery and become normal state of it. (fig 15)

4.4. New Residential Pattern in Sid-Lin

In order to establish the residential environment formed in Sid-Lin Monastery, the author performed household surveys on 12 long-term residents. During the survey, apart from rising questions specific to real situations, 4 questions designed before surveys were asked as follows. When and why did they move in? Are they satisfied with current living condition and do they want move out? How is the relationship between the neighbours? Do they always participate activities in the yard and what kinds of activities?

The followings are three typical examples as the limitation of pages.

Nima Ciren lives in the bigger house with about 30 square meters on the first floor of the yard's southeast side. This area is enough for his wife, two kids and himself to live in, even with surplus. Therefore he transformed the part at back into a clothing studio. His wife and him were introduced to here in 2004. They make clothes and sell them on the near markets for a living, with an income of about 2000 to 3000 Yuan each month now. They were quite satisfied with current living condition and never have the thought of moving out. His wife sell their ready-made clothes at Barkhor Street Mall with 850 meters from Sid-Lin Monastery at the crossing of Linkuo East Road and Beijing East Road and himself stay working at the clothing studio. Since Nima Ciren spends most time in the yard, he was appointed as householder in charge of coordination for 10 families. When it comes to traditional festivals, he also organized public recreational activities with other householders. He was so familiar with residents near the area and get along with them well. He often basked in the yard's sunshine but seldom move about the ruins of the main monastery.

Duola is one of Cizong's neighbors. In the courtyard of Sid-Lin Monastery at least two households are his relatives. His mother has been living in Sid-Lin Monastery for more than 40 years. She lived here since the time of Tibetan Opera Troupe. During her residence here, she moved for several times, mostly within the courtyard. Currently, Duola's mother and her sisters' family (totaling 9 people) are living on the second floor of the largest room in the west. This was once the kitchen for the monks, whose structure differs from other rooms. One part of the room extends outwards, making the room more spacious. Dola himself is a carpenter, and he moved back to the courtyard in 1983. Like Cizong, he made various types of traditional Tibetan furniture using the space on one side. One household on the east side is a painter, who works with Dola and draws patterns on the furniture. He does not want to move out of the courtyard, because this courtyard provides the working space for him. If he has to move out, he hopes to live with his neighbors.

The family of Cangqiong in his young age lives on the floor above Nima Ciren. He moved into Sid-Lin Monastery in 2009, because his parents lived in this courtyard. When she told the authorities that she wanted to move back, she soon obtained the approval. At present, she lives with her husband, children and brothers in a crowded room less than 30 square meters. Cangqiong's brother works in a cleaning company, and her husband works as a security nearby. Since she lives on the second floor, she rarely goes out to the courtyard, but looks after children in the house. She does not want her children to play near the remains, because she thinks it is unsafe. She does not think too much of the convenient transportation here or her easy access to a courtyard. She wants to move out to a new-style community.

The three examples mentioned above are the representatives of over 30 long-term households living in Sid-Lin Monastery. They have been long accustomed to the life of the courtyard and the relations between the neighbors are harmonious. These people's life is already integrated into the changing environment near Sid-Lin Monastery. As to the remains of the main monastery, they only hope that it will be soon recovered. But when it comes to the question of how it should be restored and what problems will ensue after restoration, they do not give too much consideration. If Sid-Lin Monastery is to be restored in a conventional way, the interests of the residents here will be the first to be compromised. The residents of Sid-Lin Monastery have been living here for more than 30 years, and they are already accustomed to the living environment. In fact, whatever protective measures to be adopted for Sid-Lin Monastery, the tranquil life of the residents here will be disturbed. If that is to happen, we have to adopt certain measures to ensure that the changes are constructive. Sid-Lin Monastery should not be only the object of these changes.

5. CONCLUTION AND SUGGESTIONS

From an urban perspective, Sid-Lin Monastery is squarely embedded into the new urban system. The surrounding of Sid-Lin Monastery is enveloped in an increasingly strong commercial atmosphere. This is the hard truth. In this context, it is unrealistic to restore its position as Dratsang. If the internal microscopic structure of Sid-Lin Monastery is not renovated, the monastery can hardly fit the traditional religious institution. From the standpoint of sustainability, the protection of Sid-Lin Monastery should highlight the return of the spirits, rather than the reconstruction of a physical entity.

Probably we can utilize the existing conditions to restore part, if not all, of the religious functions of Sid-Lin Monastery on a community level. This practice not only conforms to the wish of the public, but also produces no major influence on the existing urban pattern, thus causing no conflicts. The place for religious activities is confined to the small domain where the main monastery is located. Thus the religious activities can be performed without invading the life space of the residents. As some of the religious functions are restored, some adjustments can be made to the public layout to accommodate two life styles, the life of the monks and the life of the worldly people. The originally closed public greenspace can be opened. The remains of the main monastery may not be completely restored and be cleaned up, consolidated and renovated locally. While preserving its historical value as a relic, the main monastery may be restored into a religious place. A few monks can reside in this place for routine management. Then more work can be done to strengthen its religious and spiritual nature and to pinpoint its significance in the courtyard of Sid-Lin Monastery. Next, the restored religious attributes and the worldly life will coexist and develop together in mutual benefits.

The above conception will be refined in subsequent design. This article has made some preliminary discussions on the issues centering around the courtyard of Sid-Lin Monastery. To be "reborn" in a real sense, Sid-Lin Monastery should resemble the living Buddha in the unique incarnation system of Tibetan Buddhism: no matter how profound the preceding life, he should start the next life like an infant, adapting to the new environment and obtaining recognition from a new start.

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AN INVESTIGATION OF TERRITORY CONCEPT IN THE CONTEXT OF TWO RESIDENTIAL UNITS IN ANKARA: ISRAEL HOUSES AND SARAÇOĞLU NEIGHBORHOOD

KADRİYE BURCU YAVUZ[1]

ABSTRACT

The term of territoriality has been a significant concept since the beginning of history for both animals and human being. It is required for the maintenance of their lives to sustain their nourishment, sheltering and the other needs. Accordingly, the reflection of this situation has shown itself as an occupancy desire. A special space which its boundaries are defined is needed to be occupied for that purposes by promoted by the archetype which is inside of us. In this sense, the space regulates the behavior of people depending on its hierarchical structure. As the hierarchy of the space changes, then the interaction between people also changes. To this respect, the term of space could be defined as a regulative mechanism which alters the connection among people. This is directly linked with the territoriality concept. The more personal the space, the less interaction between people. The less personal the space, the more interaction between people. The first type of the territoriality concept might cause introversion or alonessness. On the other hand, the second type of the territoriality concept might cause extraversion or socialness. Introversion / alonessness and extraversion / socialness are related with the privacy levels which are defined by the inhabitants of a specific territory. The relationship between the desired and achieved privacy levels constitutes the formation of introversion / alonessness or extraversion / socialness of the people in their boundaries of defined territories. In this context, territoriality concept is examined considering two residential areas in Ankara, named as Israel Houses residential unit and Saraçoğlu Neighborhood. The study is supported by field survey. In the process of field survey, the territorial boundaries in the residential areas have been recognized depending on their types. Whether the territory boundaries are defined or not is determined for the both residential area. Then, it is linked with the occupancy, privacy and archetype concepts. As a result of the field survey, it is observed that Israel Houses residential unit has exactly defined territory boundaries which constitutes an ideal situation for the interaction between people. However, it is confirmed that Saraçoğlu Neighborhood does not have exactly defined territory boundaries as in Israel Houses residential unit. Therefore, it could be stated that the interaction between people constitutes a level which might disturbs the inhabitants of the neighborhood which creates an unfavorable situation for them.

Key words: Territoriality, Privacy, Archetype, Space

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1. INTRODUCTION

Human being has always needed a space which is possessed by them. This is a law of nature which is adopted by both human being and animals. The possessed space is required for living species to maintain their existence, to maintain their vital activities. This is actually an interesting fact that causes the formation of boundaries in terms of space. Each living creature should have a certain amount of space to live. In the case of occupation of this space, the existence of them would be in danger. Accordingly, the living creatures are in the tendency to protect their own existence spaces, in other words their boundaries to sustain their features of animacy. Looking at a different standpoint, a spatial territory is appropriated. It is highly connected with the privacy issue. People look forward privacy to resume their own spaces, namely their appropriated spatial territories by occupying these territories.

2. THE TERRITORY CONCEPT AND ITS RELATED FEATURES

Privacy constitutes the fundamental term which is required for the protection of the boundaries of territories. This term is defined as main regulatory tool which sustains the level of accessibility of a person or a group considering the others (Altman 1975). Privacy determines the openness of the territorial boundaries of a person to the others. If a person or group prefers to add another person or group, the level of privacy is decreased by them to include the others to their own spatial territories. It is determined by the desired privacy preference of people. There exists two level of privacy. The first one is defined as desired privacy and the second one is defined as achieved privacy (Altman 1975). Desired privacy could be identified as desirable privacy level which a person or group prefer. If desired privacy is sustained, then it could be stated that people show the ability to adjust ideal level of privacy considering their interaction relationship with the other people. On the other hand, achieved privacy could be stated as the occurred level of privacy apart from the desired privacy level. It is claimed that if the desired privacy is equal to achieved privacy, the ideal privacy level is sustained (Altman 1975). In the light of this information it could be asserted that if the desired privacy level is greater than the achieved privacy level, then it is stated that more interaction is sustained than the desired level. On the other hand, if desired privacy level is less than the achieved privacy level, then it is stated that the person or the group is defined as alone, little interaction than the desired level.

The ensuring elements which privacy sustains could be considered in two dimensions. First of all, privacy is significant in the sense of regulating relations with the other people. It is a tool for people to regulate their social relationships with other people. Second, it sustains the psychological wellbeing of people since it ensures the self identity (Altman and Wohlwill 1994). Thence, it could be specified that privacy give people an opportunity to alter their egregiousness level to other people. Accordingly, they have a chance to choose people that they want to included in their personal space. On the other hand, privacy is required to sustain the self

identity of people. Boundary protection of the boundaries of the personal spaces is significant in the context that people feel safe themselves in these boundaries and it is not possible for people to develop their self identities without a safe environment.
The privacy needs of people are related with four occupancy issue. The occupied territory is protected or appealed by different levels of privacy. Occupancy of a specific territory could be analyzed under three titles as personal, community and society occupancy. Personal occupancy could be defined as territories which belong to the people who have deep relations, for instance people who are married or having blood relations. Community occupancy could be defined as territories which are more open to the stranger people. In these territories, there is less freedom exists considering the territories occupied by personal. The last type of occupancy, namely society occupancy can be divided into two. Social occupancy could be defined as territories which are accessible to the public generally. However, it is not required to always open to the whole public. Additionally, free occupancy could be defined as territories which have not persistence rules to follow (Altman and Wohlwill 1994). In the light of this information it could be indicated that the more occupancy level exists, for instance as in the personal occupancy, the more privacy degree is observed. People are more inclined to protect their boundaries of territories as in the personal occupancy. Thus, this situation increases the level of privacy needs of the people.
The mentioned privacy and occupancy issues are directly related with the space, in other words territory. Territory is defined as the fact that the related aspects with the spatial behavior of people are called as territoriality (Altman and Wohlwill 1994). As different definition, territories imply a spatial area which is defined by a specific boundary and this area is generated with a sense of ownership. In the context of ownership, people constitute their daily performances to sustain their lives. This can be also observed in the case of the other living creatures. Another aspect which territories has that they are marked in order to indicate that they are the special boundaries possessed by certain groups. This marking issue could be implemented by some types of specific signs which define the boundaries of territories. These markings might include elevation differentiations or fences in the spatial sense. These markings refer that the boundary of an occupied space, namely territory, begins with the marking. Therefore, the stranger stays out of the defined territory (Altman 1975).
Territories are comprised of three types as primary, secondary and public territory. Primary territory could be defined as owned by people with strict rules to define the boundaries of the territory to keep away the others from that area. Additionally, owners of primary territories maintain their daily lives in the boundaries of these territories. The homes of the people could be defined as primary territories of that people. Secondary territory could be defined as having less strict rules comparing with primary territories in the context of interaction with the other people. These territories show less private characteristic. They might be identified as semi public areas. The last type of territory, public territory could be defined as an area which boundaries are open to the general public and there are no rules to keep away any specific groups from that area. Everyone has the right to involved in public territories.

The issue of the occupation level of territories and types of territories are highly interconnected with themselves. As stated earlier, personally occupied territories are shared with people who have close relations, therefore it would not be wrong to state that personally occupied territories could also be defined in the context of primary territory concept. Similarly, community occupancy issue is related with the secondary territories. The occupancy of specific territories by the specific communities causes the formation of secondary territories which boundaries are protected by the rules to allow specific communities to include in. Lastly, social occupancy and free occupancy are related with public territory. In the socially occupied territories, whole public could not be included in the boundaries of these areas. However considering in the free occupancy context, everyone could be included within these areas. Therefore; although both social and free occupancy concepts could be defined under the head of public territories, there exists a bit level differentiation between them.

After the definitions of privacy needs and occupancy of territories arising from these needs, the feelings in which people develop within the boundaries of certain territories should be investigated. These feeling are in a relationship with the terms called as appropriation, attachment or identity. These three terms identifies meaning and importance which are developed by people living in using their certain types of territories. Their territories gain value when they develop a meaning about that territory. This situation causes the formation of a relation with the people and the territory as a significant place. Therefore, meanings attached to the territories are significant in the sense of the determination of a certain territory's characteristics related with the human behavior included in. This causes the attachment of people to particular place, namely territory, called as place attachment. Both place attachment and place identity refer that when people develop social, cultural and psychological importance to those places, they feel themselves as a unity with those places (Altman and Werner 1985). Additionally, as another definition, attachment feelings of people to certain places reflect the feeling of possessiveness arising from developed image and identity (Franck and Schneekloth 1994). Therefore, it could be stated that place gain its value, in other words its meaning, when people living in it develop mentally relations with it considering socially, psychologically and culturally. So that it would be possible to think the place and the habitants included in as a single component, compatible with each other.

It could be stated that the territoriality term could be related with the archetypes which people develop. Archetype could be defined as learnt behavior which is derived from ancestors. Most of the time we could not recognize the fact that some of the behaviors we show in our daily lives are highly connected with the archetypes which come from previous generations by birth. These behaviors constitute basic daily behaviors as sheltering and nourishment. Attendantly, it could be stated that basic daily activities could be considered as instinctively learnt. This instinctively learnt behaviors show themselves in an unconscious way. This concept is also discussed by Jung under the perspective of title called as collective unconscious. Individual unconscious which is obtained by the person from the community life and its integration with collective unconscious which is obtained by birth, come down from ancestors, is called by Jung as archetypes.

As said, archetypes could be defined as unconscious behavior or feelings of people which obtained by ancestors by birth. One of the unconscious behaviors could be asserted as the need of people to have a personal space. As stated above, territories constitute the personal spaces of an individual or a group of people. These personal spaces, namely territories, should be protected by its owner to maintain its existence and its existence depends on the need of a protected personal space, which could be considered as an archetype. In their protected personal spaces, people try to maintain their lives by sustaining their needs in these boundaries. Therefore, they do not want anybody to reach beyond these boundaries without having permission from them.
In the view of such information, primary, secondary and public territory types will be analyzed in the context of some certain residential units in Ankara, named as Israel Houses and Saraçoğlu Neighborhood. In the analysis of these examples, which kinds of territories are identified will be explained for each residential unit example supported by the images of these examples in order to understand the spatial reflection of "the unconsciousness feeling of possessing the space".

2.1. Israel Houses

Israel houses could be stated as one of the successful residential units which protect the territorial boundary of its habitants. Israel Houses were built by an Israel construction firm in 1950s named as Solel Boneh, that's why these houses are called as Israel Houses (Küçük 2005) and these houses show the clear spatial identification characteristics. It could be argued that the main theme in the context of territory concept has not changed since the construction period of these houses since the division of primary, secondary and public territory concepts could still be clearly identified, thanks to the design characteristics of the site. As a matter of fact, this residential unit was successfully built by developers since it shows the characteristics of an ideal neighborhood unit. Thereby, it could be asserted that this residential unit could be considered as a small scaled neighborhood unit. The recreational usages and a square which was designed for commercial purposes within the scope of human scaled design sustain a prosperous and livable area. These places could be identified in the context of territory types. The commercial square could be identified as public territory indicated in Figure 1. and Figure 2. However, not so much people use this square except the habitants of the residential unit. Accordingly, this place could also be considered as the combination of public and secondary territories. In addition to this, the built of recreational usages is sustained by the successful arrangement of the buildings' backyards (Figure 3.). The consideration of backyards as together enables the formation of an effective recreational area for the habitants. Therefore, it could be claimed that the hierarchical sequence of the territory types could be easily understood in the context of this residential unit.

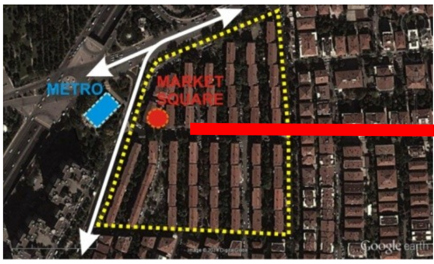

Figure 1. Location of the residential unit

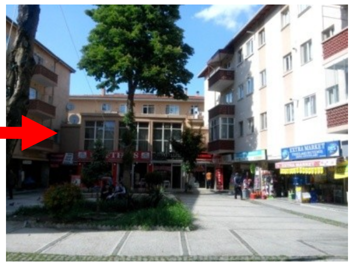

Figure 2. Market square as public territory

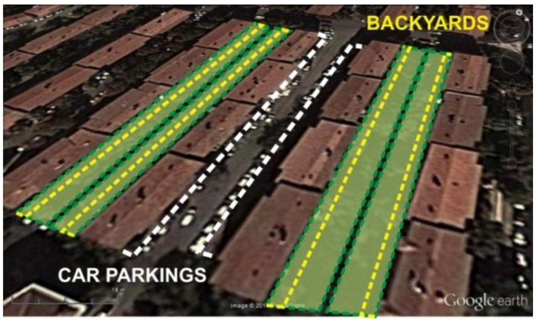

Figure 3. Aerial view of the site

Figure 4. Conceptual side view of the site

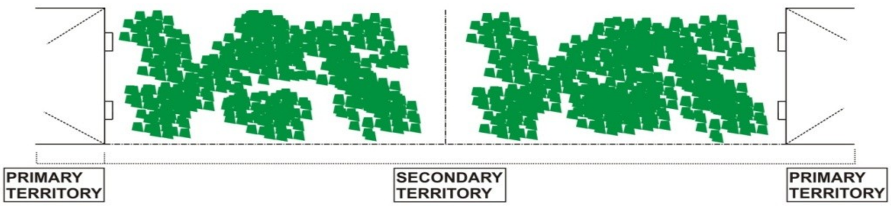

Figure 5. Conceptual top view of the site

As indicated in Figure 3.-4.-5., the back yards of the buildings constitute a well designed recreational area for the habitants of the residential unit. In this example, the floor of the backyards is under the road level. This situation generates the exact division between the backyards and road, one of them is secondary territory and the other one is public territory, respectively. The buildings, in this case, are primary territories; backyards are secondary territories and are used effectively for recreational purposes by the residential units' habitants and the roads including sidewalks are public territories. Additionally, a market square was designed to provide necessary daily needs of the habitants of the residential unit. This square could be considered as public territory; however, it also shows the characteristics of a secondary territory since most of the time habitants of the residential unit and the people from immediate environment use this square.

In addition to this, this residential unit is a successful example in which its habitants have equal desired and actual privacy levels. It is due to the division between primary, secondary and public territories are clearly defined in this example. People continue their daily lives in their flats which are primary territory, socialize with the other habitants of the residential unit at their secondary territories which are created by the effective arrangement of the backyards. Additionally, strangers cannot enter to this secondary territory of the habitants since this area has exact distinction with the road used by the public, defined as public territory. This distinction was procured by the ground level differentiation between the back yards and the road, secondary territory and public territory, respectively.

2.2. Saraçoğlu Neighborhood

Saraçoğlu neighborhood stands on Kızılay, central business district of Ankara, exists on a central position of the city, nearby the ministries zone (Figure 6.). The neighborhood was built for the bureaucrats who work for ministries. Accordingly, it could be stated that the neighborhood was built for meeting the residential needs of top-tier public officers. The neighborhood has similar design characteristics with Israel Houses residential unit explained previously. Buildings stand as human scaled perspective makes the neighborhood having a calmer environment which reflects the built environment characteristics of mid-1940s, the period which the built of Saraçoğlu Neighborhood was started. The neighborhood and the ministries area attached with the neighborhood had an effective relationship considering in the context of territory concept beginning from the period of mid 1940s. However, when Kızılay area has had the characteristics of central business district of the city, the division of territories could not be differentiated clearly as it could be before (Figure 7.-8.-9.). The main reason for this constitutes the population increase of the area, which rises the circulation of people who desire to benefit from central business activities. Therefore, at the present time, it could be claimed that the houses constitute primary territories; however, the front yards of the buildings do not constitute a defined primary or secondary territory. It seems like enabling strangers to enter these yards. Apart from primary and secondary territories, public territory includes the sidewalk and continues with roads (Figure 10. and Figure 11.).

Figure 6. The location of the neighborhood

Figure 7. Building, yard and sidewalk

Figure 8. Building and front yard

Figure 9. Façade and front yard

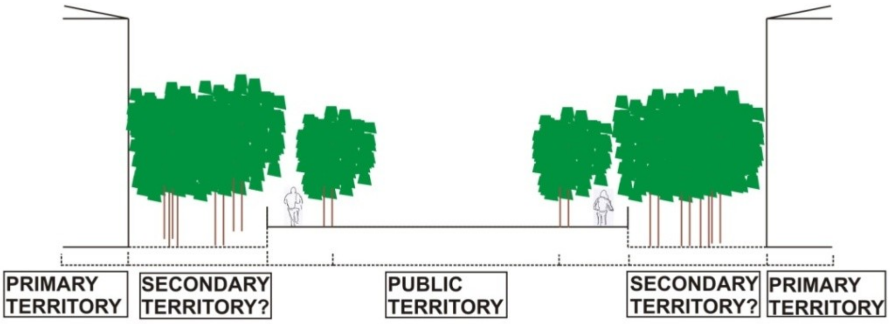

Figure 10. Conceptual side view of the neighborhood

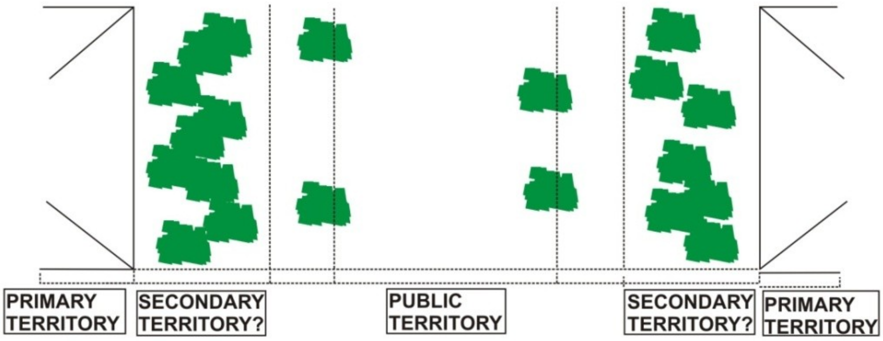

Figure 11. Conceptual top view of the neighborhood

As indicated in the Figure 10. And Figure 11., the front yards of the each building constitute a secondary territory (might private or public territories, also) for each buildings' habitants as well as each buildings constitute primary territory for their dwellers. In this example, secondary territory and the public territory cannot be separated in an obvious way. Although the front yards of the buildings, as indicated in Figure 10., mostly located below of the road level, the clear division between the sidewalk and the front yard could not be sustained. This situation occurs due to the neighborhood is located on one of the most crowded area of the city. In this neighborhood, both pedestrian and public transport transit levels are high. Accordingly, it could be claimed that since the neighborhood is located on a high density central business district and the boundaries of each territory types are not defined clearly, the neighborhood is easily accessible to strangers.

3. GENERAL EVALUATION AND CONCLUSION

In this study, people's desire of achieving dominance and its reflections to the design are analyzed. For this reason, the territory types which are the reflections of different occupancy types (personal, community and society) are examined in two examples as Israel houses residential unit and Saraçoğlu neighborhood. Among these two examples, Israel houses residential unit is determined as having territory types at the exact places as they should be. Although, this residential unit was not designed as a gated community, the habitants of the unit do not feel unsafe since their private territories (primary and secondary) were defined in an effective way by design. For instance, secondary territories created by the back yards are only used by the habitants. Strangers are separated from this area in an exact way. The second example, Saraçoğlu neighborhood has some unclear territory boundaries comparing with Israel houses example. The obvious differentiation of this neighborhood from Israel houses is that it is more open to the public; it is more accessible by the strangers apart from its habitants and this situation creates an indefinite situation about the boundaries. In this context, although the front yards of the buildings do not constitute an active greenery area, namely recreational area for the public use, strangers could easily enter to these yards or could interrupt the process of the usage of local people.

Both of the examples were built to sustain ideal neighborhood life to their residents by providing clear identification of territory types. However, the rise of the central business district characteristics of Kızılay, nearby Saraçoğlu Neigborhood, has caused the neighborhood to lose its defined boundaries of territory types. On the other hand, the location advantage of Israel Houses, namely located on the residential area of the city where does not constitute central business district characteristics, has ensured these houses to provide their clearly defined territory types.

To sum, at the present time, Israel houses residential building has the ideal territory types division. The area enables people both to live their personal lives in their personal territories and to socialize with the habitants of the site providing efficient recreational usage created by its back yards. Habitants of Israel houses could adjust their privacy levels as they wish since design opportunities which their living area sustains. On the other hand, Saraçoğlu neighborhood has indefinite territory types division. In the area, the habitants could have difficulty in adjusting their desired privacy levels since the secondary territories are under the threat of public one. Therefore, what is the ideal one between these two examples? The answer is Israel houses residential unit. Since this unit allows people to live their both private and social lives by sustaining a successful design, namely a livable environment has appropriate territorial divisions, it could be indicated as a good example about how territories should be designed considering people's need of occupancy related with their privacy levels.

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KEYNOTE SPEECH
(21 November 2014 Friday, 13.30-14.00)

Prof. Dr. Martin BECHTHOLD
"The Quest for Innovation: Methods and Mindsets"

THE QUEST FOR INNOVATION: METHODS AND MINDSETS

MARTIN BECHTHOLD [1]

If airplanes were like buildings we would still be going around in biplanes. A comparison of the rate of progress and advancement in the building industry with that in the field of aerospace engineering can lead to no other conclusion. Humans have constructed shelters from the very beginning of human existence many thousands of years ago, but even today's most advanced buildings have ultimately advanced very little. Bricks today have the same shape as the very first human made unfired clay bricks about 6000 years ago. Glass today is only marginally better than glazing systems in the middle-ages. Structural efficiency in wood construction, for example, has only increased by a factor of an estimated 3 or 4 over 2000 years. Drafting a similar comparison with human flight we find a much accelerated development from Otto Lilienthal's work and the Wright brother's first motorized flight in 1903. Now, just over 110 years later, airplanes carry hundreds of people, fly faster than the speed of sound, and last decades in continuous service. What went wrong with architecture?

The well-known fragmentation of the building industry usually is first blamed for the snail-pace of progress in our field. Compared to that relatively few companies, and solid government support, has propelled the aerospace industry forward. The World Wars with their military needs triggered an intense research phase that fast-forwarded airplane design and engineering, and without which the aerospace industry would not be where it is today. Wars have contributed little if anything to building design, instead drawing resources away from any serious building-related research effort. But don't our buildings, after all, perform reasonably well as they are? Even buildings constructed hundreds of years ago are fairly safe and moderately comfortable. Why invest much towards innovation in the construction sector?

Today we know this presumption to be utterly wrong. The relative inefficiency of constructing and operating our buildings consumes the majority of global raw materials and energy, and contributes a large amount of emissions to our rapidly warming planet. Building design and construction has to rapidly catch up and become vastly smarter, leaner, and more sustainable. But to advance our industry we need new ideas and methods in order to accelerate the rate of innovation. We cannot wait hundreds of years to lower carbon efficiency of our existing and our new buildings. We can no longer afford to postpone progress. We need to re-tool our discipline, and emphasize research!

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[1] Prof.Dr.Harvard University, USA

Research in Architecture?

Individuals without connections to the building industry are often surprised to hear that research indeed exists in our field. What one could possibly be working on is equally unclear to outsiders, much in contrast to fields such as engineering or medicine where research is widely assumed to be fundamental. There is more understanding of building related research in the University setting, where colleagues from other disciplines expect those affiliate with departments of architecture, landscape architecture or urban design and planning to be scholarly engaged.

At Harvard University I am engaged with a broad range of research projects and topics, most of which are connected through their pursuit of material systems and innovation. Conducted in the context of the Material Processes and Systems (MaPS) group, and often collaborating with Prof. Sayegh's Responsive Environments and Artifacts (REAL) group, our work is different from yet related to material science, refers to industrial process engineering as much as to chemistry and building physics. It operates on dramatically different scales, from the nano-scale to the scale of the city, with outcomes that range from prototypes and pilot project to patents and papers. Most importantly, however, the work has led to the development of methods that accelerate the rate of innovation and our quest for novelty, ultimately geared towards advancing the built environment to a more sustainable future. This article puts forward several aspects of this work in a provocative, polemical manner as food for thought, not as a literal recipe for success.

MaPS Design Research

Material systems describes a broad interest in all aspects of materiality, beginning with extraction and sourcing, through processing and fabrication, transportation and distribution to construction, use and finally end-of life scenarios of reuse, recycling, or disposal. The work includes studies for the intermediate as well as those for an immediate future, some is more, other less driven by applications, and all of the work is collaborative often across disciplinary divides. The following aspects have evolved over several years of working on different topics and problems. They will be illustrated with examples from a variety of past and present research projects.

<u>Briefs not Plans:</u> Traditional research often crafts a precise research plan at the outset. Doing so works well if the problems, methods and goals are articulated and well understood, but it can be limiting when innovating in the materials area and dealing with the uncertainty of unknown application domains. Here the commitment to a theme can be a more productive way to guide the imagination and channel thought processes towards novel outcomes. These themes are often described in the form of briefs – a tradition long established in the studio model of design education where professors challenge their students with a brief that includes programmatic and other requirements for a building. In the research setting briefs can be less quantitatively specific, but instead often focus on themes that are aligned with real world issues and the capabilities of the research team.

The Surfacing Stone project illustrates this principle well. Here several Harvard faculty[1] and students formed a group to investigate and discover new design opportunities brought about by manipulating natural stone with a 6 axis robotic waterjet. The team developed a thematic brief that focused on the manipulation of stone with the goal of controlling light transmission and views in ways that were unique to both the tool as well as the material. This quest ultimately resulted in a novel structural stone shell robotically cut and perforated to address views during the approach to the site of the installation (Figure 1).

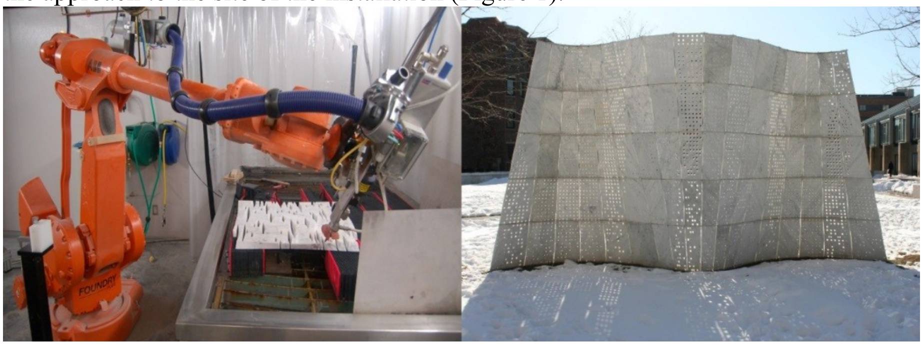


Figure 1: Robotically waterjet, stone slabs were manipulated such that 72 perforated thin stone slabs, precisely cut, could be dry-assembled into a loadbearing and post-tensioned shell.

<u>Questions not Answers:</u> A good interview relies as much on good answers as it depends on the right questions. Questions are essential in research as well, because the research can be looked at as an answer to questions. Coming up with good questions is not always easy, but in itself requires research.

In our ongoing interdisciplinary work with chemists and material scientists the value of questions has become evident. During an initial meeting our partners asked a seemingly simple question: what work could the scientists that would solve the most pressing problems of buildings today? While not in itself a bad question it did not allow us to formulate a research agenda. The vast scale difference between the built environment and material science makes the question of what research can connect those fields in itself intriguing and non-obvious. In addition to this material science in itself is a vast field, but one characterized by researchers and labs with extremely specific expertise and interests. Our challenge over several months of meetings and conversations was to find an entry point with the promise to match the capabilities of our scientific partners with a promising application domain in the built environment. We eventually were able to collaborate together by starting with a range of translucent material systems that allowed us to investigate questions of views and light control, among others. This work continues and grows today, involving several faculty from the Harvard Graduate School of Design (GSD) and

[1] Faculty included Monica Ponce de Leon, Wes McGee and the author.

the Harvard School of Engineering and Applied Science (SEAS)[1] , and today is conducted under the Adaptive Living Environments (ALivE) umbrella (Figure 2).

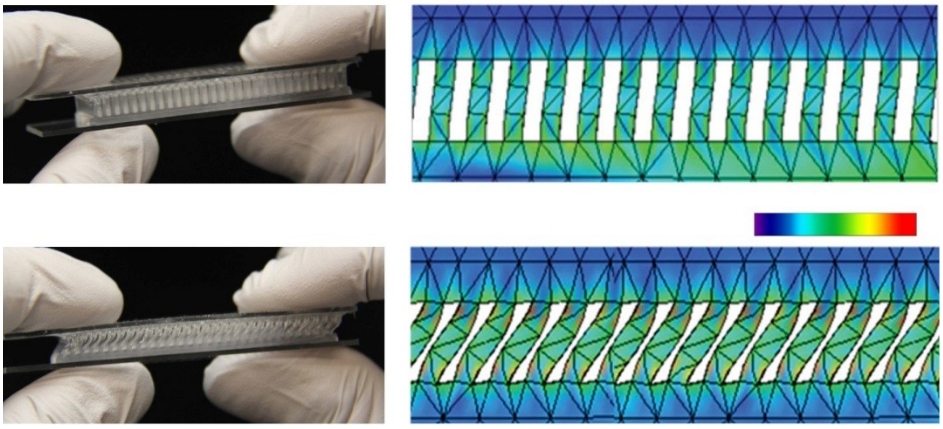


Figure 2: The patented Dynamic Daylight Control System, a joint development of designers and scientists, relies on the shearing of soft pneumatic layers to control daylight[2].

Many not Few: There are very few geniuses among us, but together we can create novelty and, through implementation, also innovation. Collaboration as a principle of scientific and creative work, of course, has a long tradition. MaPS work is always collaborative, but for certain projects we amplify the potential of many minds over fewer by inviting guests without prior knowledge of our work to brainstorm with us to generate ideas. This process involves the creation of an appropriate spatial setting and the definition of themes and challenges that participants address in small groups. We intentionally mix individuals from different disciplines because we value diverse input.

Brainstorming sessions have created several intriguing new ideas in the context of the ALivE project, where the challenge in the early research phase is to identify real opportunities for innovation in the built environment based on the given nano-scale material science expertise of our collaborators. We mix scientists, designers, artists and others in small groups that come up with ideas in joint conversation that is moderated by one of the group members. Moderators are not determined based on hierarchy, but by their ability to keep a conversation going and stay focused on a theme. Every group is challenged to come up with 5 – 10 ideas within a very short time. All ideas are presented both graphically as well as textually, and at the end of a brainstorming session the ideas are shared. All participants then ‘vote’ on what they

[1] Key faculty are Allen Sayegh (Co-PI) and Panagiotis Michalatos, both GSD, and Joanna Aizenberg and Katia Bertoldi both from SEAS and the Wyss Institute of Biologically Inspired Engineering.

[2] Park, D., Kim, P. Alvarenga, J., Jin, K., Aizenberg, J., Bechthold, M.: “Dynamic daylight control system implementing thin cast arrays of polydimethylsiloxane-based millimeter-scale transparent louvers” in: Building and Environment, 2014.

perceive are the best ideas. This vote helps the core team understand better what ideas may point to real opportunities, hence are worthwhile investing time and resources in for further development. Following the brainstorming session we further analyze all ideas, cluster and sort them by categories such as application domains, effect, or underlying technology, and proceed from there jointly with our scientific partners with the research (Figure 3).

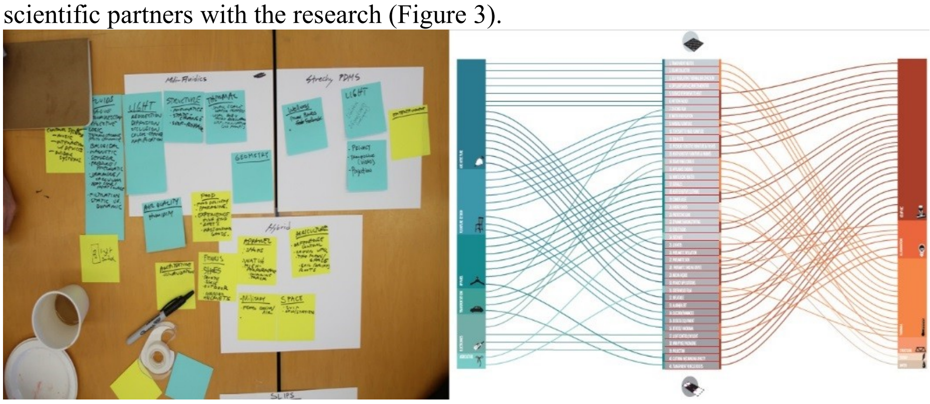


Figure 3: ALivE ideation or brainstorming sessions develop many ideas which are later analyzed and categorized in order to decide what to work on.

Another aspect of this principle is to share our in-progress work with broader audiences. In the ALivE project we create an exhibition once to twice a year, and invite Harvard affiliates as well as outsiders to visit the shows and share their reactions with us. This process, although time consuming, again provides valuable feedback to us and helps us steer the development process of the various projects we are working on (Figure 4).

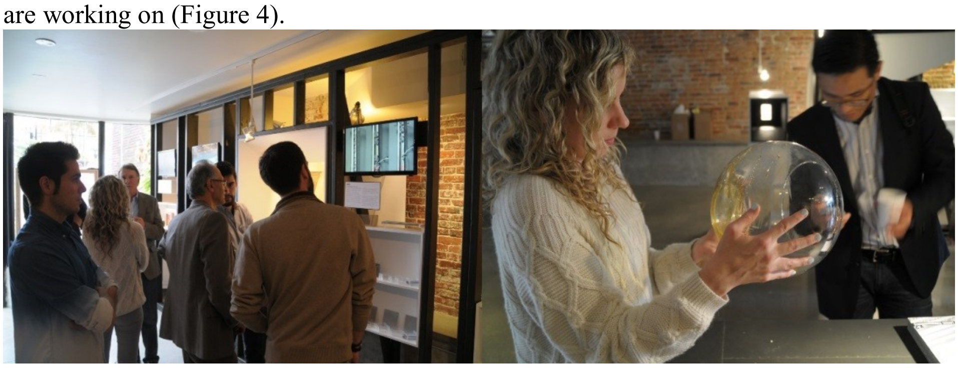


Figure 4: ALivE exhibitions generate discussions, feedback, and ultimately advance the development process.

Get Physical: The principle of productive failure or 'failing early' is well known in product design circles[1], and it refers to the importance of trying out ideas physically because the development process will benefit as much from what does not work as it

[1] Brown, T., Roberts, T.: *Change by Design: How Design Thinking Transforms Organizations and Inspires Innovation*. New York: Harper Business, 2009.

gains from what works. This is certainly true for our work on ceramic material systems where prototypes are an essential part of the development process (Figure 5). It is also true for our collaboration with material scientists. Here the degree to which prototypes and their failures can be productive correlates strongly with the physical scale of the experiment.

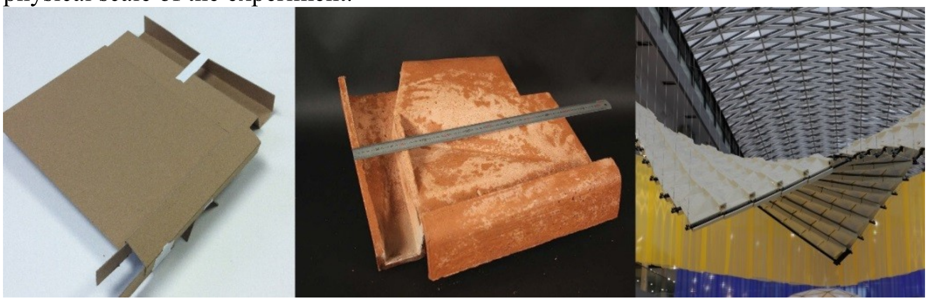


Figure 5: Prototyping at different levels of precision was key in developing a novel ceramic structure.[1]

In the ALivE work it is essential to prototype ideas early. Other than in product design where basic ideas can often be prototypes with basic materials such as tape, cardboard and other available resources any scientific study requires much more time and effort in order to work. Prototypes need to be carefully planned and designed. Material science usually produces very small experiments, and declares success if certain behaviors or effects can be demonstrated at the nano- or the micro scale. Functionality of the larger scale is then inferred. We often begin our work with scientists at the point where certain material behaviors have been successfully demonstrated. In our quest for applications ALivE students and researchers then design objects that are situated in between models and products, in between material samples and experiments. These objects often strive to demonstrate a novel relationship between an environmental stimulus and one or more human senses. They remain fairly small – can be produced in scientific labs geared towards succeeding on the small scale – yet are large enough to help us evaluate their behavior through direct personal experience rather than through the intermediate interface of scientific instruments.

Suspend Doubt: Work in both the sciences and in the field of design is often guided by a hypothesis, but designers will rarely think of their proposals as such. But design as the transformation of an undesirable into a desirable condition[2] always contains an element of hypothesis or conjecture. Compared to scientific work the scenarios generated by designers can often seem bold, far-fetched, or lacking rigor. Designers can give form to future scenarios and environments, to settings and processes that might be enabled by something the relevant scientific research has only begun to understand. These visions have not overlooked, but they intentionally suspend doubt about the many practical and research problems that need to be solved before a

[1] The project was developed in collaboration with Prof. Andreas Trummer from the TU Graz. The author thanks ASCER Tile of Spain for their support.
[2] Paraphrasing Herbert Simon.

vision turns into reality. Design visions provide guidance and motivation at the same time (Figure 6).

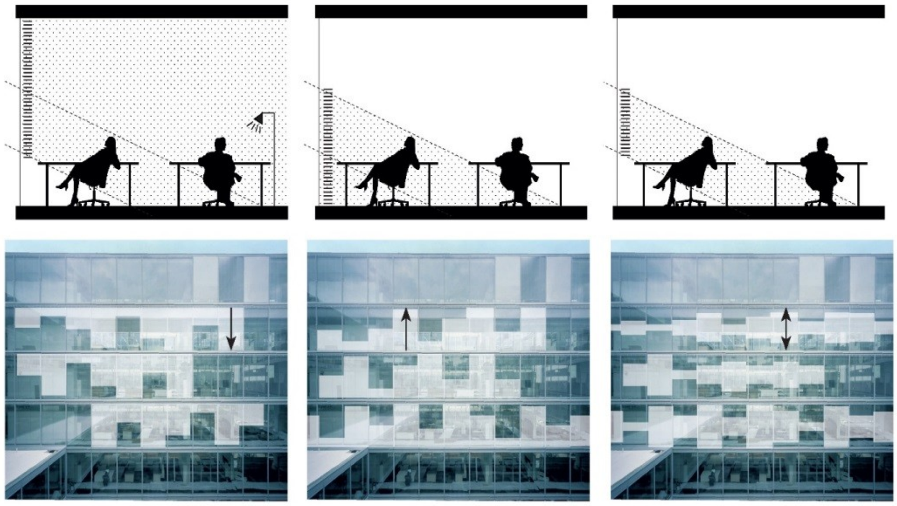


Figure 6: Before the actual development of the DDCS system shown in figure 2 the team crafted a vision sketching out the experience of a building's occupant as well as possibly adaptive appearances of a building. At that stage multiple technical problems still had to be worked out before these visions could become reality.

Top and Bottom: Design research excels through the ability to switch from top down to bottom up thinking. These terms describe attitudes during the development process describes. Top down denotes an application, problem-centered viewpoint while bottom up is the development of capabilities starting with material experiments or other fundamental science. Both perspectives are needed, both require the suspension of doubt as mentioned before. Innovation can emerge if researchers are able to switch modes easily and at the right times.

Conclusions

Architecture and the building industry needs to advance. To do so we not only need more substantial industry and government commitment, but also methods that allow designers to productively advance novel ideas in collaboration with other fields such as material science, chemistry or engineering, to just name a few. Leadership during this process is the ability of designing and guiding the process itself such that innovative outcomes emerge. The principles outlined above can form integral part of this new approach to interdisciplinary research. Design methods that originate in architectural thinking are not limited to the conception of buildings, but they can be instrumental in crafting successful interdisciplinary collaborations that are able to address the challenges of our time.

Acknowledgments:
The author likes to thank ASCER Tile of Spain and the Adaptive Materials Technology Platform (directed by Prof. Joanna Aizenberg) at the Wyss Institute for Biologically Inspired Engineering for their support. The work would have been impossible without many dedicated and talented Harvard students. Prof. Allen Sayegh, my joint principal investigator of the ALivE project, deserves special mention.

SESSION 7

20 November 2014 Friday, 11.00-12.15

APPROACH ACADEMIA AND PROFESSIONAL PRACTICE TROUGH RESEARCH BY DESIGN

JOÃO MENEZES DE SEQUEİRA[1]

ABSTRACT

This paper will try to stress that the approximation between academia and professional practice has its roots on the revolution that occurs in the schools of architecture in the beginnings of the XX century. And this revolution has its origin in the idea of connecting arts and crafts and then the idea of bringing practitioners into the academia and changing the concept of academic curriculum. We think that the consolidation of this approximation can be done if we consider architectural research by design as the main path to develop.
This paper result of the lecture made in the 21th of November in Konya at the occasion of the seventh session of the 2nd International Congress of Architecture (ICONACH II) under the theme "New approaches in architecture and urban planning in education".

Keywords: Research, education, architectural practice

APPROACHING ACADEMIA AND PRACTICE

Today and for me, both as a teacher of Architectural and Urban Design, a researcher and as a practicing architect, speaking about new approaches in education, is to speak about the ways research has introduce herself in the academia and in practice as a unifying path.
What I mean is that, I believe architectural research and especially research by design is the best way to approach academia and the architectural practice.
This approximation is possible if we start with design-oriented approaches and trying to clarify some concepts.
Research in architecture is a very fuzzy and complex issue due to the hemorrhagic literature that talks about design research. According to some authors, like Nigel Cross (2001, 45) the discussion start's in the 60's of the last century with the design methods conference organized by John Christopher Jones and D. G. Thornley, even if we think, like Jonathan Hill (2013) that the origin of this idea is much older and is more complex then we expect.
Howsoever we can, in a simplifying manner, try to organize some types of research that can help us to understand research by design. We will use two different approaches, one from Trygve and Haakon Faste (2012) that identifies at least four

[1] Prof. Doc. Architectural Lab. R&D - LabART / Lusófona University. LISBON

concepts and other from Frayling that proposes three concepts.

Table 1

Trygve Faste and Haakon Faste	Frayling
(2012)	(1993-94)
Design **through** Research	
Design **of** Research	research **for** design
Embedded design research / Research **through** research	research **through** design
Research **on** Design	research **into** design

The approach made by Trygve and Haakon is completely different from the used by Frayling. For those two, first authors, the approach should be done under the point of view of design, and the one from Frayling is done from the research point of view.

Design **through** research is defined as the processes "were traditional research activities seek to verify research hypothesis with or without the acknowledgement that such activities are design" (Faste, 2012, 7). It can be defined as the idea that research can be framing as design.

Research **through** design accounts for all the research that has to be done for the good performance of architectural and urban design, like materials research, building temperature behavior, development work (customizing some constructive technologies) and action research (where we can see much of the digital research, characterized by a step by step experimentation in studio or in lab environment).

Design **of** Research, is a concept that in the words of Faste (2012, 7) “describes the creative activities of planning and preparation for subsequent empirical or theoretical research".

Research **into** design is most of the work that we make in the academia, for the preparation of classes and even in the classroom, and for that reason alone is the well known type of research in the academia. It is connected with the acronym H.T.C. which means history, theory and critic. Is historical research, aesthetic or perceptual research, research on social, economic, political, ethical, cultural, iconographic, technical, material and structural perspectives, etc. In a word is research that is fundamental for the teaching of architecture and urban design (planning).

Embedded design research is the same of research **through** design, that is a “combination of process and research culminate in an artifact as the embodiment of design research knowledge”[1] or in other words “research through design is design activity that operates as research” (Faste, 2012, 6).

Research **on** Design is where "researchers systematically examine various design processes in order to improve the future practice of design" (Faste, 2012, 7).

Research **for** design or by design is the most controversial kind of research because

[1] About tacit knowledge see Polalyi, 1966, and also Biggs, 2002, about embedding knowledge.

there is a thin line between this research and the actual work of professional practice and between this type and the platonic idea of be inside the design process and outside with a consciousness of been the “object that produces itself”.

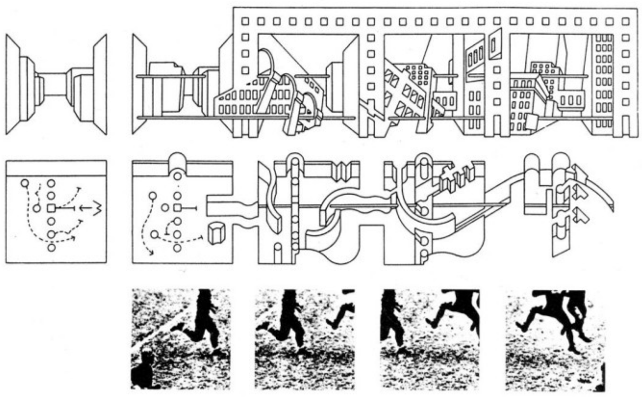


Fig.1 Bernard Tschumi, composition made for the Manhattan Transcripts p.48

Bernard Tschumi (1994) has also this problematic in his architectural theory, where the paradigm of architecture is between the labyrinth and the pyramid, problematic taken from Jacques Derrida's (1979) deconstruction of Hegel philosophy. This means that this is not an issue to be theoretically solved here and I guess not even in a full extended paper, not because it is impossible to solve but because of his metaphysical and verbal impasse.
The important question is that despite the metaphysical impasse, empirical necessities have been work on it since the beginnings of the 20th century, because in some issues, like architectural and urban design, our thought is much slower than our hands.
As I want to stress in this paper, research is the way we can connect academia and practice, and this is seen easily in the way some contemporary architects communicate their own work.

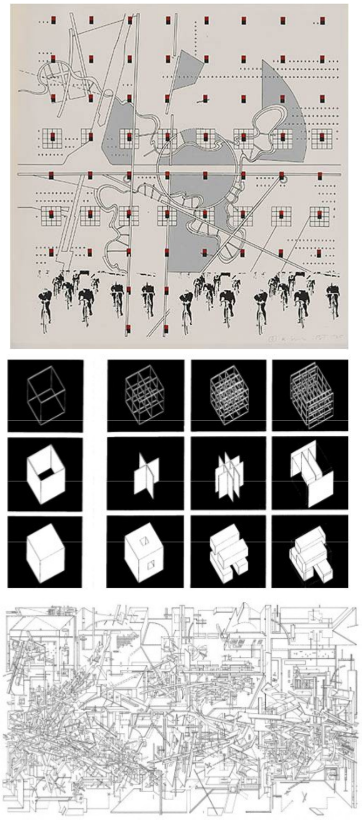


Fig. 2. From top to bottom: Tschumi studies for the project of the Parc de La Villette in Paris; Peter Eisenman house studies; Daniel Libeskind's "Micromegas" Drawings (1979)

The preponderant idea of communication as we all know is mainly started in the postmodern architecture, but transparency (that it's another concept) is started long before in modernism. The crisis of transparency of the Modernist building has two causes, one from modernist itself (Sequeira, 2014) and the other from the today complex infrastructure of buildings (De Mouron, 2005). The appearing of postmodernism and the development of the substitute idea of communication is, as we will see, in a profound crisis. Today the idea of communication and transparency has been transformed in a transparency of communication, introducing architecture as a media device (Sequeira, 2014).
In a devious way and with enormous consequences in contemporary architecture, architects are compelling to communicate their own processes of creation and in doing it, they can brought new insights to architectural research. Nevertheless these insights are coming from a specific type of research and have becoming increasingly more important in architectural education.
We will try to connect the transformations occurred in the pop movement with the process occurred between the two of the most revolutionary transformations done

in the schools of architecture, one in the beginnings of the 20th Century, with the Bauhaus and Vkhutemas schools, and the other in the second half of this same century, in the revolution of the Architecture Association School in the UK by Alvin Boyarsky.
The idea of process transparency of the object has started between the two World Wars with the Bauhaus and the Vkhutemas Schools.

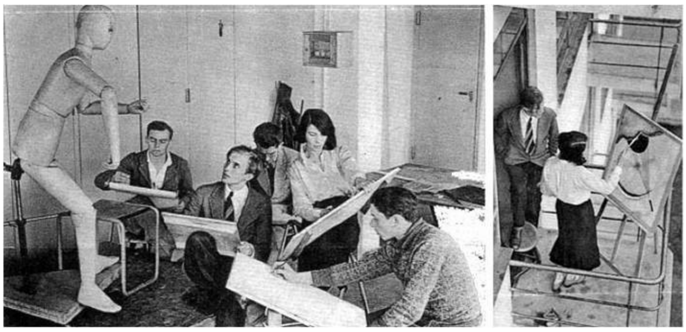


Fig.3. Classes in the Bauhaus School.

The *Staatliches Bauhaus* (1919 to 1933) was the second formal and material emergences of the idea of create a school were design was a discipline that would bring together to architecture all arts and techniques. The system of education was profoundly marked by the idea of a study of the design process as a way to conciliate individual expression with mass-production objects. Originality has a product consumer must be intimately mix with the simplicity of the production methods to be used.

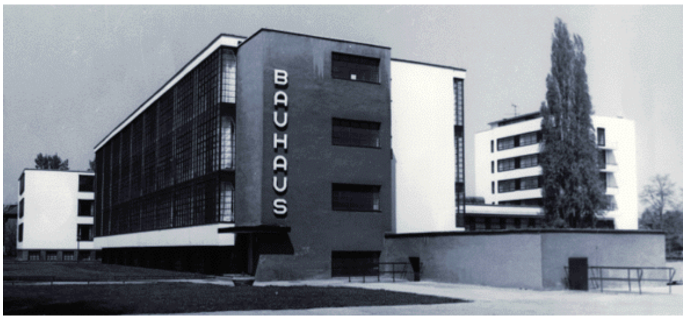


Fig. 4. The Bauhaus Building by Walter Gropius in 1925–1926

Even the previous German school the Deutscher Werkbund (1907-38), formed by Herman Muthesius was already studding mass production way of design and many of the subsequent contradictions between the individual expression and mass-production techniques and between usefulness and beauty were discussed already there in 1914.

Fig.5. The Weißenhofsiedlung Settlement built for exhibition in Stuttgart in 1927 by the government under the direction of Mies van der Rohe.

The same was to happening in Russia with the School of Higher Art and Technical Studios (Vkhutemas) founded in 1920, were the connections between scientific and artistic studies are at the core of the school pedagogy.

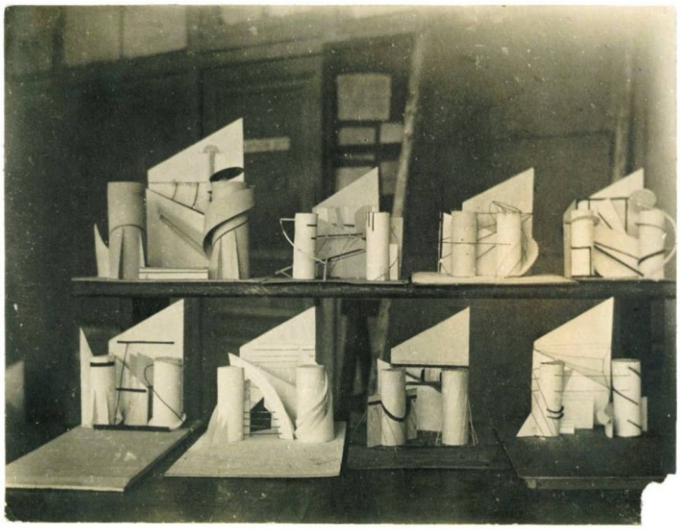


Fig. 6 Exhibitions of students' works on The Revelation and Expression of Three-Dimensional form, late 1920's

Fig.7. Exhibition of student works on the revelation and expression of mass and weight in the lecture hall, 1927-1928

In both schools students must apply for aesthetics at the same time as science, economic production, higher mathematics, physics, theoretical mechanics, descriptive geometry, history of art and architecture, theory of color, construction, ergonomics, and so on. And all this experiences don't have scientific prejudices over artistic ones.

In the rest of the society some researchers start to use de word design in other fields. Operations research brought by radar air-defence studies, synchronization systems for fire-control - air gun and propeller – and automatic piloting with the investigation on curvilinear prediction of flight, introduces words like *feedback* and *pattern analysis* and starts the research in computer and servo-mechanisms – the McColl, L. A. (1946) *Fundamental Theory on Servomechanisms*, was a mark - that lead to cybernetics and to Artificial Intelligence (AI).

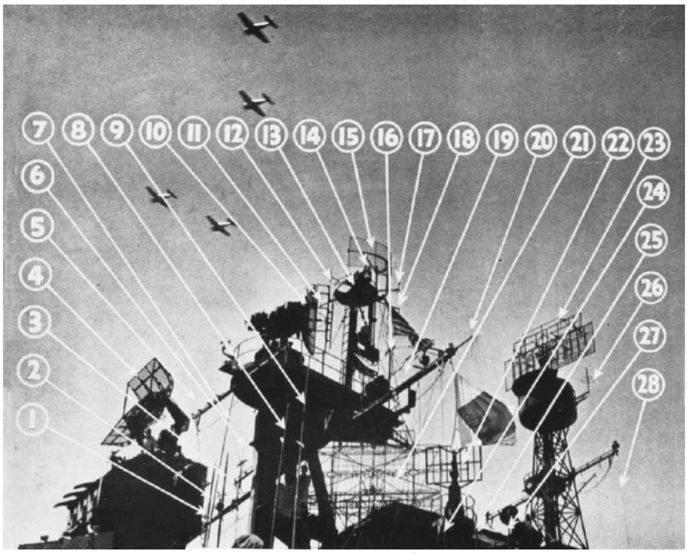


Fig.8. Radar air-defence in the 2nd World War (Wiki)

The article by Rosenblueth, A., N. Wiener, and J. Bigelow (1943) about Behavior, Purpose, and Teleology in the Philosophy of Sciences Journal n.10 was one of the firsts to introduce the idea of programming loop control based on neurophysiology and voluntary activity and starts a more large interdisciplinary research that was coined Cybernetics by Norbert Wiener and A. Rosenblueth in 1947 [1].

The advances on automation design and especially in cybernetics connection with brain operations lead to the fascinating idea that human thought and even creative thought can be design in explicit ways and maybe materialized in automatic machines.

And, when Horst Rittel (1972) said that "the reasons for the emergence of *design methods* in the late 50's and early 60's was the idea that the ways in which the large-scale NASA and military-type technological problems had been approached might profitably be transferred into civilian or other design areas" he his confirming that most of the studies in process have their origin in the political availability of funds and in the progressive fascination for the materialization of the patterns of though.

Formally the *design methods* movement appears in the 60's, after all these experiences, and they focus their attention especially in *design methods* as a subject field of inquiry. They look not at the objects produced but both, to the way they have been engineering and the way they perform and seek to formalize it by diagrams, patterns and schematics. As Bayazit (2004, 22) puts it "the scientific developments during World War II made great contributions to the solutions of

[1] According to these authors the study of J. C. Maxwell (1868) "On Governors" in Proceedings of the Royal Society, No.100 was the first cybernetic study.

design problems, especially in the engineering disciplines." Academics especially from the UK, Germany (Hochschule für Gestaltung de Ulm[1]) and US (MIT, Berkeley) sought to rationalize, systematize and even codify the design process and present it as a scientific method.

OUTPUTS → INPUTS ↓	**2** **Design Situation Explored**	**3** **Problem Structure Perceived or Transformed**	**4** **Boundaries Located, Sub-solutions Described and Conflicts Identified**	**5** **Sub-solutions Combined into Alternative Designs**	**6** **Alternative Designs Evaluated and Final Design Selected**
1 **Brief issued**	3·1 Stating Objectives 3·2 Literature Searching 3·3 Visual Inconsistency 3·4 Interviewing Users 4·1 Brainstorming	3·2 Literature Searching 3·3 Visual Inconsistency Search 3·4 Interviewing Users 4·1 Brainstorming 4·2 Synectics	3·3 Visual Inconsistency Search 4·1 Brainstorming 4·4 Morphological Charts	3·3 Visual Inconsistency Search 4·1 Brainstorming 4·2 Synectics	2·1 Strategy Switching 2·2 Matchett's FDM
2 **Design Situation Explored**		3·1 Stating Objectives 3·9 Data Reduction 5·1 Interaction Matrix 5·2 Interaction Net 5·8 Classification 6·4 Specification Writing		5·4 System Transformation 5·6 Functional Innovation 5·7 Alexander's Method	
3 **Problem Structure Perceived or Transformed**	3·2 Literature Searching 3·5 Questionnaires 3·6 Investigating User Behaviour 3·7 Systemic Testing 3·8 Selecting Measurement Scales 3·9 Data Logging		1·5 Boundary Searching 3·7 Systemic Testing 4·1 Brainstorming 4·4 Morphological Charts 6·2 Selecting Criteria 6·3 Ranking and Weighting 6·4 Specification Writing	4·1 Brainstorming 4·2 Synectics 5·4 System Transformation 5·5 Boundary Shifting	1·1 Systematic Search 1·2 Value Analysis 1·3 Systems Engineering 1·4 Man-machine System Designing 1·5 Boundary Searching 1·6 Page's Strategy 1·7 CASA
4 **Boundaries Located, Sub-solutions Described and Conflicts Identified**		4·2 Synectics 4·3 Removing Mental Blocks 5·3 AIDA 5·4 System Transformation 5·5 Boundary Shifting 5·6 Functional Innovation 5·7 Alexander's Method		4·1 Brainstorming 4·2 Synectics 4·3 Removing Mental Blocks 5·3 AIDA	5·3 AIDA
5 **Sub-solutions Combined into Alternative Designs**					1·2 Value Analysis 3·5 Questionnaires 3·6 Investigating User Behaviou 3·7 Systemic Testing 3·8 Selecting Measurement Scal 3·9 Data Logging and Reductio 6·1 Checklists 6·2 Selecting Criteria 6·3 Ranking and Weighting 6·4 Specification Writing 6·5 Quirk's Reliability Index
6 **Alternative Designs Evaluated and Final Design Selected**					

Fig.9. Input/Output – Matrix John C. Jones, design methods (1970)

So, history of Design Methods has already started when John Crhistopher Jones wrote the paper "Systematic Design Methods" on the Internal Paper of the Associated Electrical Industries or organized, with D. G. Thornley in the same year the *Conference on Design Methods: papers presented at the Conference on Systematic and Intuitive Methods in Engineering, Industrial Design, Architecture and Communications*, in London. But according to Nigel Cross (2001, 45) that conference "is generally regarded as the event which marked the launch of design methodology as a subject or field of inquiry", and is generally known as "the first generation of design methods".

We all know how this faith on machines and on transparency has finished in the 70's in the cultural disciplines. When Christopher Alexander said: 'I've disassociated myself from the field... There is so little in what is called "design methods that has anything useful to say about how to design buildings that I never

[1] This school was cofounded by Max Bill in 1953 and has very interesting curricular areas and spite of the closing of the school in 1968 it was here that starts some of the most critical positions towards the modern movement.

even read the literature anymore... I would say forget it, forget the whole thing" (Alexander, 1971, 5). Was something like saying “the queen is dead”.

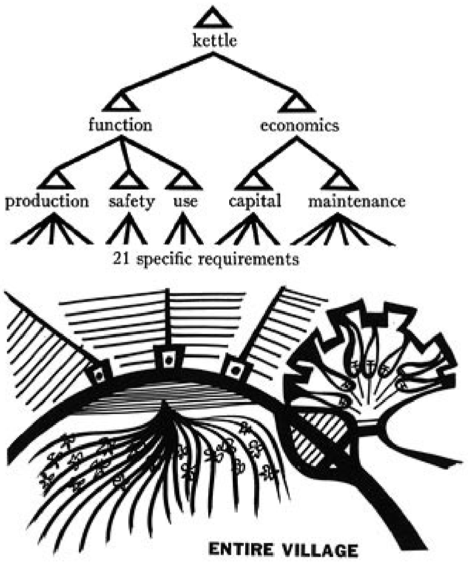


Fig.10. Christopher Alexander: A basic tree of possible requirement sets for a kettle (left). Diagram sketches from the book's appendix, depicting an optimal layout for a rural Indian village (right)

The idea of communication as a fundamental issue in architecture and art seems to have their roots on the Pop Art movement of the 50’s first with Reyner Banham with the British Independent Group and then with the seminar book "Complexity and Contradiction in Architecture" (1966) by Robert Venturi and Denise Scott Brown.

The differences between these two moments of this same movement can be demonstrated by Reyner Banham admiration for technology and expressionism, and by Venturi and Brown refusal of technology as an end and the ideological preference by iconography instead of expressionism.

For Venturi architecture has disconnected itself from the society and from history precisely because she insists on structure transparency, which is abstract and amnesic by nature and by the same tock lacks "inclusion" in popular taste and "allusion" to the traditional architectural values. According to these authors those "faults" are the result of rejection by the modern movements of ornamental iconography in favor of a formal abstract expressionism.

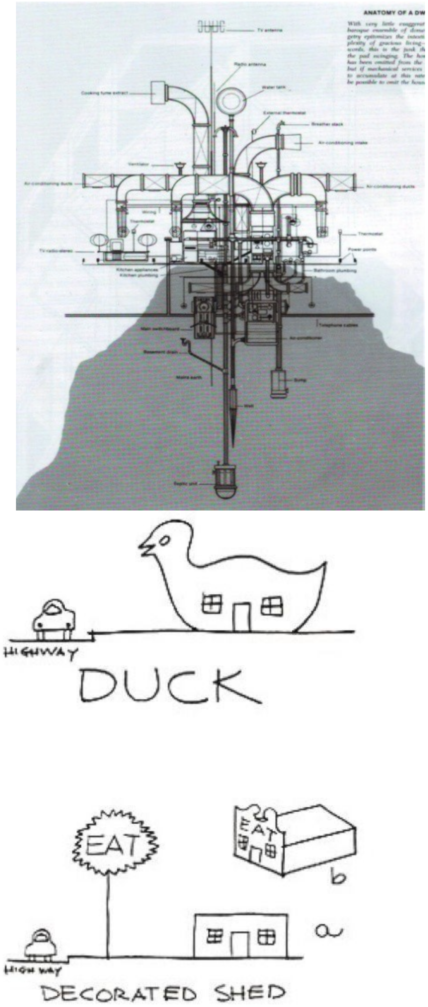


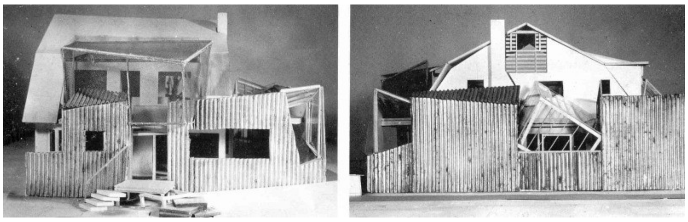
Fig. 11. (Left) The Anatomy of a Dwelling. Reyner Banham + François Dallegret in The Architecture of the Well Tempered Environment [1984]; (Right) Robert Venturi, Denise Scott Brown, and Steven Izenour – The Duck and the Decorated shed in Learning from Las Vegas (1972)

Venturi and Brown develop a very interesting metaphor on their book "Learning from Las Vegas" (...), the idea that architecture seems to present a dichotomy between the "The Duck and the Decorated Shed". For them the "duck" is the modern paradigm, of a design that is an abstract and free structure only subject to an expressionist sculpture that is a sign. And they believe on a postmodern model of a "ornamented box", a building with elevations decorated and communicative and a vernacular interior space. This means that architects should apply ornaments

independents from space and structure, because space and structure are designed to serve the program a vivid space.
Nowadays this dual inheritance between Venturi and Banham has had different answers either in the works of Rem Koolhaas or Frank Gehry.
In the first we find strong influences both from the images of Archigram and from the New Brutalism, somehow in both, the House of Music, or the China Central Television Headquarters CCTH we witness to technological innovations which by themselves create snapshots of urban icons. That is, liberation of structure by modern movement has allowed this structures to became Architectural and urban icon's. In the Seattle Public Library Koolhaas doesn't change the premises of the Venturi argument and assumes the differentiation between structure, now seen as the result of the program and surface as a skin that uncover and reveal parts of the structure. But, this veil pretend to hide the structure appealing to a more attentive look, because it reveals and cover, and by this it presents itself as a production of an architectural icon, in much the same way that the House of Music.

Fig.12. Rem Koolhaas & Ole Scheeren (top left) (2004) Seattle Public Library structural program; (top right) Seatle Public Library skin; (botoom left) OMA (1999 a 2005House of Música, Porto. Perspective view; (bottom right) OMA (2009) China Central Television Headquarters.

Frank Gehry starts his work with a uncommon inventive exploration of materials in their composition that in their hands become almost ready-made objects, as is the case with the almost venturian intervention in Santa Monica, but quickly it moves to the manipulation of structural signs as it happens in both Aerospace Hall (1982-84), the building Chiat / Day and in the Peix Hotel d'Arts (1988-92).
Since the 80's this architect seems to have repositioned the Venturi opposition between modern structure (architecture as monument or Duck) and the postmodern ornament (the sign or decorated shed), exactly Peix Hotel d'Arts in Barcelona, where the box/shed ornament takes again a structural scale of an icon. The Guggenheim in Bilbao assumes completely the unvaluation of the structure by the surface, or if we reformulate the phrase, assimilate the structure on the surface.



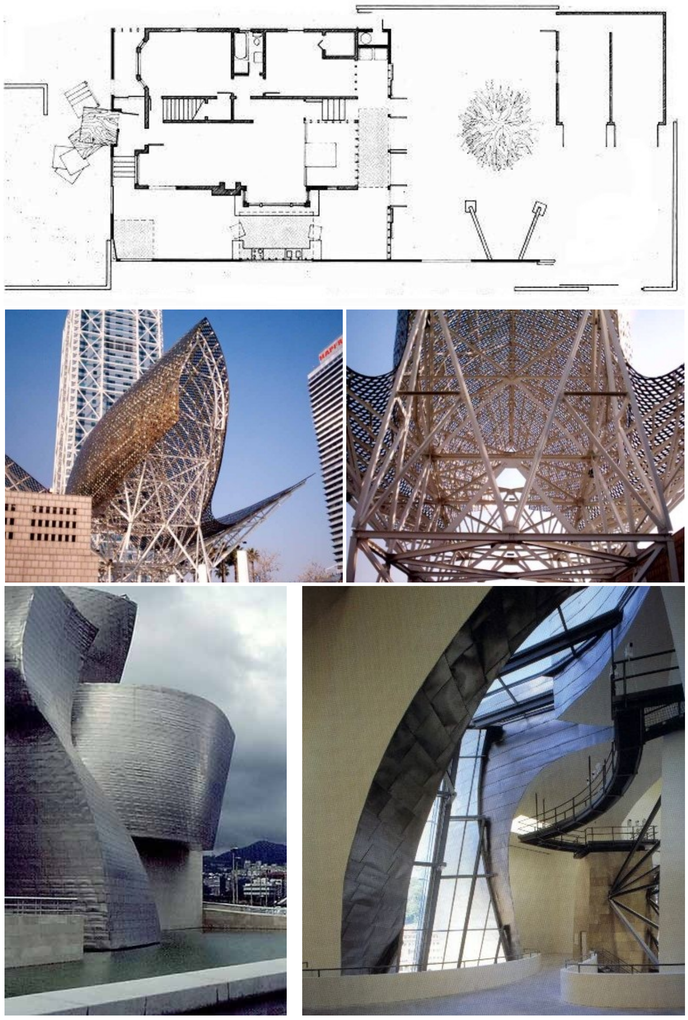


Fig. 13. Frank Gehry: (1978) House in Santa Monica, elevations and plan (top); (1988-92) Fish Hotel d'Arts, Barcelona. View of the surface structure (middle); (1991-97) Bilbao Guggenheim exterior (left) and interior (right) view (bottom).

But, let us return to School and to architectural education.
Since the "design methods" crises in the 70's and since the discontinuity of the Bauhaus and Vkhutemas education system, the development of the consumer society, the progressive renaissance of the ancian Beaux-Arts system, was unuvoiable and academia has been fighting with those internal contradictions. since. Between the Beax-Arts system and the Bauhaus/Vkhutemas system, we see the same contradiction that we see outside the academia, between the idea of a

transparent process of ideas and the necessary seduction of the image.
In the beginning of the 70's the Architectural Association School was the only school that has conditions for a change. Since the rejection of the Baux-Arts system to the "flirty with the pop culture" by Cedric Price and the strongest influence of Archigram with Peter Cook this was the only School that could gone out of the system. And with the End of the process of conformity to the official system of RIBA and the subsequent financial problems, students once again take the school in they're hands and elected Alvin Boyarsky that assume the direction in 1971 until his death in 1990.

Fig.14. Back to school

Boyarsky has taken careful attention to the dissemination of the internal works of students with the annual Projects Review and with the Prospectus book/journal, raising the school profile and publish the work of students on an International scale.
He abandons the all idea of a academic curriculum - that was a hybrid one between the beaux-arts and the remains of Bauhaus structure – given all freedom to tutors to set their own agendas and programs and to follow their own interests and manifestoes. And he specially chosen tutors by their creative ideas and by their media projection regardless theirs academic curriculum. For the first time inexperience tutors have the power to conduct their studios and they doing it using their own professional experience and their own ideas. The list of staff attracted to this brainstorming atmosphere was quite extraordinary, we saw unit studio tutors like Elia Zhenghelis, Bernard Tschumi, Peter Cook, Dalibor Vesely, Joseph Rykwert, Daniel Libeskind and after Rem Koolhaas start in 1975, and Zaha Hadid joining the staff in 1978, etc.
Tutors had to teach and evaluate students work in a different way, not only they took their one professional methods to the academia, but also they must change it in a way they can communicate with the audience.
Instead of only evaluate results they start to evaluate the creative processes and the way concepts are present in the architectural design project. The idea of a research methodology starts to have ways to be communicated.

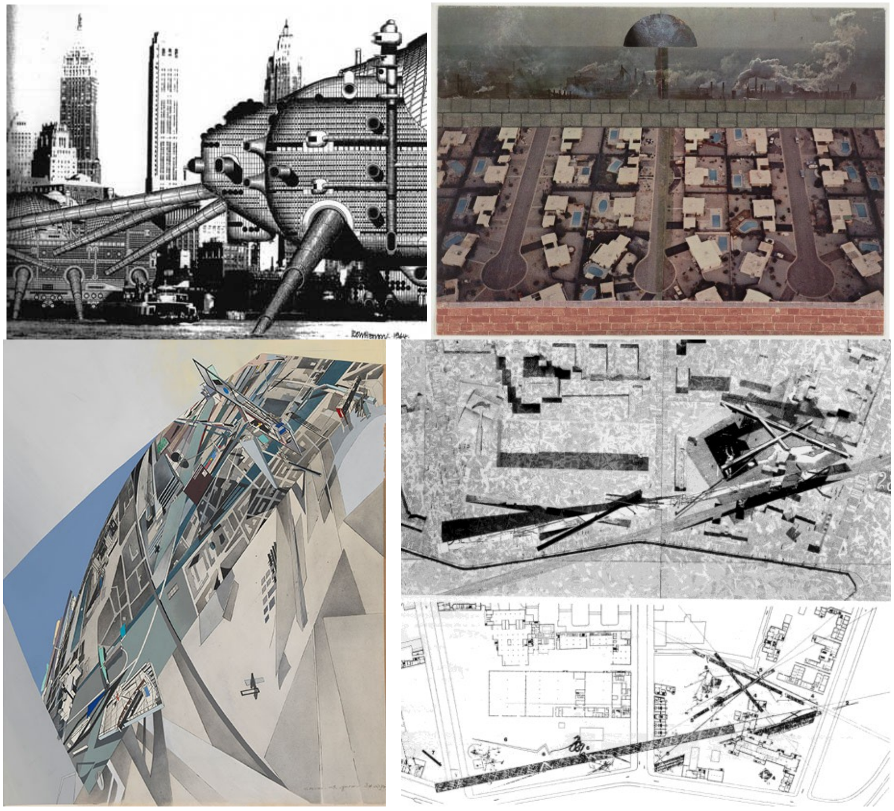


Fig.15. Peter Cook and Archigram, Walking City in New York, 1964 (top left); Rem Koolhaas, Madelon Vreisendorp, Elia Zenghelis, and Zoe Zenghelis, final thesis in 1972 at AA "Exodus or the Voluntary Prisoners of Architecture" (top right); Zaha Hadid "The World (89 Degrees)," 1984 (bottom left); Daniel Libeskind, studies for the edge-city (bottom right)

CONCLUSION

Let us now return to school, to our initial, but now altered, table.

TABLE 2

Research on architecture	
	design through research is the possibility of structure and framing research as design;
	design of research is the intention of structure and framing research as a design process
	research into design is the more classical research about architecture
Research in architecture	
	research through or for design is design-based research
	research on design is design-led research

My hypothesis is to structure architectural research into two main areas, research on architecture and research in architecture.
The first one can be designerly research as design or research about or on the architectural product. Is research that is concern with the building as it is when finished and with his past, present and future behavior, performance, reception, etc. Or the possibility, conscious or unconscious, of structure research through design.
The second one is research in architecture, is research that can be based in design or research on the processes of design. Research not only about the processes and methods used during the designing, but also about the way the research subject emerges in the outcomes of design.
The first type contemplates design through research, design of research, and research into design. In a way it has more to do with fundamental research, but is not confined to it.
The second type contemplates research through design or research for design and research on design. In a way it has more to do with applied research, but also is not confined to it. Design-led research is a type of research that is concern about the study of the nature of the design process, the object of inquiry is design and can be seen also in practice when we are concern with the nature of practice and we want to gain operational knowledge about our own practice. In a certain way is what we are constantly teaching to our students, to reflect in their own design process.
On the other hand we have design-based research that is a research about a specific subject treated in an architectural project. For design-based research the process of design is the pattern used as a research methodology and it seeks to gain new knowledge partly by the creative means and the outcomes of the artifact created.

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INNOVATIVE APPROACHES IN ARCHITECTURE AND PLANNING THE FUTURE OF OUR PAST.

Dr.Bouzid BOUDIAF[1]

ABSTRACT

Historic Arab cities show a variety of origins and modernization patterns; these were conditioned on the one hand by external factors such as pre-existing settlements, deliberate locational choices and prevailing dynastic modernization and transformation, on the other hand by internal factors such as the morphological principles implied in individual architecture components and in genesis of the urban environment.
In this paper, we will try to highlight the socio-cultural aspects in the city structure context and their relations to the city morphology referring to the underlying shaping forces of urban form which, drawing on related, deep-rooted human attitudes, constitute the real agents of physical manifestation and are source of the non-material qualities transpiring through materials expressions.
This presentation seeks to understand the significance of the city structure in different dimensions of urban environment. Understanding the interaction between underlying political, economic, socio-cultural forces as deep structure elements is an important aspect of research objectives. This paper also studies how physical or functional changes follow changes in the underlying forces among the modernization process and city structure regeneration.
The approach to the research objectives is based on two methodologies:
• Deductive: a theoretical investigation based on the properties of the city structure, definitions, principles of design, and the dilemma of achieving modernization is as much cultural as technical. This combines information from literature reviews and the ideas of key figures in the urban development field and the place-identity, social identity and identity process as theories for cultural models of the city.
• Inductive: a study of Algiers as example of historical settlements that have undergone much change processes. The study looks to elicit the images of the city main structure to support the theoretical propositions of surface and deep structural city elements. The conclusion to this part is based on an analysis of the case study.
The research concludes its conclusion through the theoretical and empirical work
the socio- cultural aspect in the modernization process as a board and complex field.
Moreover, it introduces the concept of *City Structure* as a new way to envisage urban Conservation studies.

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Key words: Architecture, Culture, Urban design, Conservation, Sustainability.

1. INTRODUCTION:

The last decade of the XX century was marked by deep economical and political changes provoking some irreversible transformations in the socio cultural organization and the physical structure. These changes can be explained by the failure of the economical models on which were worked out the different policies of development and principles of growth and management.

The economic models of Ford and Keynes were replaced by the new economical order, which is characterized by a new economical logic based on the accumulation of the capital. This new order led implicitly to the process of restructuring economy through the emphasis of the specialization and the flexibility. Implicitly this new order led Algeria to readjust the political and economical environments in the hope to be in adequacy with the project of globalization. This readjustment is based on the rationality, and is materialized through the management of the human resources and the territorial planning at different scales and levels.

In 1997, the Algerian population reached 30 millions, a figure which is expected to rise by another 5 millions by the year 2010. More than 50% of the population is living in cities (Algiers alone represents almost 20% of the urban population), which represents more than 100% increase in city dwellers in a period of less than 20 years.(Bearing in mind that 25% of the dwellings have been built between 1999 and 2005 and for the other 75%, 2/3 of them necessitate whether a rehabilitation or some maintenances)*. The impact of this rapid urban development is that large areas of almost all the Algerian cities, situated in the North of the country, look the same. **So do Algerian cities look Algerian and if they do what makes them look that way ? As a result, the city of today differs from its past in several respects : size and scale, street layout, land use patterns, architectural style and type of housing**. Traditional urban form and building which would have provided information about regional and national identity have been largely replaced by forms characterizing the international and universal buildings and spaces. These changes have altered the city's form and have given rise to questions about the impact of these changes on the image of the city in terms of size and cultural values. So the concept of urban space becomes a determinant of the ability of planners, architects, engineers and administrators to provide an environment which is adequately structured to avoid chaos and to maintain an acceptable quality of life.

2.STRUCTURAL TRANSFORMATION OF THE CITY:

The objective of part one is literature review that builds up a conceptof the city main structure properties particularly in the process of urban transformation based on the structuralism approach which defined a structure as a system of transformation. The proposed structural approach to urban transformation of the built environment in this research is coming from an awareness of the meaning and concepts of city structure, city center and city evolution, comparative studies on the ideas of the theory of structuralism, are presented. These cover descriptive, explanatory and analytical discussions. Structural transformation is the major property of the city structure. The mainsource of transformation in cities is its city main structure. The city main structure is responsible for growth, development and finally, transformation of a city. Its impacts on the evolutions of the whole city, on transformation of pattern and variety of land uses, the physical growth, and its impacts on urban environment sustainability are under consideration in this part.

2.1 Structuralism:

The significance of structuralism is to look into knowledge as an entity. The concept of structure is used in a variety of academic disciplines and cross-cultural contexts to question form, order, systems and transformation. Structuralism proposes in essence the reconstruction of what is already known. Piaget (1968) claims that there are two important differences between *global* structuralism and the *deliberative*, *analytical* structuralism of Levi-Strauss, where the former speaks of *laws* of *composition*. Durkheim's structuralism, for example, is merely global because he treats totality as a primary concept explanatory, as such, the social whole arises of itself from the union of components, and its emerges.

2.2 General concepts:

The views on the process of changes in a city and its main structure consisted of various interpretations. The general term mostly used is change. The hypothesis based on the major differentiations between the term *change* and *transformation* that become very clear in the modernization processes in the urban environment for Arab cities. The other terms are growth, evolution, and development. The meaning of these terms for urban concept is derived from its common meaning.

2.2.1 Change

The meaning of change covers various ranges, from change with physical manifest to changes in activities or even economic or social-cultural characteristics. City systems and their elements can change through cultural and educative process. It is this form of change that is significant. It can, of course, imply direction, as though it is a product of conscious thought (Larkham; 1999). Human settlements are continually changing (Lang; 1994). The physical interpretation is the most perceivable form of the changes. Kostof (1992) reaches the conclusion that in cities, only change endures, that all cities are caught in a balancing act between destruction and preservation. The scale of change either physical or functional varies from a single element, which is the building as an urban unit, to the scale of the global form of the city. The changes could be organic or planned. There is necessity for changes in cities, as Lang (1994) claims, for, inevitably, changes in the public realm create new opportunities and new problems resulting in the need for future changes. The cycle is endless.


1830
1833
1846
1880
1895

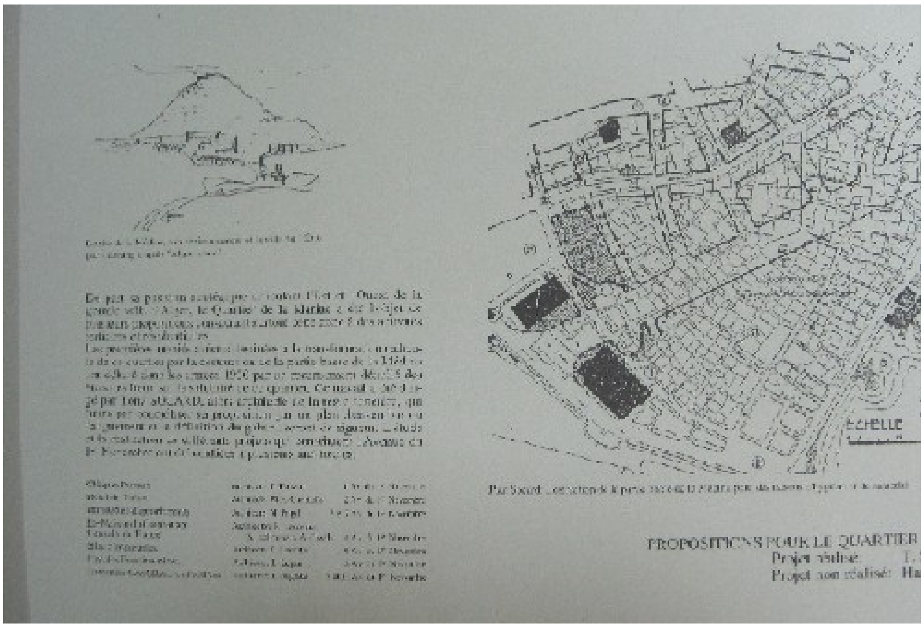


Figure 01. The Europeanisation of the traditional Islamic city of Algiers started by the French (1830-1962) in attempt to eradicate its Islamic identity.

2.2.2 Transformation:

Transformation is the most central characteristic of a structure. According to structuralism (Piaget, 1968), structure is a system of transformation, which generates and is guided by its inherent laws. The three key ideas of wholeness, self-regulation, and dynamism are tied together through the process of transformation in the structure. Transformation in a city occurs because of norms, semantics, and knowledge that are inherited in the social phenomena of that place. Transformation in a city structure is a result growing awareness of man and society. Transformation increases the complexity of system, always guiding it from simpler to a more complex system and structure. The continuity of the process of transformation relies upon patterns of surface structure, which is defined by the whole physical characteristics of the city.

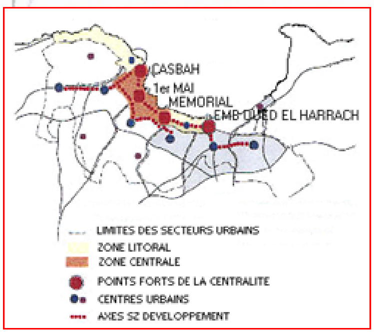


Figure 03. Political, economic and physical
Figure 04. Algiers transformation, an integrated developments combined to transform urban development with the old city the city of Algiers in 1985. Structure (GPU developed in 1990s).

2.3 The city structure:
The city structure is based on a whole entity; it is a global structure, which provides the relation among local structures of various areas. It gives both a sense of identity to, and a grasp of relations between the parts and the whole. Continuity is a physical property of the city if it is used to integrate the whole territory of the city. The city, as a spatial system, consists of a complex and bounded whole, encompassing a set of activities or constituent elements and the relationships among those elements, which together make up the system.
The way a city can cope with all pressure, changes and express the self-regulation, depends to how city manage to transform, to increase and enrich the city as a system with clear distinction between change and transformation. In the simplest terms, change is imposed; it is not from within, whereas transformation uses the resources inherent within the structure to enrich itself and its identity.

Figure 05. Urban transformation mechanism for surface physical elements

2.4 Structural transformation:

Cities have to transform and they do constantly transform, but when the change are inconsistent and unconscious of the plurality of the existing city structure, they inflict damage on the principal rules which govern the city structure, in spite of any partial survival of the structure. Regarding changes in structure, Bourne (1982) states that a structure can becomestatic, in which case it has to be broken in order to grow, or it can be dynamic, thereby, permitting growth without obsolescence.

Structural transformation in a city clarifies the internal organism and mechanism of its growth and development through dynamic internal change. In this transformation all the relevant parts of the city interacts as a whole with its organization. The result of structure transformation is preservation and improvement the whole city structure global and local- properties and performance, also; the common result of structure transformation in city main structure is shifting the role of the traditional integration core in urban life.

A city, however perfect its initial shape, is never complete, never at rest (S.Kostof, 1991).

3. CITY STRUCTURAL TRANSFORMATION: A SUSTAINABLE PROCESS FOR URBAN ENVIRONMENT MODERNIZATION

A structure is considered to be an abstract set of formal relations underlying the greater manifestation of observable forms. Eiseman distinguishes a *surface or perceptual structure* and a *conceptual or deep structure*. Deep structure is specified as an abstract underlying order of elements that makes possible the functioning of transformational rules. The surface structure is the transformation of a deep structure.

3.1 Underlying forces within the city structure:

According to structuralist paradigm, transformation within any kind of structure takes place because of underlying forces and mechanism of how these forces work together. For the city structure these forces could be interpreted as deep structural elements.Underlying forces are densest in the city main structure. All kinds of transformation like cultural transformation are more evident, powerful and more effective within the city main structure are the concentrated laws for cultural activities and monuments, attraction for people coming to these places and so places of greatest interaction between them. Consequently the city main structure is the place that the power of whole underlying forces emerges. The surface structural elements, like different places, buildings, and activities are the way the society responds to the forces embedded in the city main structure.

3.2 Principles of city structure sustainability:

"Sustainable architecture involves a combination of values: aesthetic, environmental, social, political, and moral. It's about using one's imagination and technical knowledge to engage in a central aspect of the practice -- designing and building in harmony with our environment. The smart architect thinks rationally about a combination of issues including sustainability, durability, longevity, appropriate materials, and sense of place. The challenge is finding the balance between environmental considerations and economic constraints. Consideration must be given to the needs of our communities and the socio-cultural paradigm that helps the urban transformation during the development and modernization process in the Arab cities. *The following principals are the major aspect to achieve the sustainable city structure:*

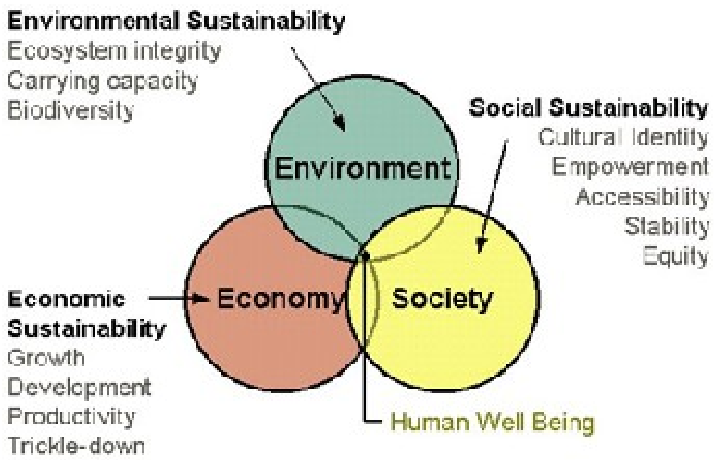
• *Understanding Place* - Sustainable design begins with an intimate understanding of place. If we are sensitive to the nuances of place, we can -inhabit without destroying it.

• *Connecting with Nature* - Whether the design site is a building in the inner city or in a more natural setting, connecting with nature brings the designed environment back to life.

• *Understanding Environmental Impact* - Sustainable design attempts to have an understanding of the environmental impact of the design by evaluating the site, the embodied energy and toxicity of the materials, and the energy efficiency of design, materials and construction techniques.

• *Embracing Co-creative Design Processes* - Sustainable designers are finding it is important to listen to every voice.

• *Understanding People* - Sustainable design must take into consideration the wide range of cultures, races, religions and habits of the people who are going to be using and inhabiting the built environment. This requires sensitivity and empathy on the needs of the people and the community.



Social dimensions of **Environmental dimensions of**
Economic dimensions of
Sustainability **sustainability**
Sustainability
• Reduced waste, effluent Inhabitants health and safety
Creation of new markets and
generation, emissions to
opportunities for sales growth
environment Impacts on local communities
Cost reduction through efficiency
• Reduced impact on human quality of life;
improvements and reduced
Health Benefits to disadvantaged groups
energy and raw materials inputs
• Use of renewable raw e.g disabled
materials Elimination of
Creation of additional value.
toxic substances

Figure 07. Three dimension for environmental sustainability .
Source: http://www.arch.hku.hk/research/BEER/sustain.htm-31/12/2005

3.3 Socio-cultural force as a deep structural element:

The underlying forces are the elements of the deep city main structure while the physical elements are the elements of the surface structure. Interaction between the forces is manifested on the surface characteristics. That interaction is based on laws of composition as city structure property. Transformation in the surface elements among the city structure leads to survive the responsiveness of the city. The central concern in any study of the city structure should refer to the interrelationships of the underlying forces.

Physical environment determinants, social needs, demographic pressure, culture and religion, political issues and technological development, could be considered assome of these underlying shaping forces. The inherent power of sustainability and responsiveness, even after the worst periods of deterioration, can be considered as the self-regulation of the structural property and the process of transformation. This is dependent on the interacting mechanism of socio-cultural forces and on the balanced status between them.

3.3.1 Social forces:

The social force is a driving force. It embodies in human beings the desire to socialize and belong to a society. People are unconsciously aware of the social forcesand accommodate them within the settlement structure and then interpret them onto the surface structure, to the spatial layout of the settlement structure. The need unconsciously embedded in the human soul to socialize, are fulfilled by formation of city structure.

Social structure determines the social distribution of space and the evolution of urban spatial. Even the appearances and physical organizations of objects in public spaces depend on the social forces, because these kinds of spaces within the city main structure are supposed to be the containers for social life. Social relationships address the dynamism and transformation within urban environment and the social communication.

3.3.2 Cultural forces:

An important aspect of culture with considerable impacts on city structure, especially the city main structure, belongs to religion in its many interpretations across time. Religious should be considered intrinsic in human life. Religious beliefs are the context of culture and at time have had the highest degree of influence onhuman civilization, and consequently on major urban objects. It many instances religion was so predominant in the physical structure of the holy cities as to be the very essence of them.

3.4 Sustainable urban principles of the Arab city structure. A sociocultural view.

A number of factors played decisive roles in ordering and shaping the plan and form of Arab and Muslim city. In addition to the influence of surface structure factors, local topography and morphological features of pre-existing town, the

Muslim cityreflected the general socio-cultural, political, and economic structures of the newly created society. Saoud (2001) defined the concept of quality of urban environment in terms of both "sustainability", and "city structure" quality, based upon the sociocultural paradigm; In general this involved the following:

• *Natural Law*s: The first principle that defined much of the character of the Muslim city is the adaptation form and plan of the city to natural circumstances expressed through weather conditions and topography.

• *Religious and cultural beliefs*: The religious beliefs and practices formed the center of cultural life for this population, thus giving the mosque the central position in spatial and institutional hierarchies. The cultural beliefs separating public and private lives regulated the spatial order between uses and areas.

• *Design principles stemmed from Sharia Law:* The Arabic Islamic city also reflected the rules of *Sharia* (Islamic Law) in terms of physical and social relations between public and private realms, and between neighbors and social groups.

• *Social principles:* The social organization of the urban society was based on social grouping sharing the same mentality, ethnic origin and cultural perspectives. Development and modernization were therefore directed towards meeting these social needs especially in terms of kinship solidarity, defense, social order and religious practices. Factors such as extended-family structures, privacy, sex separation and strong community interaction were clearly translated in the dense built form of the courtyard houses. The social organization of the urban society based on social grouping. Social and legal issues were taken over by religious scholars who lived in central places close to the city main structure which contains the mosque and the public life were disputes mostly arose.

4.URBAN GROWTH OF ALGIERS: FROM A TOWN TO THE METROPOLIS

Just as many other cities do, Algiers comes from a small town on the coast, encircled in walls and surrounded by fields. Until late in the XIX Century, these walls were used as a separation between the urban center and the small villages and « summer residence » or Fahs.

Table 1: Algiers :Repartition of houses, dwellings and villas in 2003. (Reference : Laboratoire de Geographie et d Amenagement Urbain, University of Science and Technology « Haouari Boumediene »)

	Block of flats and apartments	Villas and individual houses	Traditional houses	Ordinary dwellings	Temporary houses	None declared	Total
Units	1632682	148550	42839	4018	22744	3511	385344
Percentage	42.45%	38.55%	11.12%	1.04%	5.90%	0.9%	100%

Algiers in Arabic means a group of islands, during the Phoenician period, the land of Algiers was used as a trade post for the sake of commerce. In the Roman times, Algiers was called Icosium, was an unimportant city comparatively to Cherchel or Tipaza. In the tenth Century, Bologhine Ibnou Ziri founded a permanent settlement which developed into the Casbah and port of Algiers. After Algiers, during the Ottoman period and particularly with the Barbarous brothers (Aruj and Kheireddine) whom developed the maritime commerce by developing the port and the city was known as the headquarter of the most successful arm of the Ottoman fleet.

The Casbah of Algiers and the localization of the so called the « citadel » is an illustration of the basic condition of urbanism. The « citadel » (or a mini - city within a city) retain the symbolic centrality as it was the ruler’s refuge and in the same time, it symbolized the administrative and military center. The space in the medina is a particular and specific conception that can be perceived as a positive actuality of volumetric form and the prerequisite medium from which the whole fabric of urbanism should emerge. This concept of space is prototypical and its essence is discernible in different spaces and situations of the Casbah.

Another criteria very important in the case of the Casbah of Algiers is the topography, this criteria not only shapes in some respect forms and spaces of the medina but determined also the localization of buildings such as the mosques, the palaces and the « citadel ».

During the French occupation, the extension of the city has grown up around the medina, there was a spatial separation between the ottoman and the French urban spaces excepted the center of power called « the marina district ». At the French occupation , the walls were pulled down after 1832, the fortress in the Casbah dismantled, and the strip of fields had been urbanized following the military project developed by " **le genie militaire**" and whose works started by 1860, known nowadays as « Municipality of Algiers ». This area had been incorporated as part of Algiers with an important symbolic, social and artistic role, taking the part of a functional center the same as the old nucleus had always been.

Later, with the introduction of a new mode of transport (railway), those small centers in the surroundings (particularly the districts called :Mustapha Supérieur and El - Hamma) got integrated formally into the city by 1880 , these areas received at that time all the industrial activities (due to their proximity to the railway and the port). However, some of them remained as summer residences like the district of El - Biar, and others as subsidiary centers like Bir Mourad Rais or Bouzaréah.

In the beginning of the XX Century, a new style of architectural language was developed. From the architectural and cultural points of views, this style called the **Arabisance** referred to the traditional buildings.

From 1930 until the recovery of the independence, Algiers served as an experimental area for the development of ideas reflecting the vision the city as claimed by of the Modern Movement.

In the 1960's, Algiers was estimated for almost 500.000 inhabitants, and due the departure of the colons and the arrival of lots of immigrants, the city grew extremely, with speculation and without a general project concerning construction among the centers. Suburbs grew without any more identity than that of being built in the same physical space. As a result, the city of today is entirely and completely different from what it was in the past. The physical development can be characterized by its insensitivity to cultural values, and its ignorance of typological and morphological features.

This development exposed Algiers to another problem which is the conservation of the traditional city. As masses of people had migrated from rural areas and from the mountains to the city; so in addition to creating squatter settlements on the outskirts of the city, the migration had and still is one of the reasons for the deterioration and destruction of the traditional city. The main aspects that can explain the deterioration of the medina are the densification and the judicial status of the houses.

In the 1970's, the decision makers of urban development focused on the distribution of functions by applying the Zoning, they tried to balance concentration of activities in the traditional city by a policy of decentralization and progressive endowment of peripheral dorm areas with qualified services both at neighborhood and urban scales.

The growth and extension of Algiers were oriented to the East side of the city, and many civil public buildings and housing were realized such as the U.S.T.H.B(University of Science and Technology « Houari Boumèdiene » at Bab - Ezzouar), thousands of dwellings were built particularly on the sites of Bab - Ezzouar, Bachdjarah and Bordj - El - Kiffane. At the end of that decade, the government realized that this development were done on the most fertile land from the agricultural point of view, so the decision was taken to reorient the development to the South - East. This orientation allowed the planners to suggest the delocalization of the industrial activities situated in El - Hamma and they proposed to increase the density of this district with high rise buildings developed principally as offices.

In the beginning of 1990's, the development was oriented on the basis of new laws in which the inhabitant should be involved as a participant. This development took into consideration what was launched in the 80's. The Master plan of the 1990's called the P.D.A.U.(Plan Directeur d'Aménagement et d'Urbanisme) was established on the following hypotheses :

The preservation of the traditional city or « la médina » ;

The densification of the districts El - Hamma and Hussein - Dey ;

The development of the main and important civil public buildings on the same virtual axis;

The objectives from these hypotheses were the development of a linear centre with a multi poles, and each pole should have a vocation. These poles are:

A historic pole represented by the Casbah reflecting the heritage of the Ottoman period;

The district of « Premier Mai, El - Hamma » were destined for tertiary activities, with the main buildings determining the notion of centrality in the city ;

The third pole « The memorial » was much more symbolic with political and cultural buildings;

The fourth and the last pole in the East side and opposite to the medina should contain the financial buildings, it represents the C.B.D.

In 1997, the city of Algiers was reorganized and it had a different status comparatively to the other cities of the country. Algiers was elevated as a gouvernorat and the limits of territory of this governorat are four times of what it was before when it was considered as a wilaya. The administrative authority had carried out a new structuring project called G.P.U. of the G.G.A.(**G**rand **P**rojet **U**rbain du **G**ouvernorat du **G**rand **A**lger). The approach adopted in this project is based on the polarity of the city. Six poles were identified, so the territory is divided in six areas and each one had a vocation that should able the city to be competitive at the international level. Before the enumeration of these vocations, we must emphasize that this development focalized principally on the coastal areas. The six poles can be summarized as follow:

Pole one contains the medina and the first colonial center with the port: Cultural vocation;
Pole two composed of areas where their urbanization were done between 1880 and 1924, and during the French occupation, these areas were designated to industrial activities. The districts are: 1er Mai; El - Hamma and Ravin de la Femme Sauvage. The vocation of this pole is administrative activities;
The third pole nearby the second and presenting almost the same characteristics as the second except the slums which were developed along side « Oued El- Harrach and the industrial area of Oued Smar ». The pole contains the following districts : Caroubier, El - Harrach and Pins Maritimes, this pole should be developed for cultural and sportive activities ;The village created in 1860 juxtaposed to a group of buildings used, during the ottoman period, for military defense. This village was created for agricultural exploitation, and the development was oriented towards the agricultural activities and not to the sea. The districts of this pole are : Bordj -El - Kiffane ;Lido ; Verte Rive and Stamboul. The vocation was cultural and tourist activities.
The fifth and the sixth are situated at the West side of the medina, the others mentioned above are in East side. So these two pole composed respectively of Cap Caxine for the fifth and El - Djemila ; les dunes and Zeralda for the sixth which was designated for touristic and business activities. The main activities retained for the fifth were for tourism.

Table 2: Algiers: The urban development of Algiers through the statistics. (Reference: Laboratory of geography and urban design,
University of Science and Technology « Haouari Boumediene », 2003)

	Population in 1966	Population in 1977	Population in 1987	Population in 1998
Designation	Grand Alger (according to the repartition of 1959 called Constantine's Plan)	Grand Alger (according to the new repartition of the national territory of 1974)	Grand Alger (according to the new repartition of the national territory of 1984)	Gouvernorat d Alger
Number of municipalities	10	13	28	57
Area	170km2	186km2	250km2	870km2
Population	1094851	1641521	2015374	2562428

We should say that for the last three poles that besides the lack of urbanistic structure - which obviously implies a lack of structure in the identity of the physical space, we must mention that most of these areas have developed during the post - colonial period and according to their potentialities, they present a poor development of the tertiary sector and almost no development of the services related to their status and localization from a regional point of view. Another aspect characterizing these poles is that most of the families living in the periphery are immigrants, they left their villages or lands for economical reason or they were searching for security. So they weren't interested in getting integrated and identified with their social environment.

This manner of structuring the city of Algiers was rejected, in 1999, by the president himself as it could lead to physical and social segregations. After the rain fall and the earth quake, the city council has been carrying a series of urbanistic interventions in the entire city: shaping of urban spaces, creation of some new ones trying to provide them with symbolic elements. The result is that any void was treated whether as a greenery space or an open space (I won't consider this open space as a plaza because the main reason for this space was emergency and not as a space for gathering or playing and without taking into consideration neither the climatic aspects nor the proportions between masses and voids).

5. ELEMENTS OF UNFRIENDLINESS: THE URBAN MORPHOLOGY BASE

Several causes contribute to the inhospitality of the present urban environment. Most of them depend on the physical organization, the appearance of the city and therefore on the way it is planned and designed. Once again one set of problems rests on functional instances. The modern city envisioned as "machine a habiter", does not work properly; congestion of traffic, poor hygienic standards, and high pollution levels are some of the indicators of this phenomenon.

It can be assumed that the urban morphology can be approached through the analysis of certain specific character of the built environment. They deal with quantity of the distribution of built vs. inbuilt and private vs. public in the urban scenario, first of all in its two - dimensional organization on the ground plane. They include, also, the third dimension as the physical appearance of full vs. void, and further set of elements which deals with the dynamic aspect of the environment, i.e. with the activities that dwell in that environment, seen in their qualitative aspects, from the point of view of their appearance.

5.1 Characteristics of the Medina:

The first and most characterizing elements of the traditional city is the organization of the urban fabric through the selection of built vs. inbuilt or in other terms, of volumes vs spaces. From a quantitative point of view, it relates to density and in particular to coverage, to distances and in general terms, to dimensions. It addresses the issue of a perceptual permeability. The most effective attribute of the urban environment is given by design of the boundaries between the realm of the empty space and the realm of the volume and by the syntaxes of the two entities. Related but non coincident with the figure ground is the block street pattern which highlights the articulation of the public domain versus the private. It deals with permeability, too, in physical if not perceptual terms.
The character of objects and non objects that we assume and anticipate for volumes and spaces in the two dimensional configuration, actually comes on stage with the third dimension. Height and shape of volumes concur with their layout to determine the physical quality of the urban environment. Bulk characterizes the volumes both in term of masses, height and profile, and of forms, skyline, setbacks, overhangs...etc. Bulk is further characterized in its spatial envelope by more specific architectural features such as colors, materials, patterns, textures, linguistic

elements ...etc. Both bulk and architectural features contribute to determine the image of the city and its ability to carry hidden or direct messages of comfort, security, calm, dynamism, as well as recognition and orientation.

5.2.Evolution of the urban morphology:
A quick overview of the basic and most recurrent character in the form of urban areas, classified by different origin (traditional or pre – colonial, colonial and post – colonial or contemporary), may help to identify the major relations between morphotypes of fabric and their performance in the general terms to quality of life.
1. in most cases figure ground and block street pattern almost coincide (with small blocks) or private spaces are internal (in larger blocks) and visually disconnected from the public network of streets;
2. Public spaces are immediately and continuously flab ked buildings and clearly defined;
3. Blocks are usually smaller;
4.The street pattern is highly structured and hierarchically organized (despite an apparently irrational organization of it): connector streets (both straight and meandering ones) link without discontinuities major parts of the city, piazzas sit along or slightly off them, distributor streets are smaller in length and width and often winding.

In the beginning, it has been underlined how the growth of the colonial city has destroyed or deeply spoiled the harmonic equilibrium of the traditional city.
In comparison with the traditional city, the expansion of the colonial city shows several new elements:
1. The street pattern appears more regular and geometrical;
2. Streets are wider and often enriched by tree lines, squares are wider and regularized.

Recurrent characters of the contemporary city layout are much more difficult to define. Pluralism of formal styles has found its analogous in different attitudes towards the organization of the physical environment. In the largest amount of cases, however, a few common characters can be selected:

1. Coverage density decreases, that is in the same quantity of land a smaller percentage of it is built on or, in other terms, the same quantity of built coverage is spread over a larger area;
2. Figure ground and block street tend to differ greatly: the organization of volumes is discontinuous; several built areas correspond to one large block;
3. In most cases the structure of the layout appears random, in other cases volumes are organized in a more or less geometric fashion;
4. Spaces are hardly ever designed either in a simple, recognizable or in a more complex way;
5. In many cases blocks assume leftover forms, derived from the disposition of the street pattern laid out after the circulation system needs.

The passage from the city of the recent past and the outskirts produced by our age is a radical shift. It reflects the character of an epistemological break: the conception of a volume oriented city vs. the tradition of the city organized by spaces. The traditional city keeps clear difference between residential buildings and institutional monuments, a formal consistency to a selected number of types in the former, a larger set of solutions for the latter. Heights of residential buildings are contained in a limited range. Street walls have rarely dramatic changes in height and being formed of different buildings (smaller in the traditional, larger in the contemporary city), they show a complex variety. Architectural features which derive from local style, construction process and materials give a formal unity to the whole and relate appearance of the physical environment to geographical areas. The typical contemporary city has no street walls. Its appearance is made of separated volumes under light as Le Corbusier had anticipated. Streets are formally undefined circulation tools. Proper piazzas do not exist being substituted by shapeless traffic intersections.

5.3. Irreproducibility of the traditional city:

The traditional city is more livable than the contemporary one because of the way spaces are organized, its volumes are put together and their surfaces are treated, and, in general, the way it was built. There is no room for nostalgia, however, the traditional city is irreproducible, but not because of the stylistic intolerance of the modernistic attitude.

The situation we have to live with is made of more stable realities. The first one is almost obvious: the functional performance we ask of a city today is out of the reach of the pre - colonial city in terms of concentration, growth, circulation, activities...etc. The second one, less obvious but as relevant, we need to consider in any attempt to improve the built environment. It has to do with the changes in the production patterns which have been drastically modified without any analogous adaptation to the design and the control system.

Size and modalities of intervention by which the city grows have radically changed. Times of urban modification make the city dynamic jump in a different qualitative reality. Furthermore, from a construction industry point of view, the economic background has induced a rapid evolution of the market. The special nature of the product and its unusual life cycle seem to have represented restraint for the maturation of the market itself. Finally, from the point of view of public control, the tools that have been used so far, most of them informed to a limitative attitude, have proved to be inadequate to maximize the benefits of private and public investments on the public at large.

Between the end of the last century and the beginning of the present one, the ideal city started to look with progressively larger attention at images of the future as a reference for its organization. With the globalization, the architectural production is developed by what I consider the new stars or the new "elites" . Among the leading characters of what I consider as a reform, space, culture and history are directions towards which studies should headed? By doing so, we will recover values and positive characters of the traditional city while taking advantage of the technological progress. The architects and the common sensibility are rapidly evolving together with an increasing participation of the public to design process. Now that the collective consciousness is ready to back a new positive attitude towards designing and building the urban environment, the main themes rest on the tools and ways to achieve the expected results. Some of the tools that seem to have recently been the most effective from the public use and enjoyment point of view are related to the internal methodology of the discipline, the design process and before all, to the principles from which the designers's activity springs. Some others deal with the legal procedural frame tiding together the three main groups of actors in the urban development processes.

The building is composed of different elements which have different longevities. So :it is necessary to distinguish;

Elements that do not need maintenance (foundations, pillars, beams, walls...etc.);

Elements that necessitate a minimum of maintenance such as the interior paneling;

Because of the usury, some elements need to be renewed periodically (faucets,

carpets...etc.);
Elements that have to be renewed due to mechanical factors (motors, fans, floodgates... etc.) or to the physical and chemical factors (asphalts, joints, painting... etc.);
Elements that have to be replaced while they continue to assume their function (sanitary devices, electric facilities... etc).

DISCUSSION:
It is clear that improving the maximum of the existing housing will not resolve the problem of habitat, the need for the construction of new lodging is inevitable. The new production contributes partially to this improvement, and we can say that the new lodgings will represent a yearly growth of about yearly growth of the order of 4% of the real estate park.

The rehabilitation and the modernization revalue the heritage. While either preserving or raising the habitability of the units to an acceptable level, we can in this case, maintain a balance between the demand and the new construction and the available resources to construct them. The nature of the heritage, the reality of our habitat make that the maintenance and the modernization should be treated as one of the activities of the construction. The improvement of the habitat requires that we have to maintain the existing and give it the same importance as the new constructions. This consideration will lead us to see: how can we make a judicious repartition of capital, labor and material between the rehabilitation, the new construction and the modernization. The rehabilitation and the renovation are more difficult to organize; they require qualified employees comparatively to the new construction. They include a lot of small and very various tasks or works, most of them are unforeseeable.

The main justifications for the increase of the expenses in the rehabilitation and modernization are:
1. The charges and taxes for the maintenance, the rehabilitation and the modernization;
2. The disproportion between the offer and the demand in terms of lodgings and population needs;
3. Acceleration of the change in all domains of life and which might explain the requirement for the frequent transformations;
4. The use of sophisticated facilities in the buildings increases the fragility of the latter and let them to be vulnerable.

From the technical point of view, the traditional city should be preserved by intervening periodically on its components whether in terms of maintenance, renovation or rehabilitation. In the central area, most of the traditional houses are built with a sustainable material. The accessibility to this area is easier and is already equipped comparatively to the periphery which needs infrastructure and consumption of land.

The problem of the qualification lead us to say that generally speaking, in for new construction, the qualified workers represents almost 20%, while in the rehabilitation or renovation this proportion is around 80%. The maintenance of the traditional buildings or their modernization necessitates an experienced staff as they should be able to recognize the weaknesses and to know how to remedy. So, this fact help us to understand why most of the employees are aged and don't work at the same cadence that their new construction colleagues, and of those whom are occupied in the new buildings, and generally speaking they are employed by a small and specialized enterprises. These enterprises are usually incapable to guarantee some social advantages offered by the famous or international enterprises and interested by the development and the construction of the new buildings. So the impact of this situation is the difficulties of recruitment in the renovation or rehabilitation. These aspects justify however the prices practiced by the enterprises and unaffordable by most of the population. It is known that the sector of construction and building is a sector that requires less qualified employees and for more than a decade, this rehabilitation and renovation were considered as secondary activities in this sector and from the cultural and heritage points of views, the main obstacle was and is the nature of property from the juridical side. So do we have to think about changing our strategy when it will be too late for preserving our heritage?

Rehabilitation and renovation are costly comparatively to the new construction, but these expenses become more and more important with the time. For a new building, they are around 0, 25% of its value per year, but they climb quickly to reach 1, 6% at the end of 3 years and 1, 8% of the forth year. Several things can be deducted of it: few saving gained while trimming on the quality of the construction which will have a great impact on the expanse for the maintenance. More the real estate heritage is old; more the charges for the maintenance are high. The exploitation of the renovated building is more expensive than a new one, because the value brought by the improvement of the arrangement and the equipment will not stop the process of usury and do not reduce the expenses. So in terms of sustainable development, the improvement of the habitat might be a poisoned gift for the future generations if we keep things as they are particularly in terms of qualification of the employees, the cost and the use as most of the renovated and rehabilitated buildings are used as museums, restaurants or for prestigious ceremonies: it is much more seen as an elitist attitude toward the preservation of our heritage.

CONCLUSION

In structuralism theory, the structure is a system of transformation based on the evolution of the surface structure. The transformation of structure depends on the dynamic interrelations between the structure’s elements.
In structuralist thought, structure and transformation are bonded together and their interrelationship is reflected in the surface appearances of phenomena. The structure,

then, can be understood by investigating its evolutionary process, which has transformed their entity while keeping identity.
Arab cities change dramatically (Case of the G.C.C) or gradually (Maghreb : Algiers, Tunis, Rabat), assuming many different kinds of change. Physical growth, socio-economic development and urban evolution are all varieties of such change, each with its own meaning and variously based on different factors either physical or non-physical.
Many factors like system information, economy, and technology play role in the changes. If a city relies on indigenous knowledge, technology, cultural values and tradition, these changes could be considered as transformation for all the energies that drive them emerge from within the city and its society, i.e. from its own structure. Many things can happen in a city that is changes not transformation. These are caused by process that are not inherent in the city structure and will weaken it. The Muslim city, with its socio-cultural features, had a cultural, social, political, and economic logic in terms of physical fabric, layout, and uses, which can provide a lesson for modern planning and design practices. The modern Muslim city should maintain the deep structure identity, and then it can achieve the proper transformation of the surface structure without losing the unique features for its urban environment during the modernization process.
As well; the Muslim city can be easily adapted to meet modern functionality and urban responsiveness and maintain its high congruence with our deep structure (our natural, religious and socio-cultural environment) paradigm of planning in the madina inorder to expose its intrinsic urban order that is not merely orthogonal or geometrical. This is argued by revisiting the concept of planning as an intention and action, in its historic context, while being prudent so as to not create confusion with the current urban planning, the objectives and tools of which are totally different. However, the lessons gained from inquiring into madina's urban mechanisms, and their sustainable synergies, may support the current planners to bridge the gaps in the making of current chaotic cities – which are void of sound communal constructs and rely heavily on aesthetic orders.
Before embarking on presenting the planning paradigm of the madina, a brief review of its persistent Orientalist images was essential in order to expose their deliberate emphasis on its unplanned nature. While intentionally disregarding the apparent social and cultural order of the madina, which manifested a typical sustainable urban pattern throughout its history, these images were driven by using widely external aesthetic and form typologies.
To prove the attitudes of planning in the madina, a review of different actions of organizing or making order was necessary so as to reveal its comprehensive urbanism, and distance it from the colonial notion of a confined me´dina. This has led to the discussion on its different levels of planning and what constitutes its urban parts following the jurisprudential and functional archetypes.
While the madina is presented as not a merely totalitarian and authoritative territory, its consistent social and spatial microcosmical order through its strategic corpus' internal and neighbourhoods' local planning is explored.
The notion of order behind its compact urban fabric is also substantiated through different meanings that stem from a user's experience in a beehive urban fabric.

However, the modern planning practices have come to vindicate the relevance of such a beehive urban structure that places the human being at the centre of an urban space, which creates a sense of belonging and memory in a city that several current living madina(s) have proved.
The main strength of the current madina is its sustainability as a city capable of encountering the challenges of twentieth-century urbanism, particularly in developing countries. This paper argues that the historic urban experience and deduced lessons of planning from historic cities could open a new horizon for contemporary planners to assimilate the complexity of human space without being biased to a certain orthogonal order that is merely aesthetically geometrical or culturally superior.

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KINETIC ARCHITECTURE: TOWARDS THE POETRY OF SPACE IN MOVEMENT[1]

İREM YILMAZ[2]

ABSTRACT

The concept of "Kinetic Architecture" provides an extensive framework for the broad-array of inquiries upon the relationship between movement, human and space. Focusing on the dynamic configuration of physical space via movement in Kinetic Architecture, in this paper it is asserted that in order to understand kinetic spatial embodiments, a new aesthetic conception that goes beyond our conception of static spatial embodiments is needed. Using the conceptual frameworks; Eco's poetics of the "Work in Movement" in context of his theory of "The Open Work", Dewey's theory of "Art as Experience" and Heidegger's conceptions of "poetry as building" and "poetical measuring" as an explanatory tool, it intends to conceptualize aesthetics of the space in movement. As considering the movement as existential manifestation, poetical building of space in movement is opened to discussion as an alternative way of production of space in relation to aesthetics.

Key words: kinetic architecture, movement, human, space, poetry, aesthetics

1. INTRODUCTION

Kinetic Architecture is developed as a field of study in order to examine how architecture can respond to diverse needs, desires and conditions within the constantly changing modes of life. Going beyond the traditional conception of space which is static, immobile and determinate, it introduces movement as a new element of building to generate a new conception of space which is dynamic, mobile indeterminate and unpredictable. It promotes continuous change of space via movement bringing forward dynamics, flexibility and adaptability of artificial environment and establishes an interactive adaptable relationship between the natural and the artificial environment. In this interactive relationship, movement which can only be grasped within time, becomes an element of communication. And this leads to a challenge for architecture in terms of conceptualizing changing patterns of human interaction with artificial environment through time and via movement. To deal with such a challenge, architects develop many diverse approaches to kinetic spatial design.
Although there are many kinetic spatial design approaches in the literature,

[1] This study is developed in context of the PhD lecture of "Formation Of Spatial Image in Architecture" directed by Prof. Dr. Aysu Akalın in Gazi University
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Michael Fox explains them in two categories as **pragmatic** and **humanistic**. In his definition, whereas pragmatic category concerns practical aspects of movement such as space efficiency, shelter, security, transportation, safety, economics and etc., humanistic category interests phenomenological aspects of it focusing on personal spatial experiences. And he asserts that even though one should consider design in relation to both of these categories, it is important to understand and accommodate an inclusive range of humanistic considerations on top of the more pragmatic spatial optimization of the space.[1] In this context within the scope of this paper, the humanistic category is brought forward to discuss the aesthetics of kinetic architecture objects in terms of their phenomenal attributes.
As Robert Kronenburg stated aesthetic value of motion challenge the very nature of what architecture really is.[2] Kinetic architecture structures as behaving like living organism changed the way we communicate to artificial environment. In this sense Sokratis Yiannoudes uses Shery Turkle's term of **"marginal objects"** for kinetic architecture structures which he defines as beings on the boundary of human and machine. As they blur the boundaries separating the living and the non-living, their phenomenal attributes stand on the boundary between these categories.[3] In this case, traditional aesthetic conceptions lose validity to interpret such structures. So that in order to understand kinetic spatial embodiments, a new aesthetic conception that goes beyond our conception of static spatial embodiments is needed. Accordingly, this paper aims to examine how can **a new aesthetic conception** can be developed and it opens factors that affect the aesthetic value of such structures up for discussion. In this framework it brings forward three phenomenons:

- **movement** as an element of interaction in architecture
- **human** as a performer of space
- **space** built by movement as an existential manifestation

Thus and so, it intends to explain poetry of space in movement in relation to aesthetics.

2. MOVEMENT IN ARCHITECTURE

To understand the phenomenon of movement in architecture, Kinetic Architecture serves as an extensive research field. It defines a new spatial design praxis closely related to kinetics which refers to the study of motion and its causes. Substantially shaping as a distinctive research field in the second half of the 20th century Kinetic Architecture carries out its study on rethinking architecture in terms of movement going beyond conventional static and single-function spatial design. 20th century architectural trends of Expressionism, Futurism, Constructivism, Kinetic Art Movements have been widely influential in the development of such a field along

[1] Fox, M., Kemp, M., "Interactive Architecture", Princeton Architectural Press, 2009, p.30, 34
[2] Ibid.,2009, p. 27
[3] Yiannoudes, S. "Kinetic Digitally-Driven Architectural Structures as 'Marginal' Objects - a Conceptual Framework", Digitally-Driven Architecture, Footprint Delft School Of Journal, Delft, 2010, p.46.

with scientific and technological developments.[1]Although there are many definitions of Kinetic Architecture in the literature[2], it is possible to define it as a field that problematizes situations of the production of responses via movement in artificial environment to the effects of natural environment in terms of formal, functional and technical issues. In this perspective as Fouad also indicated in his thesis, Kinetic Architecture is about creating a relation between natural environment and artificial environment.[3]

To interrelate natural environment and artificial environment, Kinetic Architecture problematizes the continuous re-building of space via movement in terms of dynamics, flexibility and adaptability of artificial environment. Moreover, as considering natural environment with all its constituents (human, heat, wind, etc.) as a set of forces which are energizers of the movement, it explores the effects of these forces on material forms. And in relation, it works on the changing and evolving patterns of that constituents' interaction with the artificial environment.[4] Working on such patterns leads to thinking in scenarios of movement revealing different levels of possible engagements. And architectural state built on these scenarios turns to be in flux. So that in Kinetic Architecture, space transforms from a former static modular order into **a topological field**[5] which responses to the forces of its environment and dynamically changes.[6]

In order to investigate how to design such a dynamic space, Kinetic Architecture lays its foundations on an interdisciplinary base and accordingly relates to other fields of knowledge such as material science, biomimetic, robotics, cybernetics, informatics and also other concepts in architecture such as interactive architecture, responsive architecture, and liquid architecture. Via its interaction of all these fields, Kinetic Architecture provides a generic base of knowledge for directing the movement to build a dynamic space. As to direct the movement in space, Kinetic Architecture brings forward the ways and means for operability. The ways consists

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[1] See also. Alkhayyat, J. M. J., "Design Strategy for Adaptive Kinetic Patterns: Creating a Generative Design for Dynamic Solar Shading Systems", MSc Digital Architectural Design, School Of Build Environment, University of Salford, Manchester 2013, p.17

Parkes, A., "Phrases of the Kinetic: Dynamic Physicality as a Construct of Interaction Design", Thesis Proposal for the degree of Doctor of Philosophy, Massachusetts Institute of Technology, Cambridge, 2008, p.10-12.

Fouad S. M. A. "Design Methodology: Kinetic Architecture", B.Sc. of Architecture Thesis, Alexandria University, Alexandria, Egypt, 2012, p.9,16.

[2]Although the resources that one can see in the references bring a variety of definitions for Kinetic Architecture, especially the thesis study of Soha Mohamed Abd El-Hady Fouad presents a comprehensive literature analysis on Kinetic Architecture definitions.

See also Fouad S. M. A. "Design Methodology: Kinetic Architecture", B.Sc. of Architecture Thesis, Alexandria University, Alexandria, Egypt, 2012, p.9,10.

[3] Ibid., Fouad S. M. A., 2012, p.10

[4] Fox, M., Kemp, M., "Interactive Architecture", Princeton Architectural Press, 2009, p.26, 28

[5] Umberto Eco explains the concept of "field" in relation to its origins in physics. In this sense the concept of "field ,evaluates the classical one-way casual relationships from a new stanpoint and regards complex effects of forces, configurations of possible events and the dynamisn of the structure.

See also, Eco, U. (1989).The Open Work, Harvard University Press, p.14.

[6] Grünkranz, D., "Towards a Phenomenolofy of Responsive Architecture: Intelligent Technologies and Their Influence on the Experience of Space", Vienna, 2012.p.6

of kinetic methods by which kinetic structures perform such as rotating, folding, sliding, transforming, expanding and etc. But these performances are closely related to quality of the materials used. The materials varying as rigid, plastic, elastic play a decisive role on the performance type. And the means are described as the impetus for actuation such as pneumatics, chemicals, magnetism, electrical systems, mechanical systems and etc. Additionally the means are also differentiates according to their performance in an analog or digital way. However, the ways and the means as working in unison build up the embodiment of movement and constitute the **topology of movement**. Besides these, Fox divides basic topologies of movement in three categories as embedded, deployable and dynamic systems. Embedded systems define integral and necessary parts of the building coupled with computational control. Deployable systems characterize deconstruction and reconstruction possibilities which afford mobility. And dynamic systems determine movable part of the building that act independently with respect the control of a larger context. [1] In

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[1] Fox, M., Kemp, M., "Interactive Architecture", Princeton Architectural Press, 2009, p.46
Schumacher, M., "Move: Architecture in Motion- Dynamic Components and Elements" Birkhauser, 2010, p.32-35, 44

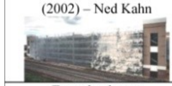
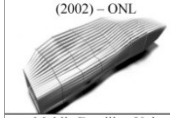
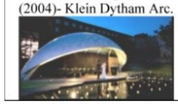
Work	Kind of Work			Mobility		Natural Effect		Technology		Reason		Movement			Movement Topology
	Art Work	Architectural Prototype	Architectural Building	Fixed	Non-Fixed	Human	Other	Analog	Digital	Pragmatic	Humanistic	Building Components		Complete Building Structure	Ways & Means
												Int.	Ext.		
Naked House (2000)-Shigeru Ban 			x	x		x		x		x		x			Move - Wood boxes
Turn-on House (2000-05) - Alles Wird Gut 		x			x	x			x	x				x	Rotate, Move – Steel structured roller units
Wind Veil (2002) – Ned Kahn 			x	x			x	x			x		x		Swing - Aluminum panels
E-motive house (2002) – ONL 		x		x		x			x	x	x			x	Move - Pneumatic and hydraulic cylinders, wooden beams and air chambers
Mobile Dwelling Unit (2003) – LOT-EK 			x		x	x		x		x				x	Move - Metal container units
Leaf Chapel (2004)- Klein Dytham Arc. 			x	x		x			x	x	x		x		Slide - Steel structured perforated metal surface

Figure 1a. Examples of Kinetic Structures in Categories

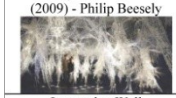
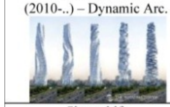
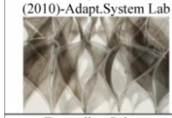
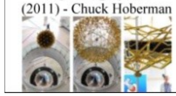
Work	Kind of Work			Mobility		Natural Effect		Technology		Reason		Movement			Movement Topology
	Art Work	Architectural Prototype	Architectural Building	Fixed	Non-Fixed	Human	Other	Analog	Digital	Pragmatic	Humanistic	Building Components Int.	Building Components Ext.	Complete Building Structure	Ways & Means
Bubbles (2006) - Michael Fox 		x		x		x			x		x		x		Expand - Airbags
Hylozoic Soil (2009) - Philip Beesely 	x			x		x			x		x	x			Wave - Acrylic tiles
Interactive Wall (2009) - Festo 		x		x		x			x	x	x			x	Swing – Bionic Fin Ray structure
Dynamic Tower (2010-..) – Dynamic Arc. 			x	x		x	x		x	x	x			x	Rotate - Prefabricated Steel Structured Units
Shapeshift (2010)-Adapt.System Lab 		x		x		x	x		x	x	x		x		Fold - Electroactive polymers
Expanding Sphere (2011) - Chuck Hoberman 	x			x		x			x		x			x	Expand – Aircraft grade aluminum structure

Figure 1b. Examples of Kinetic Structures in Categories

this sense, topologies of movement, a mixture of different ways and means and also systems, promotes a way of continuously building space spreading over its whole process of being. This process actualizing in interaction with natural environment constituents is full of numerous possibilities and potentials base on the constituents' effect on movement. Among these constituents, human as being the performer of space at the same time faces extensive field of possibilities. Each time he performs in the space, he experiences a different series of spatial situation in line with the effect of his own decisions or the environmental factors. Thusly, any experience of him cannot be exactly the same as the other. And he combines all his experiences to generate a general perception of space. So that this kind of perception of such a dynamic space consists of multiple spatial appearances. And to make sense of all these appearances a new aesthetic conception is required.
To enable interpretations of new aesthetic conception and to draw a general view upon kinetic structures, a table[1] is constituted analyzing them in categories of Kind of Work (Art work, architectural prototype/installation, architectural work), Mobility (fixed, non-fixed), Natural Effect (human, other), Technology (analog, digital), Reason (humanistic, pragmatic), Movement (building components, complete building structure) and Movement Topology (ways and means). By way of choosing kinetic structure examples that has different combinations of these categories, a general perception is constituted in relation to field of Kinetic Architecture.(Figures 1a-1b)

3. POETICS OF THE "WORK IN MOVEMENT"

To develop a new aesthetic conception for Kinetic Architecture, Umberto Eco's poetic of the "work in movement" sets the pace. Eco develops the poetics of the "Work in Movement" in context of his theory of "The Open Work". Thereby he explains the poetics of the "Work in Movement" in relation to the openness of art work. Based on his studies on many fields of art such as music, literature, sculpture, architecture, he asserts that although a work of art is complete and closed form in its uniqueness as a balanced organic whole, it is also open on account of susceptibility to countless different interpretations which do not impinge on its unadultarable specificity and he evaluates aesthetic value of the art work according to its potential of interpretation. But beyond this kind of openness, he also mentions about another kind of openness which he calls **an intentional openness** of the art work different from typical openness of other art works. In this framework he defines the work in movement as formed by structural units that are unplanned or incomplete physically so as to allow many interventions. However this doesn't mean that a work in movement creates a random state. On the contrary, he mentions about that the artist builds up a network of relationships to which the performer can join in a directed way and constitutes an incomplete work of art for

[1] Although a version of this table is prepared for another study on analyzing movement of kinetic structures, in the context of this paper it is solelt used to construct a general view to the field.

the performer to complete. And this can lead to that the performer can configure the work in way that the artist cannot predict. So that as Eco mentions, each performance of the art work reveals a diverse appearance of it depending on the performers way to interpret it. In this sense each performance is complementary of other performances and solely the whole of these performances presents a satisfying appearance of art work. Because such art works cannot present all its artistic manifestations simultaneously. This fact brings forward the conceptions of **subjectivity** and **complementarity**. The work in moment reveals itself through the performers' subjective interpretations of it complementing each other. [1]

The work in movement creating a field of possibilities, comprises ambiguous situations open to diverse sorts of operative choices and interpretations. In this kind of works, there is **wideness of information** which is measure of one's freedom of choice when one selects a message. Within this wideness of information the performer choses and focuses on a few elements of it, but by experiencing it he binds together all the defined elements of which he is focally aware and makes them whole. Every whole created in such manner presents a way of existence of the work. But in this process, the reflection is generated by original pervasiveness of the work within which the performer exercises its selectivity. So that although the performer rebuilds the work multifacetedly via his experiences gained through his reflections and actions, constitutively the designer enables such a building via the field of possibility he created. And the aesthetic value of the work relates to the quality of this field of possibility. In other words the work in movement is open to the extent of the wideness of information and it raises in value in line with the multiplicity of its meanings that is to say the abundance of its all possible interpretations.[2]

In the work in movement, meaning is created through experiences. To comprehend such creation of meaning, besides Eco's theory his precedent Dewey's theory of art as experience is also a significant reference at this point. Dewey refuses to identify the existence of work of art apart from human experience and conceptualizes the word "aesthetics" referred to experience as appreciative, perceiving and enjoying. He asserts that the work of art is complete only as it works in the experiences of others than the one who created it. Emphasizing the individual property of experience, he claims that a work of art is recreated every time it is aesthetically experienced. Along with he explains that one have an experience when the material experienced runs it course to fulfillment and experience becomes conscious, a matter of perception, only when meanings enter it that are derived from prior experiences.[3]

Considering Eco's and Dewey's aesthetic conceptions, in Kinetic Architecture, meaning is created as a result of human's (performer) subjective experiments over the course of interaction with space in movement. Human connects the experiences gained through his experiments and the experiences he picked among his earlier

[1] Eco, U. (1989).The Open Work, Harvard University Press. p. 4, 19, 20, 24, 27.
[2] Ibid., Eco,1989, p. 42, 43, 44, 57.
[3] Dewey, J., "Art As Experience", Art and Its Significance : An Anthology of Aesthetic Theory, ed. Ross, D. S., State University of New York Press, 1994, p. 207, 213, 218

experiences to create meaning. In this sense, distinguishing appropriate experiences among a great deal of experiences to connect the diverse facts and establishing organic relationships between them build up **poetry**.[1] So that, each rebuilding of the work in movement reveals poetry as an artistic manifestation of it. Accordingly, each interpretation of the work in movement leads to poetical building of it.

4. POETICAL BUILDING OF SPACE IN MOVEMENT

Poetical building of space in movement is closely related to the poetry of movement. Michael Schumacher relates poetry of movement to one's sense of poetry as one's **sense of being** as a whole and directly connects it to the cultural identity.[2] To understand such a conception of poetry of movement and to discuss poetical building of space in movement, Heidegger's conception of poetical building in relation to human existence is significant for this study. Heidegger explains every act of building in interpretation of existence as **poetry**. He uses the term **poetical measuring** as an activity that enables to comprehend existential conditions by way of evaluating experiences.[3] He explains it as: "A strange measure for ordinary and in particular also for all merely scientific ideas, certainly not a palpable stick or rod but in truth simpler to handle than they, provided our hands do not abruptly grasp but are guided by gestures befitting the measure here to be taken. This is done by a taking which at no time clutches at the standard but rather takes it in a concentrated perception, a gathered taking-in that remains a listening."[4]And he defines poetical building of space by constant poetical measuring.

Within this conception, the relationship between the phenomenons of movement, human and space become more of an issue to quest poetical building of space in movement in relation to aesthetics. When human experiences a work of kinetic architecture, correlates to the space as multi-dimensional information field and rebuilds it via his experiences in the framework of the possibilities of space enabled by movement. And this process of building bases on poetical measuring. In this process performed in reflection and action[5] of the human, each configuration of space with the effect of human or other natural environment constituents carries a poetic nature on the extent that it turns into an existential manifestation in relation to the human experiences. In each interpretation of the space, human rebuilds it as poetry revealing an artistic existential manifestation of

[1]Opcit., Eco,1989, p. 112.
[2] Schumacher, M., "Move: Architecture in Motion- Dynamic Components and Elements" Birkhauser, 2010,p.11.
[3] See also . Heiddeger, M., "…Poetically Man Dwells…", Poetry, Lanaguage, Thought, New York: Harper and Row, 1971.
[4] Ibid., Heiddeger, M.,1971, p.223
[5] See also. Schön, D. A ., " The Reflective Practitioner: How Professionals Think in Action", Basic Books, 1983.

it. And in each poetical building of space, associating it to his own existence, he creates a unique spatial situation and becomes belonged to the spatial situation he created as individualizing it. So that space in movement due to its diversity manifests numerous existential situations establishing effective relationships with each performer. And the performer develops a multifaceted spatial perception to the extent of the diversity of these situations. And the kinetic structure forming the space in movement equally gains aesthetic value in accordance with this diversity.

4. CONCLUSION

Establishing its main discussion on the conception of space challenged by movement as a new element of space in context of Kinetic Architecture, this study aims to explore how to develop a new aesthetic conception for kinetic structures. Using the conceptual frameworks; Eco's poetics of the "Work in Movement" in context of his theory of "The Open Work", Dewey's theory of "Art as Experience" and Heidegger's conceptions of "poetry as building" and "poetical measuring" as an explanatory tool, it intends to conceptualize the way we interact and make sense of this kind of works. Analyzing the way one interacts and interprets Kinetic Architecture works, it also opens poetical building of space in movement up for discussion as an alternative way of production of space in relation to aesthetics.
In this context it present mainly three things:

- the movement as an element of interaction in architecture establishes a new kind of relationship between human and space which leads to dynamically changing experience of space.
- space in movement presenting an extensive field of possibilities, allow human to manipulate it according to his existential situation.
- space in movement gains aesthetic value depending on the diversification of the existential situations it enables.

And as concluding, this study opens and promotes the possibilities of further research in this field on the relationships movement, human, space and aesthetics of kinetic structures.

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CONSCIOUSNESS & CREATION
A STUDY OF THE PROCESS OF COMMUNICATION AND INNOVATION IN THE DESIGN OF CONTEMPORARY URBAN MONUMENTS

RASHAA MALIK & ALAA HADI[1]

ABSTRACT

The main message that any architectural work carries is related to the objective facts and literal meanings .Architecture "in the eyes of the theorists" has always been in between. Architecture has the physical characteristics that enable it to be declared as visual engineering facts. On the other hand the vision of creative architectural works around us cannot be emptied from the poetic literal performance as a literal work. Connection happens when the recipient has reaction towards the architectural work. At this point the ultimate aim for this processes happens in two directions .To communicate with the Architectural work, there should be a process of the characteristics of the human mind to respond to the perception so that the recipient understands the architectural work . Depending on the process of perception which depends on the human mind and its awareness taste of Architecture through analysis. The relation between man and architecture is the main point of poetic relation of architecture because it is, space and place, therefore, two main directions can be found between the recipient and the architect .which is the connection.
The objective is to find a mechanism that help to measure the degree of similarity between the creator interpretation and the recipient of the creative architectural work through the signal concept which depends on the literal studies and the poetic concept in architecture which is used to measure the general taste of humans . Hypothesis of the study can be illustrated as" architecture creative process cannot reach its perfectness unless the schemata of the recipient reach its ultimate while his evaluation of the architectural-product". It's the positive understanding of the architectural work through the communicative relation with the viewer

Key words: - Creativity, Poetic architecture, Sign, communication theory.

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1.INTRODUCTION:

The range of study to concept of beauty is divided into two main parts. The first part is considered with the recipient and concentrated on issues of sensitivity and evaluation of audience to esthetic value. While the other part is considered with creation and production .These are topics of esthetic argument that deals with architecture as a product. Architecture can be mimed or gain through looking at it, understanding it throw signs. There is no need for a dictionary to translate it. Since it is different from read signs because they have a symbolic function they have information and give this information to the viewer though they are literal phrases they don't have pure rules and can't give specific information for one reason or another they should keep symbolic relation.

2. CREATIVITY AND THE CONCEPT OF BEAUTY

2.1 Creativity

Creativity is a multidimensional concept has been debated by theorists .It's the whole ideas that cannot be denied which is a behavior enhanced by the environment which is represented by the ability to produce artistic works as a struggle between the architect and the architecture (Abdu, Mustafa 1999). Creation happens through stages, which are: preparation, Incubation, illumination, and verification.

As "Wales" has put it, these four stages of creation do not happen one after the other (Abdu ,Mustafa 1999). It happens through cognitive procedures. Creative activity is an image of the human thoughts, his motivations his abilities, his morals, his ideas, his accumulated experience, his heritage, and his personality, its details his ways of thinking which produced the" Architectural work ".

2.2 **Concept of Beauty**

When relating "Architectural work" to the concept of beauty, we should consist on some points:

- The concept of beauty differs between the two poles of the communication process "the recipients" and the creator "the architect"
- The historic\philosophical struggle between beauty and function

The separation between the good and the beautiful, these points represent the main themes of philosophies which accomplished by Greek philosophers contribution to discuss the subject of beauty (Hegel 1979). The more recent French school in philosophy, thoughts that beauty was a spiritual phenomenon though they agree to the material criteria as the suitable size and the unity of building and the integration (completeness) and the degree of affection in color and the flexibility and steamily in the shape but they insisted that these elements can't work together to produce what is beautiful unless they are under an ultimate and mighty power from outside. The English School in philosophy concentrated on the psychological aspects that beauty is an complicated phenomena which is more difficult to be noticed by sense or obviously can be understood clearly should be studied thoroughly to be understood by scientific analysis. Others" didn't find any beauty in the substance unless it was formed by a specific system. According to the creation of the universe which is going on according a neat system in which life and motion are characterized pushed by the power of God .The main reason for that is the independent presence of beauty is our inability to control the power that creates. "Higden" contradicted this classification where he said the beauty is ultimate which is the beauty of the main sources that always related to nature and the partial beauty which can be measured by the scale of similarity and compliance of the sources. The sight meditation of things is the main source of the pleasure of visualizing things .That pleasure which classified into two types . The initial pleasure which we can reach from the first period of meditation and the second which we can come up with through thought and feelings and the visions found from meditating things. "Hogarth" emphasized again and consolidating his processors that it is essential to relate the part to the whole through the compliance of the different parts for the composed value in drawing the lines (Stolintese, Gero1988).

2.3 Evaluating Beauty

Also" Burk" mentioned that his criteria in the composed beauty as the small size and smoothness the brightness and the harmony of color which slide down , the elegance of lines , purity and relaxing beside the calmness, and ordinarily of the grades of color. So the beauty which lied inside the image of creator and judged by the viewer through:

- Evaluating beauty and building an attitude. The cognition of creativity depends on the attitude built by the thing that was cognized and this is an essential side.

On the other hand the thing that is cognized as a pure fact" or sensed by any degree of human sensitivity "through subjective characteristics.

- Specialized groups acquire, created change through time by their special criteria for evaluation which cannot be understood by the people in general media. In a situation where the high cultural and educational level, and opened to the degree of cultural gap between the ordinary people and the highly educated groups. In most cases the technical elements are sources of special tools.
- General audience does not deal with it in his enjoyment in Art. The field of composition used in, the elements of the line the solid and the void and the space balance the distribution of color and light and its grades it signs the visual fantasy.

3. POETIC OF ARCHITECTURE

It's the Art of collecting and composing to find the easy way to get from other arts outside architecture to change an empty space using the poetics of architecture. It's the composition of beauty and the beauty accumulated or composed, Ex. the relation between architecture and dancing and through its existence in a relation with space and time. "The truth of the poem "as Armand illustrated ", is neither representation nor expression … it's more resourceful than reality ...everything is relative " (Armand2007) .In the use of the style, as the architects after renascence. The poetics also added that it is very important to study poetry and get the benefit of it's to develop the poetic characteristics of architects. "Antoniadis" in 1990, also added that there is a vague meaning of poetics .It was used as a heading for composition" The aesthetics of the configuration" (Antoniadis1999) .The word poetics emerged from the Greek verb (to make) which simply means the work of musical space, architecture and also a poem. It emphasizes the esthetic meaning of all the books that deals with mentioned term. "The idea of return to things themselves "modernism" or things as they are but poetic is about value "the metaphor of metaphor" that argues a crucial linkage between ontology and morality: what constitutes an object, may not be a pure product of will…it's the un written law behind."(Armand2007). The researcher hints that there is a possibility of figurative metaphor between drama and architecture. These studies deal with the classification of metaphor the following types: - Intangible metaphor, tangible metaphor, and combined metaphor.

First: intangible metaphor: - It is the start to borrow thoughts and images concepts or ideas or humanitarian case or specific characteristic as an ex. the engineering steps to follow the movement of post modernism and connecting with other arts.

Second: Tangible Metaphor: - this emerges from a visual or solid characteristic.

Third: Combined metaphor: - The concept and visual contents emerge become the source to scan the characteristics of visual shapes within the levels of the esthetic experiment. Where we can find the levels of the esthetic experiment in relation with the subjective bases of beauty in architecture which is three levels:-

Aspiration where existence of the relations where the elements of architecture organized to form a formal organization characterized by purity , simplicity which include the lows of balance , repetition , harmony and(rhythm)using the scale of similarities and differences .

4. CONSCIOUSNESS

It is a side that pin point the criteria of the receiver of the artistic piece .And the live power of him to through his taste, explanation , and receiving the artiste piece. The artistic acceptance revolt emotional and experience composted elements (Abdu, Mustafa 1999). The receiver respond to these effects and differentiate between these pieces of art by his artistic experiences through the preparation and arising and his cultural medium to able to translate / change these blocks into a testable process giving testable judgments and these judgments must follow three aspects :-

First: Concerned with the receiver of the artistic piece of art and his experience.

Second: Concerned with the environment offered and all that it is composed of.
Third: The characteristics of artistic piece of art concerning its shape, quality, concept, and meaning.

- Architecture: Is a creative work understood according to the theories and ideas that analyses the architectural-work. Through ages within different levels of receiving, the architectural-work may not be appreciated in its time but it's appreciated after a time of it building.

- The society: The economical and ethical cultural background and the people understanding of what is created anywhere and especially Architecture" the most important side in Architecture" is its ability to build bridges with the users of urban environment and to show the relation between the created work and its recipient ,in local architecture its whole value and content.

-The dialogue: The dialogue between the artist and the recipient through the work of art, the word dialogue hear means, the esthetic connection which occur between the artist and the piece of art .The dialogue consists of:

The message: Acquisition jumps to our minds how can a dialogue done by an architect and a well-educated recipient. "Artist" and between things that are (solid) irrational which is the work of art "The architectural work". This dialogue happens through the mind of the artist and the recipient and reflected through the creative path of the creator and the rational path of the recipient. It is a mental case where the creator and the recipient attract each other (Stolintese, Gero 1988).

According to linguistic studies which" De- Saussure" and" Roman Jackson" put in 1929. They presented a study about functions of language. They think that language has only one function which is communication and each communicative process has its elements:

- The transmitter (sender) the architect.
- The recipient (receiver).
- The message (the medium) the work of Art (creative work). The message needs three elements which are:

-The Context (the authority): The context is the cultural social and economic heritage which both the (signifier and the significant own it. The message is the authority which enables the reader to understand the text. In the novel " the hostage" by" Mute Diageo", the reader won't be able to understand the events unless he acquired a historic idea an authorized power about the era of" Al-Imam Ahmed" in Yemen and how the Imam used to take others' from the people of "Al Mashaiekh" so as not to revolute against him.

- The Communicative aid: In this it is considered a technical only and is divided into two elements solid and lateral. It is divided into a number of elements. The first element is the "story" what was written. This is the first solid picture (image) to that the writer had written the text. The second element is the print house which takes the duty of revising it and publishing it. The third element is the distribution of the story or the written text, till it reaches its destination which is the reader

- The Code: It is a system of relations all phenomena are considered systems of signs weather it is Architectural or else. "The idea as digital poetry in 1975 which illustrate everyone was worried about that language is code, in 2003 everyone is worried that code is language"(L. Armand 2007) . Each modern communication consists of three elements a Sender, Receiver and message. It is a code to mark it this code carries constructions and meanings and special symbols. There are three types categories of Cods according to the idea of "Peirce", contained three aspects, they are: Code types, Code articulation, and codification (We will consider in the analysis the code type).

-Code type: The types of signs are:

- Symbolic signs: it is the sign of a shape in a hypothetic image to a system in a language used between the signifier and the significant within the code it is a symbol . It is not the same item but an image of it.

- The Icon: It is the sign that the features of the thing due to the same features in the icon and the object this is isolated in Architecture – which stands alone where there isn't an identical geometrical shape (Eco Umberto, Broadbent, and Geoffrey1980).

-Indexical sign: - It is the sign that represents the object in its relation with the item as a fact. The indexical sign is related to the item physically and compose an organic duality which the sign that loses the feature that makes it a sign if the object is removed. But it doesn't lose its feature if there isn't any index. It has three features from other sings. It mustn't be a noun or any part of the verbal language or written it may be mere a taste or a sight. There is a connection where the case of continuity the traditional concepts and the inherited values appeared in a serial form without occurring clear (jumps) (function and sign). That formed an architectural dictionary for the old classic world and the kinds of connection which is the traditional type of the five pillars "Dorky, Tuscany, Ionic, Corinthian, and Romano". Eco Umberto, Broadbent, Geoffrey1980). These elements were associated with meanings due to some tribal rules in those civilizations. The direct representation for those characters representing subjective ideas which was originated in these elements as the: perfectness, the highness of spirit, subjectivity to god which was reflected in the religious buildings.

The process of communication in the classic architecture is a case direct representation of ideas by using characteristics elements. According to" Soccer" , In his structural study, there is a root relation between significant and signifier bound by a social agreement which cannot be altered while the two concepts Denotation and connotation refer to levels of meanings according to the connection occurs._The first is Denotation: the level of meanings that the shape has and is known by its users the second represents the Connotation: the level of meanings is built according to sympathetic platform and during the effect of the building on the user each one of them. Let's take the cave as an example .It represent home, patios, family, and origin in the idea. The urban phenomenon is considered a system of signs one of these is Architecture where the function of the Architectural element gets the meaning in two ways. The first is rotates (alternative) and the second is the result of the type of function that the element do the roof (or ceiling). The element act the function of protection and covering the glass prevents water from entering inside and the victory arch. The gate is a functional type of explanation has a clear signal of power and victory and other carcasses according to a total idea in addition the elements that show the consciousness of the recipient and his cognition.

5. THE CONTACT AND THE COMMUNICATION

The philosopher "Kant" divided the human brain into three parts: Outside brain which the virtue of knowledge feeds it, the hidden brain which the virtue of desire feeds it, and the creative brain which the is felt by the feature of feeling in it emerge the concept of (images) this concept which lead the world to the freedom of thought which elevated, with Kant, the level of total harmony from it emerge the images of the ultimate and the peak of goodness (Kant, Immanua1973). This harmony will make the world of Kant's beauty which reflects the rhythm of beauty for this creative brain in picture of a creative beautiful work .As beauty is the end of reactivity (Basher Zhuhai1988). Process has a number of items that interact with each other inside the Artist and his mind. If this process is a total process that include Knowledge ability, sensibility and cognition, feelings emotions sensibility and motive. This creative process occurs in a series of steps that are interacted and we can submit it in twenty steps: -

1- Forming the frame and acquiring it in the actor's mind.
2-Compromising between special and general motivation..
3- Catching the ideas and constant formation.
4- Grasping the cognitive ideas and the creative for the aesthetic flashes.
5- The reflected ideas until they are called to begin the process of creation.
6- Preparing and accumulating the cognitive thoughts and arranging them.
7- Creative fancy and the images that are added to the creative work.
8- Concentration and deep thinking emerging and solubility in the artist art.
9- Form the images for the mention concepts with balanced usage.
10- Highlight the creative piece of art using the artistic devices.
11- The formation and liability of the artistic medium to build the creative work.
12- Solving the obstacles and passing them.
13- Relaxation to change the vision and highlighting it.
14- The importance of highlighting the indirect ability to predict things .
15- Executing and forming the creative art and fulfilling it.
16- Assessing the creative work and testing it in a critical way.
17- Re-forming by repletion of relative works and constant formation.
18- Controlling the (process of creation) by analyzing and forming and finishing it.
19- Communicate to the aesthetic value to others, which is the message of creator.

20- Accomplish the achievements of the creation process and accomplish the goal of creativity which is natural beauty. We can came up with these steps the idea that the artistic creativity is achieved through cognitive , interactive and accumulated facts where the creative act emerge from it which is changed into a great aesthetic piece of art through the creative process .fig(1) (Mustafa Abdu1999).

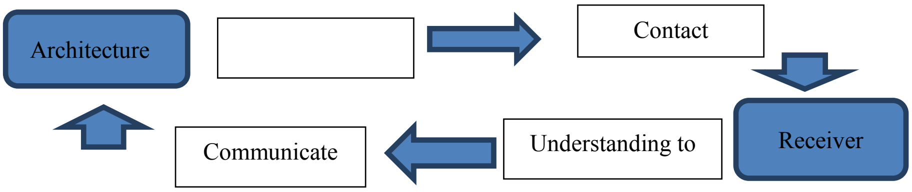


Fig.1. Communication Process

5. THE PROCESS OF MEASURMENT AND APPLIED STUDY

The part of the recipient is branched to study the subjects of testing and the mechanism of receiving the sensitive effects and reacting to it. Also the personal reactions that are related to it, which is study from two other sides the psychological side that is related to nature and the origin of the changing feelings, and the cognitive process. Also the metaphysical side is related to the analyses of the shape and content find a relation between beauty, quality, their representation, and compliance with reality. As for the part that reflected to the production side it is branched to study the phenomenon of creation experience , abilities ,skills, training and practicing piloting , which will definitely lead to the study of the nature and function of Art and literature . Characteristics of real and perfect things or false of the production of art and literature are the main subject. These studies may exceed these fields to reach the process of analyzing ethics and commitments. According to what we had mentioned, the study of the concept of beauty is divided into two main parts: First: The first part depends on the recipient. It concentrated on the aesthetic features of the audience and its evaluation to the esthetic value. The part of the recipient is branched into the study of taste and the mechanism of the sensitivity and reflects to it. The psychological reactions that related, must studied from both sides. The psychological side is related to the origin and nature and the change of feelings (emotions), and the cognitive (which is outside the range of our study). The metaphysical side is related to the analysis of the shape and content.

Second: The productive side, which is the role of the Artist, this part is branched to the study of creation phenomena and creativity, profession, skills training and piloting consequently this will lead to the study of the nature of Art and literature and function**.** And the qualities of the things that are true, perfect or false of every artistic and literal products. This study can exceed to the analysis of ethics and commitment. As far the evaluation of the Artistic work acts in the field of architecture.

5.1 Assessment Determiners

The Mechanism of logical analysis for the research samples is intended to accomplish through a model contains: -The technical features which are the basic elements for such special tools of the Artist and the general audience does not

deal with in the process of enjoying Art and Artistic works" The composition".
- The elements of lines, solid, emptiness, balance distribution of light and color in its shape and grades its signifiers, and the visional fantasy.
- The duality and signally of dialogue, sign and metaphor.
We cannot separate the quality of a building from its partial details. This depends on the exchangeable relation between the part and the whole Architecture should give a meaning to the building. One of the reasons of the existence of the accumulated semiology in Art is the desire to find one idea that can insure all types of Art.
This study concentrate on the study of position of evaluating of the recipient and the measure of the degree of compliance between the signal sent by the architectural work and the signal understood in the mind of the recipient. According to this, the structural theory explains the mechanism of communication through the massage and its alteration (the context, the code and the authority). The model suggests will be measured the sample (architectural works under test) according to the subjective opinion and thoughts of both the Architect and the Recipient. According to this we can build a sample to the relation between the Artistic creative work and its recipient. The main ingredients of this model as follow: The iconic thinking of the recipient mind contains the subjective characteristics of the creative production and its contexts. Which is the iconic of the recipient and the foundations to build a criticism attitude (which affected by the esthetic attitude) .The result of the cognition of the characteristics of the subject (fig.2).

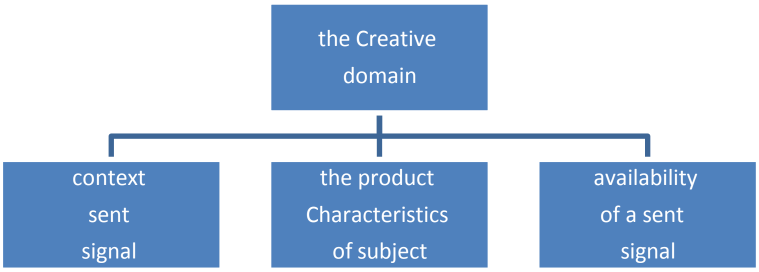


Fig.2 The model

5.2 Research Samples

The concepts presented in previous dissection, has been implemented in this research on six architectural projects illustrated in figure (3):

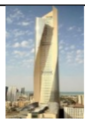
First building	Second building	Third building
 Iraqi rime – ministerial building (http.//ar.wikipedia.org) explain the word "free" through a slight bending	 AL- Hamra Tower in Kuwait(" http //ar. Wikipedia.org) It is a side of a person standing and turning his back to protect himself in the desert from the wind	 The Islamic Art museum in Qatar (http.//ar.wikipedia. org) the color the details of Islamic (heritage)
Fourth building	Fifth building	Sixth building
 **The tower of Nama city India**(http.//ar.wikipedia.or g) a tow hands with" Hinna" ornaments , which is an Indian bride's ceremony	 **The " X " Tower in Copenhagen in Denmark**(Architectural world 2009) aspirations and forms from the Danish Archie in the fifties illusion and vagueness with letter " X" .	 **The Ground Lisboan in Macaw China** **(**Architectural world 2009) expresses a mixture of cultural and functional effects which represent a mixture of urban organizations

Fig.3 Research samples

They represent the attitude of the architect (creator) on the three levels which are : 1- The formation side. 2- The symbolic side. 3- The signal (sign) The analysis contained the three aspect above and tested according to designer's own view point and the viewer point of view through a questioner designed by the authors according to the theoretical part of this research ,appendix(1):

Symbolic: It is signal that denotes figures which represents hypothetically to a law. The mutual language between the significant and the signifier within the code is the symbol of a law and the object in itself.

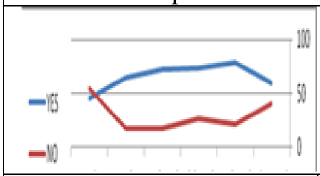
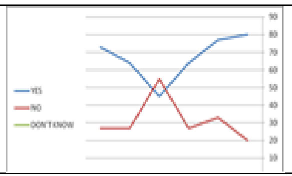
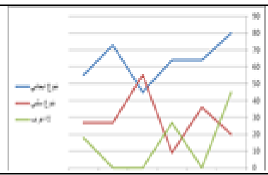
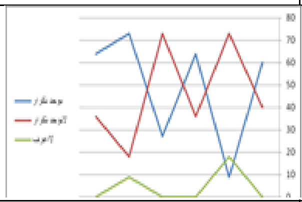
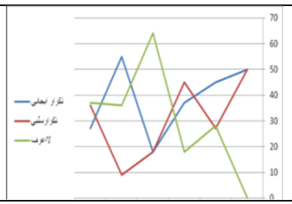
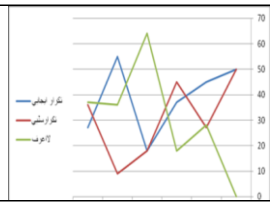
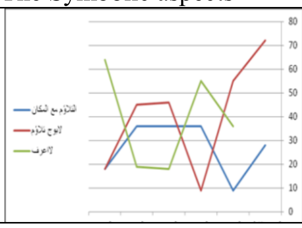
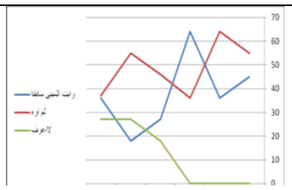
Iconic: It is the sign that represents the object due to its relation between the icon and the object. This stands for itself.

Indexical: The sign that represents the object through its association with it as a fact. The indexical is related to the object physically which makes with it a dual which is the signal that loses the feature makes it a signal where the object is removed but it doesn't lose its feature unless there is an index which has three features apart from other signs . The final results of the analyses illustrated in fig.

(4). The color indicate the matching between the results (appendix 2).

No. of building	Designer concept			survey results		
the signal	**Symbolic**	**Iconic**	**Indexical**	**Symbolic**	**Iconic**	**Indexical**
First			Indexical	Symbolic		
Second		Iconic			Iconic	
Third			Indexical			Indexical
Fourth	Symbolic			symbolic		
Fifth	Symbolic					Indexical
Sixth		Iconic			Iconic	

Fig.4.The Result

The Formal aspects		
		
Graph (1)Q Three	Graph(2)Q Five	Graph (3)Q Six
		
Graph(4)	Graph(5)	Graph(6)
The Symbolic aspects		
		

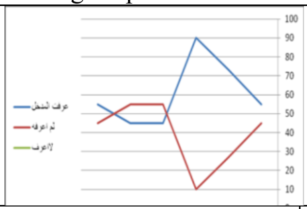
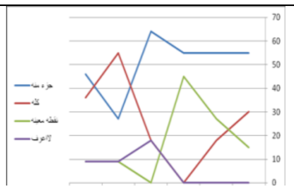
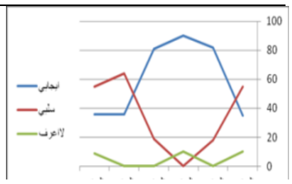
Graph(7)	Graph(8)	
The Sign aspects		
		
Graph(9)	Graph(10)	Graph(11)

Fig.5, Compare samples according to the results of questioner.

6. CONCLUSION

The recipient lacks the knowledge to read the signals that the creator tries to deliver through the architectural work. This lack increases when the depth of the meaning increased which is carried through the signal and also the rareness of the direct expression. The connection of the poor knowledge of the recipient with miss- reading of the signal that the designer (creator) wants to send through the architectural work due to the vagueness of signals sent by architecture that disconnected with the cultural criteria. The cultural criteria's are characterized by the number of varieties and not following specific style as it was in the style of the classic architecture. (Local or international) and this due to:

1- The Architectural environment in most of Arabic or Islamic cities lacks a great defect in fulfilling the creative and esthetic side of Architecture. It is obvious that the esthetic values in Architecture have decreased in a large scale leaving the path to the domination of the ugliness chaos (due to the retreat of the creative works)

2- The huge quantity of distorted buildings affected the visual environment, sense of viewers, and in a great degree on the decision of the recipient and his taste which affected on his reading of the iconic sides of the buildings. The power of international style producing new icons buildings and their characteristics may effects the creator faster different than it's affective on the receiver. So the communication process lost its smoothness. In a distorted way and in order to make new generations with a right Architectural culture therefore we should take an important and practical decision to solve this problem. Like the idea of poem that don't tell you what to think but that show a differentiation order of thinking.

7. RECOMENDATIONS

A consolidates the knowledgeable side of the recipient by:-

1- Holding meetings and debates which take part in developing new concepts about the development of esthetic thinking and the knowledge of beauty for the society in general.

2- Architectural departments should take a vital role to strengthen the interest of the society in the innovation process widening the schemata (The background knowledge) of the recipient concerning beauty in Architecture.
3- Taking into account the new achievements " complex, multi-layered and convoluted systems" which can be elements are fused together to achieve a printable file to be processed by a large-scale 3D Rapid-Prototyping machine, which produced this unique piece (due to its size and aesthetics) and its effects on the product as well the recipient.
4- Form commissions and institutions that carried the responsibilities of consultants where they can monitor supervise the level of designing and esthetics for the projects which can affect the civilized style of the city . and affect the level of sensitivity of the recipient.

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USABILITY OF A MATERIAL SELECTION TOOL FOR ARCHITECTURE STUDENTS AS A SUB PROCESS OF BUILDING ELEMENT DESIGN

MİNE KOYAZ[1]
M.CEM ALTUN[2]

ABSTRACT

Material selection as a sub process of building element design is a hard task especially for the architecture students with a minimum material knowledge. In order to overcome such a problem one of the approaches is the use of methodical support tools within the process. With respect to that approach a systematic material selection tool is developed. The material selection tool intends to define the main steps of the process and to guide the students. In order to investigate the usability of the tool and for further development, the tool is applied by the 2nd year architecture students in Bilgi University as a part of their "Building Materials and Technologies" course and a usability questionnaire is conducted.
In the paper, firstly the methodology of the work is explained; the development process of both, the "material selection tool" and the questionnaire. Secondly, the relationship of the material selection process with the architectural detail design process is issued. The application of the tool is stated and finally, the results of the conducted usability questionnaire are presented and discussed.

Key words: Material selection tool, Building element design, Architectural education

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1. INTRODUCTION

Selection of the “right” materials satisfying the expected performances is significantly important for any design. Today, with the constantly evolving and developing technologies, there are more than numerous options of materials to be used in an architectural design. In such a wide material “pond” it is even more crucial to make the “right” choice of materials. At this point, the necessity of the use of some support tools is arising, therefore the necessity of being more systematic.

The material selection tool that is to be developed has to systematize the “intuitive approach” in material selection process. The issued material selection tool is mainly developed for educational purposes and trying to show a more methodic way of material selection in architectural detailing for the use of architecture students with the minimum knowledge of materials. What are the encountered problems of an architecture student in a material selection process of detail design? How could this process be systematized? How could the material selection process become more practical? For that purpose, the existing “methodic approaches” for the material selection process has to be examined, simplified and transformed to be more “practical” with the addition of a data base usage. The developed tool should be setting the basic steps of material selection process in architectural detail design, aiming to be guiding, easily applied, fast, and result oriented.

2. METHODOLOGY

The steps that are followed in this work starts with a literature review. Existing material selection tools are researched and examined. A main flow chart of the "material selection tool" has been developed via those. After a research on the data bases the tool is adapted to be used with a selected data base. The application stage of the tool will be explained in detail at the following sections. In pursuit of that, a usability questionnaire is conducted. Finally according to the evaluation of the results the tool is rearranged.

The methodology for developing the "material selection tool" and the usability questionnaire are explained in detail at the following.

2.1. Developing a "material selection tool"

The methodology used in developing of the "material selection tool" starts with researching and examining the existing material selection methods and design supporting tools. During this step there were methods examined such as; Sneck’s method (Sneck et al. 1969), Cronberg’s method (Özkan 1976), Lohaus and Steinborn’s method (Fouad 2013), Müller’s method (Cziesielski 1990), Ashby’s method (Ashby and Johnson 2002), Japanese method (Japanese 1968) and Balanlı’s method (Balanlı 1997). The methods were applied on some example cases and their usability was compared through pilot studies. All the strong and weak attributes of each method were evaluated.

Briefly, Sneck's method and Cronberg's method only deals with the definition process of the material properties and does not define a decision process. Sneck defines the material properties from a performance based model (Sneck et al. 1969), on the other hand, Cronberg defines them from a user based model (Özkan 1976). Lohaus and Steinborn's method describes the material selection as an "iterative" process and defines the factors that are effective and expected to be taken into consideration during the material selection (Fouad 2013). Müller's method is based on defining the requirements affecting the selection process (Cziesielski 1990).

All the methods explained so far are developed to be used in architectural design. Different from those, Ashby's method is a practical and visual method from an industrial designer point of view (Ashby and Johnson 2002).

One of the examined methods was the research of the Japanese Research Group in 1968, which could be considered the most comprehensive and systematic method for selecting building materials and therefore the main inspiration for the developed "material selection tool". The method comprises the whole material selection process, from defining the material properties to their comparison and selection (Japanese Research Group 1968).

There are several later works that have used the Japanese method and developed further; such as, Ayşe Balanlı's work on the material selection process in a building. The main structure is similar with the Japanese method, but it also investigates the relations of a material and the building element and also states a more strict way for the evaluation and selection of the material (Balanlı 1997).

Regarding to the examination of the existing methods and tools the main structure, the main flow chart of the "material selection tool" is formed. The struggle here was to create a tool that is simple enough to be used by a designer with minimum material knowledge but still leading the designer to the "right" choice in the most practical way. In order to achieve that goal, there arises the necessity to use of a data base which has to be compatible with the main system of the "material selection tool". However, none of the existing material selection methods includes a data base or suggests the use of any data base. An exception is Ashby's method which is related to industrial design. So, after a research of existing data bases and testing their compatibility with pilot studies, the steps of the developed "material selection tool" is adapted to be used with a selected data base, in this case, Material Connexion. This data base has been chosen because of the possibility of different ways of searching and filtering and because of its wide material pond which is close to 70.000. It's accessibility via the library of Bilgi University from free of charge was also a motivation. From the examined other data bases; Yapı Kataloğu and Materia were also free of charge and compatible to be used with the tool, however they were found either not sufficient for their filtering options or their material pound. Therefore the usage of Material Connexion within the material selection process was encouraged through the application.

2.2. Developing a usability questionnaire

When approaches of data collection are examined,–questionnaires are the fastest technique at gathering information from large groups (Naoum 1999). For that

reason questionnaires were preferred in order to gather information on the usability of the "material selection tool".
On the other hand, monitoring the design process is a problematic task, since the design process of every individual is different from each other. According to David Yeomans commonly the design process of a building could be in four stages as; briefing, sketch design, development, detailing and construction (Yeomans 1982).
The material selection tool is explained to the students and they were asked to use the tool in their architectural detail design processes. An artificial problem is created and briefed to the students, and asked them to make their designs following the defined steps; the given problem and steps are explained in detail at the following sections. As all students were working on the same design problem and with pre-defined design steps, the usability of the material selection tool could be measured in a controlled environment.
The whole design process of the students was observed. During the designing stage some face to face interviews were conducted randomly and some initial feedbacks were taken. The usability questionnaire conducted afterwards is to gain feedbacks about the experiences of the students while making their material selections. With respect to the obtained results of the conducted pilot questionnaires and interviews, the questions took their final form.
The developed questionnaire has two purposes; obtaining data about the material selection process of the students in general and using the developed "material selection tool" with a data base. Therefore the questionnaire has two parts. The first part is applied to all students of the course and the second part was answered by students who used the proposed data base.

3. A MATERIAL SELECTION TOOL AND DATA BASE

In architectural design process first of all, some basic decisions are made at the building scale; about the structural system, organization of space and mass setup of the building. Generally due to some structural and aesthetic reasons some ideas of material use begins to arise in the designers mind. However, the material ideas in this step should not be directly affecting the material selection process. Designer has to be objectively examining the performance requirements of the building elements and making his selection of material due to satisfy these requirements. Aesthetics would be an inevitable parameter during the process, but should not be the leading one. Relations of the aesthetics and the material selection process are shown in the main flow chart of the tool [Figure1].
Performance requirements of the building elements are determined with respect to the using scenario of the building, therefore the user requirements and environmental factors affecting the building, like climatic conditions. After the performance requirements are determined for the building element, these transform into expected requirements from one layer of the building element. For instance, the transformation of the requirements of a floor system into the requirements of the coating layer of the floor. At this point from a “generic layering” each performance requirement of the building element are assigned to a layer. One requirement could be satisfied by two or more layers at once or one layer could

satisfy two or more requirements. Therefore the assigning should be carefully made with the consideration of the whole element.
When the performance requirements of the layers are determined there has to be another transformation to the expected properties of material that will be used in that layer. For instance from the coating layer example, it has some fire related requirements which could be satisfied by using a material having non combustible property.

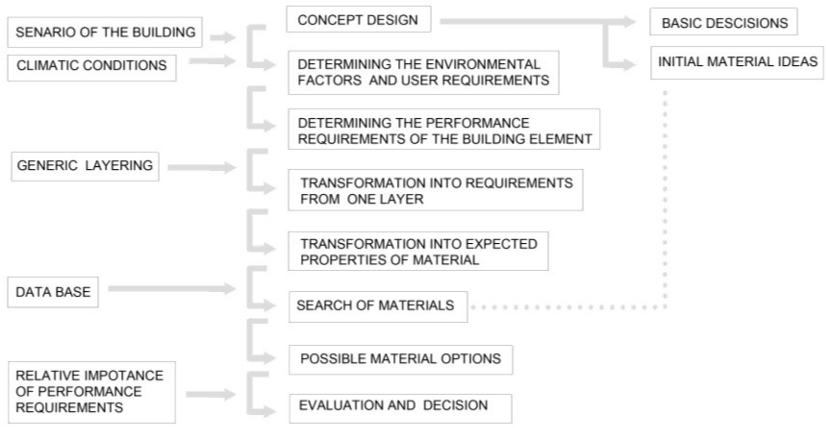


Figure 1. Main flow chart for the "material selection tool", developed based on Japanese's and Balanlı's methods.

From this point, the search for materials with the expected properties begins. Since the students have minimum material knowledge in this step the use of a data base is crucial. How the search would be conducted through the data base is optional, but the main usage is projected as searching from a key word or from the origin of material or from material properties. Designers are expected to find several possible materials and narrow down the material options.
As the final step, there has to be a decision process. The listed requirements from the layer are arranged according to their "relative" importance. Starting from the most relatively important requirement, all the possible material options are examined and by using an elimination technique the most suitable material, the one that satisfies the most relatively important requirements, is envisioned to be chosen. In order not to limit the designers, the decision steps have not been dictated with strict rules. Designers let to choose freely according to their different perspectives, as long as the chosen material satisfies the performance requirements.

4. USABILITY OF THE "MATERIAL SELECTION TOOL"

The developed "material selection tool" was explained to the 2nd year architecture students in İstanbul Bilgi University and they were encouraged to use the tool in

their architectural detail design processes as a part of the "Building Materials and Technologies" course. For the course, students were obliged to design a "housing+" for one or two person to live, on an island that they previously designated the environmental conditions. The building has to include areas for living, sleeping, dining, cooking, bathing and a plus function, such as an activity area for photograph, design, art, music, dance...etc. As a part of their design process, they were to choose the floor covering material of one of the floor systems in their "housing+" design by using the explained material selection tool.
Designing typical area details of the buildings elements was a mandatory task of the course. Students have to determine the performance requirements of the building element and appoint a function to each layer. Therefore, they were investigating the relations of the element and its layers. From that point they were to;

- transform the performance requirements of the layers to the expected properties of material,
- search for materials (Material Connexion was advised to be used as a data base, but it was not mandatory),
- list possible material options,
- evaluate them with respect to the relative importance of the performance requirements,
- decide on a material.

5. RESULTS

During the whole process the usage of the developed "material selection tool" as a part of building element design is observed. The initial feedbacks from the random face to face interviews shows that since this is probably the first time that the students uses such a methodic tool, they have been skeptical and showed propensity to skip steps. The usability questionnaire conducted at the end of the process has two parts, evaluation of the material selection process in general and material selection process by using the Material Connexion data base within the developed material selection tool. The obtained results are presented and discussed at the following.

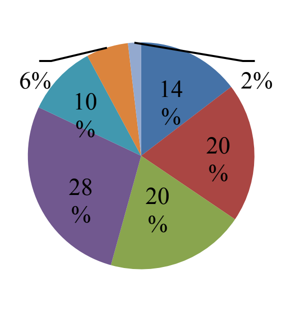
5.1. Material selection process in architectural detailing

94 students answered the questionnaire about the material selection process as a part of building element design.

When asked as follows; *which of the following(s) explains the way you use in your material selection process as a part of building element design? (Multiple options can be marked)* The distribution of the answers is given in the following [Figure2]. According to obtained results; 28% of the students *investigate materials that would satisfy the performance requirements*, 20 % tend to make their material selections by *examining the materials used in the similar projects* and another 20 % *consult to friends or professors who assumed to have knowledge on the subject.* 14 % of

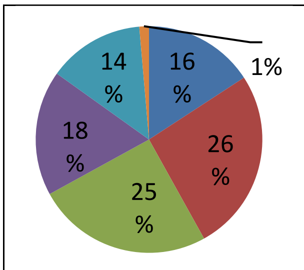
the students *tend to choose the materials that they already know* and only a few of them consider the material being environmentally friendly or economic.
Results obtained from this question is crucial, because even thought the whole material selection process planned to be shaped with the aim of satisfying the performance requirements two out of three percent of the students does not even consider them.

When asked as follows; *which of the following(s) you use as a tool in your material selection process as a part of building element design? (Multiple options can be marked)* The distribution of the answers is given in the following [Figure3]. According to obtained results; 26 % percent of the students prefer *using reference projects* as a tool in their material selection processes and 25 % prefer *searching over internet (using search engines, like Google..etc.).* 18 % mentions *using data bases, like Material Connexion, Yapı Kataloğu..etc.*



	39	□ *I tend to choose the materials that I already knov*
	53	□ *I examine the materials used in the simil projects*
	53	□ *I consult to my friends or professors who assume to have knowledge on the subject*
	74	□ *I inves□igate materials that would satisfy t performance requirements*
	27	□ *I investigate materials with the least negati impact on the environment (like local materials..etc*
	16	□ *I investigate economic materials*
	5	□ *Others .... □..........*

Figure2. Answers of the 1st question, shows the number of students who marked each option and their percentage distributions.

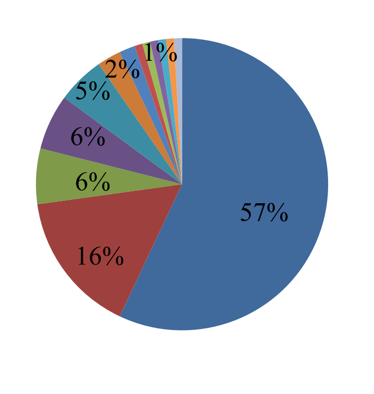


	46	□ *I use reference books*
	76	□ *I use reference projects*
	73	□ *I search over internet (using□search engines, li Google..etc.)*
	52	□ *I search over internet (using data bases, li Material Connexion, Yapı Kataloğu..etc.)*
	40	□ *I use the catalogs and brochures of the firms*
	4	□ *Others ....*

Figure3. Answers of the 2nd question, shows the number of students who marked each option and their percentage distributions.

When asked as follows; *if you use internet as a tool in your material selection process as a part of building element design please explain your steps briefly. Which search engine or data base you used? How did you make your research?*

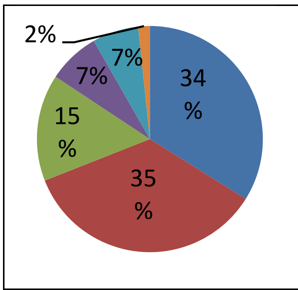
(over materials area of use, origin, properties related to performance, visual properties..etc.) What key words you used? The distribution of the answers is given in the following [Figure4]. According to obtained results; the majority of the students, 57% percent, uses Google search engine as a tool in their material selection processes. Material Connexion, Detail, Yapı kataloğu, Arch Daily ve Archi Expo could be listed as the most used data bases in order.
With respect to the students' explanations about their material selection processes, it could be said that the majority of the students prefer making research by using keywords like the *name of the material* and/or material's *area of use*. Some prefer searching over the material *properties related to performance* and some over the *visual properties* of the material. Also most of the students look for *reference projects* and search over the *dimensions* of the material. Very few prefer to look for the *origin* of material, material's type of production, material's price or material's environmental impacts.



	65	***Google*** *(http://www.google.com.tr/)*
	18	***Material*** *(http://library.materialconnexion.com/home.asp:*
	7	***Detail*** *(http://www.detail-online.com/)*
	7	***Yapı kataloğu*** *(http://www.yapikatalogu.com/)*
	6	***Arch Daily*** *(http://www.archdaily.com/)*
	3	***Archi Expo*** *(http://www.archiexpo.com/)*
	2	***Yandex*** *(http://www.yandex.com.tr/)*
	1	***Yahoo*** *(https://www.yahoo.com/)*
	1	***Bing*** *(http://www.bing.com/)*
	1	***Wikipedia*** *(http://www.wikipedia.org/)*
	3	*Others*

Figure4. Answers of the 3rd question, shows the number of students who marked each option and their percentage distributions.

When asked as follows; *which of the following(s) are effective in the decision step of your material selection process as a part of building element design? (Multiple options can be marked)* The distribution of the answers is given in the following [Figure5]. According to obtained results; 35 % of the students stated that *satisfying the performance requirements* is the most effective factor in their decision step, whereas 34 % of the students marked *aesthetics, visual properties* as the most effective factor. 15 % considers materials *having the least negative impact on the environment* while they are making decision. For only a few the origin or the price of the material is an important factor.
The results show that some of the students are tend to ignore the performance requirements if the material satisfies their visual parameters.,



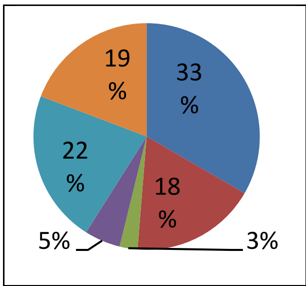
	82	□ *Aesthetics, visual properties*
	85	□ *Satisfying the performance requirements*
	37	□ *Having the least negative impact on the environment*
	18	□ *Origin of the material*
	16	□ *Price of the material*
	4	□ *Others* ....

Figure5. Answers of the 4th question, shows the number of students who marked each option and their percentage distributions.

To sum up, according to obtained results it could be said that students tend to investigate materials that would satisfy the performance requirements, but they also tend to make their material decisions according to appearance. Being economic or environmentally friendly seems to be a secondary parameter in their material selection processes for the majority of the students. The results draw a general framework on how the students are making their material choices. Though there is a material selection tool which was explained step by step still most of the students base their selection on aesthetic reasons. It shows that, for the students who answered the questionnaire, appearance is an essential parameter for the evaluation of materials, as well as the performance requirements.
Most of the students use internet sources to make material searches. The most common keywords used to make a research are the name of the material and/or material's area of use. Therefore, the data base that is to be used as part of a tool in the material selection process should have some searching or filtering options on these areas.

5.2. Usability of the Material Connexion data base.
33 students who used Material Connexion data base as a part of their material selection process answered the questionnaire.

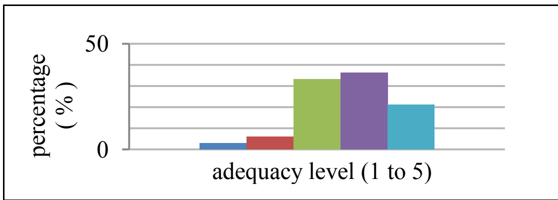
When asked as follows; *which of the following(s) search options in Material Connexion data base you used? (Multiple options can be marked)* The distribution of the answers is given in the following [Figure6]. According to obtained results; although the data base offers different ways of searching with 33% the majority of the students prefer to *search with a key word.* The preference order for the other options are as, *search from the usage title, the physical properties title, the origin of material.* Only 8% of students use the other searching options like *the processing title* and *the sustainability title.*



26	□ *Search with a key word*
14	□ *Search from the origin of material*
2	□ *Search from the processing title*
4	□ *Search from the sustainability title*
17	□ *Search from the usage title*
15	□ *Search from the physical properties title*

Figure6. Answers of the 5th question, shows the number of students who marked each option and their percentage distributions.

When asked as follows; *evaluate the adequateness of the filtering options in Material Connexion data base. (1 – least adequate / 5 – highly adequate) Briefly explain your reasons.* The distribution of the answers is given in the following [Figure7]. According to obtained results; more than half of the students found the filtering options *adequate or highly adequate.* The ones who were not sure about the adequateness of the data base mentioned some problems caused by too many sub-parameters under the titles and lack of filtering over the materials' area of use.

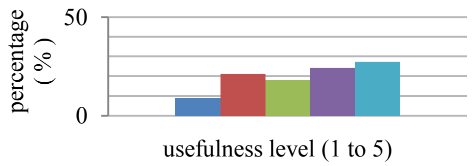


1	□*1*
2	□*2*
11	□*3*
12	□*4*
7	□*5*

Figure7. Answers of the 6th question, shows the number of students who marked each option and the percentage distribution of the adequacy level of the filtering options. (1 – least adequate / 5 – highly adequate)

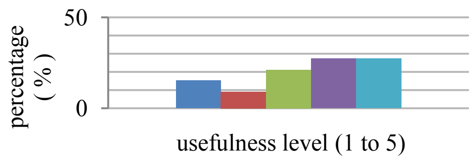
When asked as follows; *evaluate the usefulness of the Material Connexion data base in following terms. (1 – least useful / 5 – highly useful) Briefly explain your reasons.* The distribution of the answers is given in the following [Figure8-9]. According to obtained results; the data base is found useful for *seeing different material options* and also it makes it easier at *accessing and comparing material options* according to the majority of the students. However, students who used the data base have different opinions about its being *quick at getting results* and m*aking the "right" material choice.* Some mentions about accessibly and language problems, which made it difficult for them to complete their material selection through the data base.

Accessing material options



3	□*1*
7	□*2*
6	□*3*
8	□*4*
9	□*5*

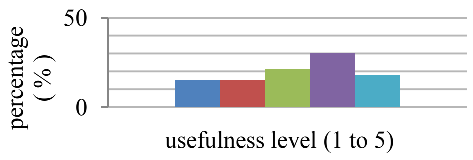
Getting result quickly



5	□*1*
3	□*2*
7	□*3*
9	□*4*
9	□*5*

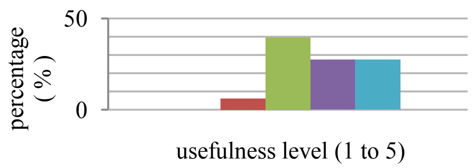
Figure8. Answers of the 7th question, shows the number of students who marked each option and the percentage distribution of the usefulness of the data base. (1 – least useful / 5 – highly useful)

Comparing material options



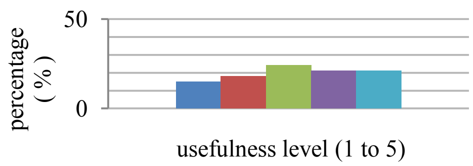
5	□*1*
5	□*2*
7	□*3*
10	□*4*
6	□*5*

Seeing different material options



0	□*1*
2	□*2*
13	□*3*
9	□*4*
9	□*5*

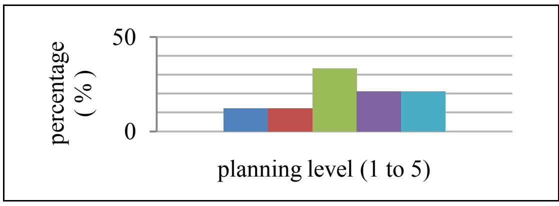
Making the "right" material choice



5	□*1*
6	□*2*
8	□*3*
7	□*4*
7	□*5*

Figure9. Answers of the 7th question, shows the number of students who marked each option and the percentage distribution of the usefulness of the data base. (1 – least useful / 5 – highly useful

When asked as follows; *do you plan to use Material Connexion data base in your next material selection processes? (1 – definitely no / 5 – definitely yes) Briefly explain your reasons*. The distribution of the answers is given in the following [Figure10]. According to obtained results; the majority of the students are planning to use the data base in their next material selection processes, whereas one of three of the students is indecisive. Overall the data base if found helpful for a material selection via performance requirements perspective.



	4	□1
	4	□2
	11	□3
	7	□4
	7	□5

Figure10. Answers of the 8th question, shows the number of students who marked each option and the percentage distribution of the planning level to use the data base in the future. (1 – definitely no / 5 – definitely yes)

In general, the use of Material Database as a part of the material selection process found to be useful by the most of the students. Having a wide material pond and having various filtering options are the strong points of the database. Also the relative comparison of the material properties like; low, medium, high, allows the users to easily compare materials. However lack of filtering over the materials' area of use could be listed as a weakness of the database.

6. DISCUSSION AND CONCLUSION

A material selection tool has been developed which is to be used within the building element design process. The usability of the tool is investigated with its application by 2nd year architecture students in İstanbul Bilgi University as a part of the "Building Materials and Technologies" course and with a usability questionnaire, answered by 94 students. Obtained results could be listed as;

- Most of the students investigate materials that would satisfy the performance requirements, but they are leaning to make their material decisions according to aesthetic reasons.
- In the decision process, being economic or environmentally friendly seems to be a secondary parameter for the majority of the students. In general, they tend to make their choices according to appearance but they check if the chosen material satisfies the performance requirements.

For that reason, although it was intentionally left more flexible, the decision process should be more strictly defined. Making a material choice for an aesthetic reason should not lead the users of the tool to a material that would not satisfy the performance requirements.

- Most of the students use the internet sources to make material searches.

The most common keywords used to make a research are name of the material and/or material's area of use.

Since it was the first time that the students used a methodic material selection tool, they were tentative about its usage and they were tending not to follow the steps exactly the way it's explained. The majority of the students were not using any material data base in their previous material selection processes and although it was advised some still choice not to use. According to the feedback of the 33 students who used the Material Connexion data base as a part of the material selection process;

- The data base found useful, because of having a wide material pond, having various filtering options and presentation of material properties in an easily comparable way.
- The deficiency of the data base is not having a searching option over the area of use.

Although there were positive feedbacks about the data base, sometimes the usage of one data base may not be enough at reaching a decision. Therefore the use of multiple data bases in relation with each other could be an alternative solution. Besides, generally firm based data bases are used but some non commercial data bases listing the general characteristics of the material and the standards could also be included to the process.

In the light of the application of the developed "material selection tool" and the evaluation of the results of the usability questionnaire, the development of the tool continues with respect to the preliminary findings.

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KEYNOTE SPEECH
(21 November 2014 Friday, 15.30-16.00)

Prof. Stefano Francesco Musso
"Inheriting our Cultural Heritage. Changes of Paradigm of Conservation."

INHERITING OUR CULTURAL HERITAGE. CHANGES OF PARADIGM OF CONSERVATION

STEFANO FRANCESCO MUSSO[1]

Abstract

The world is quickly and deeply changing, facing new challenges in the built environment. Conservation can play a crucial role for preserving the future of the planet, not wasting but rather continuing to use (or reuse) the depot of physical traces that the previous ages left us, as provisional responsible for them, in cultural ways and respectful. A crucial question rises apropos: are we really ready and able to inherit this impressive mine of knowledge, identity and cultural richness? We cannot in fact go on along the paths that have been traced, within the western world and culture, since more than two centuries about conservation/restoration (with all its contradictions and suggestions). We cannot behave as if nothing has changed and ignoring the problems of the contemporary societies, or like they were external to our commitments, interests and responsibilities. The key-lecture will deal with some of the main challenges that the culture of conservation (or movement, as someone could call it) will have to face in the near future in order to survive and not to reduce itself to an ancillary role and to an un-influencing condition within the contemporary world. A particular focus will be put for this reason on the crucial role that ICT play also in this field.

The reasons of conservation/restoration nowadays.

We come after two centuries of debate that has been deeply and completely aroused in the Western World or - even better – that would be considered as merely European. This long process saw the appearing and progressive consolidation of the opposite polarities of conservation and restoration, up until the slow, but now ever consolidated expansions process, "for kind, age of formation, for extension and quality", of the various "goods" subjected to tutorship and safeguard. For this reason, we often think to a completely known and consolidated universe of objects, though it appears to be progressively and quickly expanding far beyond the traditional notion of "monument" as an isolated masterpiece of art or as a historical memory or witness. New problems or artefacts can always emerge to our attention

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and they could also make our world, rich of fragile certainties, explode or implode. Many journalists or scholars, politicians or architects could also remind us the fatigue and disillusions while working in some troubled lands and parts of the present world, where conserving can mean to have to deal, not just and not as much, with the technical or theoretical alternatives within we often limit our work. It would imply to face wider horizons of sense and, in particular, the problem of coexistence between peoples which are fighting, each living and interpreting the environment and its depots of signs and historic tracks in very hostile ways. Not to speak about the dramatic situation of many human groups and communities with no state, no land, no food or citizenship and for whom conservation, even before restoration, could assume a very understandable and crucial meaning. We conserve, in fact, for a future world of civilization, cohabitation and sharing of memories, values and potentialities of life. Otherwise: why should we do it? For this and other reasons, we cannot just ignore similar questions, pretending they concern exclusively political assets not regarding us, or our possibility of acting. It seems that, instinctively, we think to ourselves as to responsible of some "jewels" which value we debate on, but that certainly belong to a world of consolidated peace, for which these problems seems to have no meaning at all, or that have been already solved by other fights in previous times. Things are not exactly like this, neither for us, European, and it is plain to see we have to acknowledge the fact. Being able to see through the curtains of unawareness and approximation, we can discover that they could concern also monuments or artefacts of our civilized countries[1].

Conservation/restoration for whom? Values, impacts, consequences.

Nevertheless, when we think to (or we deal with) the problems, the ideas and the aims of any conservation or restoration theory, or with the correlated practical actions, we inevitably face the crucial theme of the values involved in the field.

It is not a novelty. Alois Riegl[2] treated this conflicting and contradictory aspect at the beginning of the Nineteen century, asking to himself the reasons why his times were so deeply crossed by a new and powerful "modern cult for ancient monuments", almost a religious attitude that never existed before. While examining the phenomenon, he clearly outlined and analysed a wide and articulated range of values belonging to the dimensions of contemporary (present) and of memory (past), of every time, of course. They were and still are values belonging to men and are assigned by themselves to the ancient monuments, thus reflecting the changing in their cultural asset and atmosphere, along the times passing on. We could even now

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[1] On these arguments see also: Stefano Francesco Musso (2009). *Conservation/restoration of built Heritage. "Dimensions of contemporary culture"*, in: Piet Lombaerde, Laura Lee (editors),. *Bringing the World into Culture. Comparative Methodologies in Architecture, Art, Design and Science*, UPA Editions (University Press Antwerp), ANTWERPEN (Belgium), p. 86-107, ISBN: 9789054876304

[2] Cf. Alois Riegl, *Der Moderne Denkmalkultus, sein Wesen, seine Entstehung*, Braunmuller, Vienna-Lipsia 1903 (It. tr.: A. Riegl, *Il culto moderno dei monumenti. Il suo carattere e i suoi inizi,* in Scarrocchia, *Sandro, A. Riegl: teoria e prassi della conservazione dei monumenti. Antologia di scritti, discorsi, rapporti 1898-1905*, Accademia Clementina-CLUEB, Bologna 1995)

refer ourselves to those values, together with their complex games, in order to explain which the real contents of our discussions and actions are, within the field of the protection, conservation, restoration and valorisation of built Heritage. This last notion, in itself, is quite recent and it represents the result of the long and rich history of the modern theories of restoration, starting from its right beginnings, between the XVIII and the XIX centuries, as many protagonists affirm (Eugène Emmanuel Viollet-le-Duc, John Ruskin, William Morris, Max Dvorak, Camillo Boito or Gustavo Giovannoni, among the others). It is sufficient to recall, apropos, the important analysis by Francoise Choay[1] about the evolution of the same idea of monument. This was initially considered only as a "masterpiece of art", an isolated and unique object mainly characterized by aesthetical or historical values. Afterwards, a new and more complex concept was slowly developed considering a monument as a cultural good, not exclusively of material nature, that can also have outstanding social and economic values[2]. Any doubt should therefore exist about the crucial role that our ideas, concepts, theories, as well as our analytical, diagnostic and intervention techniques, in their whole, play in the contemporary world and society, even if with sometimes contradictory and conflicting results.
The question "why?" do we conserve/restore thus emerges as the really crucial one, as regards our attempts to understand and correctly use our ideas and instruments. Within this perspective, in fact, any our desire or compelling attitude towards the conservation/restoration of a material good that derives from an almost unknown past, so that it can reach the future, should be explained, communicated and hopefully accepted from the social communities we belong to, more than by the only cultural or scientific ones. Only in this way we could hope that this effort will be really sustainable for our descendants and will be felt as a chance and not only as a load or as a problem for our present situation.

The conservation/restoration project: times, contents and goals

The word and the topic "project" of course emerges every time we speak about conservation/restoration of built Heritage, but it is always characterised by profoundly different meanings and accents. We all know it is a crucial crossroad for research, teaching and professional practice, as it is in other fields. Right for this reason, someone underlines the fundamental differences between a "project concerning a new object" and a "project concerning an existing one". This is particularly evident because this last one cannot just be the mere sum of some functional modifications but it aims to take a real care of the existing artefact, with its memories, depots of knowledge and potentialities, in order to make it useable for our future in the most undamaged and preserved state - if ever also enriched by new

[1] Cf. Choay, Françoise, *L'allegorie du patrimoine, (*It. tr. D'Alfonso, Ernesto & Valente, Ilaria (ed.*),* *L'allegoria del patrimonio,* Officina, Roma 1985)
[2] See, a propos, all the international documents and the numerous International charters devoted to the problem of the destiny of ancient architectures, towns and cultural landscapes but also to the huge legacy of immaterial goods of humankind in the contemporary world in the perspective of the future generations.

resources and not certainly impoverished of the already existing ones. The project is in any case and with no doubt a crucial point in the process of conservation/restoration of our Heritage. However, the project is just one moment, even if fundamental, in the process of conservation/restoration and, in any case, it is a moment that "only apparently" seems to ratify its conclusion. Here an enormous risk lies. Centuries of discussions, in fact, have not decided, neither the coming ones will do, which possible alternatives concerning goals, objects, instruments and methods of the conservation/restoration project could be. Meanwhile, if our research or practice only concentrates itself on its riving contradictions, the hazard is losing other key elements of the problem. Many scholars suggest apropos not to limit our look to the conservation's culture, meant as a withdrawn world, all-sufficient or, worst of all, self related. A route exists in fact between teaching, learning and acting in this field and it is marked by profound divisions and connections, by polarities and reflected images. In the today's world, architecture and conservation/restoration often look like "poor neighbours", not communicating, subjected to the perennial contraposition between the exaltation of creativity and the research for analytical rigor, but also between the tension for pure knowledge and the profession's pragmatism and needs, in time of deep transformations which would instead demand their profound and meditated integration. According to many experts, the relationship between conservation/restoration and architecture is not only inside their common affiliation to the same world of objects, methods or instruments. Conservation and restoration are tied to architecture firstly by the common aim of inhabiting the world on an even keel, between memories of a past which can still be significant and productive and a future which must be free but not oblivious, for us not to waste what the earth has given and still gives us. Therefore, we need to ask "what" and "how much" architecture can offer to conservation, but also - and with the same strength - what and how much conservation can offer to architecture[1]. The reference to the contemporary philosophic and epistemological thought, at this point, is the necessary background to correctly underline the need of a higher integration with the various architectural disciplines, even by facing the risk – by many dreaded – that this would end up in a loss of centrality (or of power!!!) of the conservation/restoration seen as autonomous worlds. However, we must ask ourselves if our scientific, cultural and technical actions can keep on being proposed as a sort of "pillbox defence" (or a "Ivory tower"), granted that it exists or should exist, or if rather opening up for a confrontation in which our reasons would stand just because their own strength, instead of invoking weak protectionist or binding policies when those are actually ignored or half tolerated by the society, for the welfare of which we are saying that they should be adopted[2]. On the other hand, it appears evident that the project, considered as a mere technical action, tied to the artefact and its destiny, could not be the only focal point of our activity, because a

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[1] Cf. Kealy, Loughlin, *Teaching/thinking/learning/doing. Conservation and creativity in architectural education,* in Musso, Stefano F., De Marco Luisa (ed.), *Teaching Conservation/Restoration of the Architectural Heritage. Goals, Contents and Methods*. EAAE-ENHSA Transactions n. 38 – Leuven (Belgium – Tessaloniki – Greece) 2008 - ISBN/ISSN: 2-930301-35-X (now in press).

[2] Cf. Musso, Stefano F., *Teaching Conservation/Restoration: tendencies and emerging problems*, in Musso, Stefano F., De Marco Luisa (ed.), *Teaching Conservation/Restoration*…, quoted.

wide amount of questions, themes and objects are progressively emerging. Moreover, this is true if we think to the difficult relationship that presently exists between Science and Technique where the second one is no more the instrument adopted to realise the previsions of the first one, but it is going to begin more and more the goal of (and in) itself[1]. We must at least consider with a new attention the problems connected to the management phases or, even, to normative rules, which closely concern conservation and restoration. Unless, we reduce our activities to a mere search for more or less sharable technical solutions (accepted by many or few, by a "school" or another), the only attempts for answering questions which, at heart, others have selected before our intervention[2]. The fact is that, perhaps, we cannot just restrict ourselves to the mere discussion or confrontation, sometimes hostile, exclusively about "how" to technically intervene, completely ignoring "who" decides "where" and, most of all, "why", something must or can be conserved or restored[3]. By and large, we cannot simply ignore, forget or avoid the many facets and implications which the problem implies at larger scales (urban, territorial, of the built landscape) which exceed each single artefact we take care of. Above all, at these levels, it seems clear that the themes related to conservation/restoration are profoundly entwined with the more general processes that condition or mark our communities and landscapes, now ever more immerged in a global and planetary dimension but always seeking for more or less certain identities (or, better, specificities). These last, just as regards Heritage, should be deeply rooted and clearly expressed, thus demanding an active safeguard, for a really sustainable future (not only economically, socially and environmentally but also cultural).

Methods, instruments, tools and procedures

Though the problems could have very different answers, every conservation/restoration process usually respects some fundamental methodological steps, a sort of logic scheme, or a sort of flow-chart that always asks frequent feed-back procedures, in order to check its correctness and efficacy.

We could recall in this regard the ancient metaphor of the Architecture or, better, of a building as a "body. Leon Battista Alberti[4] inaugurated the Renaissance and the re-discovery of the Roman classical culture not to imitate but to overpass it, with this powerful "paradigm" as Francoise Choay defined it[5]. One of the consequences of this theoretical concept is the paragon we often propose between the activity of a

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[1] As regards the relationships and the respective roles of Science and Technique/Technology in the contemporary world see, as a simple example: Garimberti, Umberto, *Psyche e Techne. L'uomo nell'età della tecnica,* Feltrinelli, Milano 1999 – ISBN: 88-07-10257-9 and, in general, the most recent epistemological elaboration from Karl Popper to Hans Georg Gadamer, from Francoise Lyotard to Jürgen Habermas.

[2] Cf. Stovel, Herb, *Challenges in moving from architectural conservation education to heritage conservation education,* ibidem

[3] Cf. Della Torre, Stefano, *Cultural Heritage Process Charted: defining competences to decide educational programs,* in: Musso, Stefano F., De Marco Luisa (ed.), *Teaching Conservation/Restoration…*, quoted.

[4] Cf. Alberti, Leon Battista *De re aedificatoria…,* quoted

[5] Cf. Choay, Françoise, *La regola e il modello: sulla teoria dell'architettura e dell'urbanistica*, Officina. Roma 1986 D'Alfonso, Ernesto (ed.).

physician and that of an architect when he intervenes on an existing monument that was built following forgotten rules and plans and is now affected by unknown decay phenomena or structural instabilities. This metaphor was proposed and utilized by Leonardo-da-Vinci when he was asked by the Milanese people to suggest a solution for the completion of their unfinished "Duomo" (Cathedral) proposing the best form to be adopted for its new flesh. Leonardo[1] proposed, starting from Alberti's idea of the necessary "conformitas" (accomplishment) between the existing and the new parts, to adopt a light structure based on a square or octagonal plan in order to match the existing pillars of the dome and thus respecting the structural logic of the gothic church.

If we accept for a moment to use again that metaphor (conscious of its limits), we could individuate in our job at least the following schematic but fundamental phases, even if they do not always exist and follow each other in this specific unidirectional order: analysis, diagnosis, anamnesis, prognosis, therapy, prophylaxis. To the basic phases of inquiry, as we see, other parts of the job follow, on the level of intervention, passing towards the crucial and not automatic moments of the interpretation of the analytical and diagnostic results. These new phases are represented by the project hypothesis assumption (prognosis), their control, the definition of the project (the therapy: aims, tools, intervention techniques, technological, environmental and economic requirements…etc.) and its realization in the construction site to end with the programmed maintenance of the restored building.

The "Anamnesis", in particular, is very interesting, because it implies the attempt to re-construct the history of the monument in order to understand "how" it was conceived, realized and afterwards modified by men or by natural events, but also "how" and "why" it was used and consumed in the past. We are speaking of course about an "idea of history" that is quite distant from the traditional one and that shows all the influences that the evolution of the historical sciences and methods knew during the past century and, particularly, the birth and development of a "New History" ("Nouvelle Histoire") [2] aside the traditional one. A new history defined as a "history as a problem", facing the ancient "history as a tale", attentive to the "long duration" of some phenomena and not only to the single outstanding "events" that marked the existences of the past generations and societies. It was a new concept of

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[1] Cf. Leonardo Da Vinci, *Lettera ai fabbriceri,* Published in *Bruschi A. Maltese C., Tafuri M., Bonelli R.,* (editors), *Scritti rinascimentali,* Il Polifilo, Milano 1978.

[2] As regards the so named "New History" or more properly "Nouvelle Histoire" that developed during the Twenties of the past century aside the French revue "Annales d'historie economique et sociale" see, as a simple reference among a very wide literature about the argument, the following texts: Braudel, Fernand, *Un leçon d'histoire,* Les Editions Arthaud, Paris 1986 (It. Tr. *Una lezione di storia*, Einaudi, Torino, 1988),; Braudel, Fernand, *L'Europe. L'espace, le temps, les hommes*, Art set métiers graphiques, Paris 1987 - for the notions of "histoire de la long duré" o "histoire evenementielle"; Bloch Marc, *Apologie pour l'histoire ou métier d'historien*, "Cahiers des Annales", Librerie Armand Colin, Paris 1949 (It. tr.: *Apologia della storia o mestiere di storico*, Einaudi, Torino 1969); Le Goff, Jacques, *Storia e memoria,* Einaudi, Torino, 1982; Le Goff, Jacques (ed.), La nuova storia, Mondadori, Milano, 1990; Le Goff, Jacques – Nora, Pierre (ed.), *Fare storia. Temi e metodi della nuova storiografia*, Einaudi, Torino, 1981; Le Goff. Jacques, *Histoire et Mémoire,* Gallimard, "Folio", Paris 1997; Lucien Fevre, *Civilisation. Évolution d'un mot et d'un groupe d'idées*, Paris, Renaissance du livre, 1930.

the historian's trade carefully intent in studying all the possible traces of the past, material and immaterial, descriptive and qualitative but also quantitative and apparently meaningless in themselves, because their sense could exclusively emerge from the great series of single data considered in a different perspective. It was a method to reconstruct the unknown history of the past, ancient or recent, avoiding any preventive selections of data, any a-priori choice of a particular position within the rich offer elaborated on the level of the "Philosophy of History". Only this kind of historical research could allow reaching these new epistemological borders, thus contributing also to an innovative development of the conservation/restoration matter. This attempt to highlight the moment of its construction and all the subsequent phases of the existence of the artefact can and must use, in fact, different data and various information sources: indirect, that is to say independent from the physical consistency of the monument (written documents, iconography or oral testimonies and traditions), or direct, that is the monuments considered as the first and fundamental documents of themselves, as Jacques Le Goff has clearly explained. Right within this second perspective, our job inevitably interacts with all the analysis and diagnostic tests that could be developed in order "to inquiring" the building, in its present state and consistency material, hoping to understand at the end, despite it changes during our studies.

Innovation in Conservation

The themes related to the knowledge, or better to the many forms of non destructive studies and inquires of existing buildings, have thus acquired along the recent years an outstanding role. A sort of satisfaction also exists in this regard, because a common language has certainly been acquired on this field, with evident and appreciable fallouts. Nevertheless, some worries emerge for the risk of a kind of consolidated "orthodoxy", which may hide a simply formalistic respect for some apparently inescapable rules, accompanied by a certain passiveness of our way to handle conservation/restoration interventions.

In any case, we are always intent in achieving the sure capability to develop:

- rigorous architectural surveys, supported by adequate technological devices and, first of all, clearly based on methodological geometrical basis recurring to traditional methodologies of longimetric nature, to topographic devices, to analytic or digital photogrammetric instruments and tools till the most updated 3D laser scanning possibilities; they are intended to know and dominate, also thanks to the evolving elaboration and restitution techniques, the "geometries" of the monuments (original and acquired, for construction mistakes or for structural assessments or changes, regular and irregular, intentional and casual[1])
- serious historical inquiries, grounded on strong critic and analytical apparatus, as well as on rigorous studies of the indirect archive sources, always compared with

[1] As regards these different "geometries" which always characterise the ancient buildings and that constitute the real "scientific object" of any serious architectural survey, see: Torsello, Paolo B., *La materia del restauro*, Marsilio, Venezia 1988 – Musso, Stefano F., *Recupero e restauro degli edifici storici. Guida pratica al rilievo e alla diagnostica*, EPC Libri, Roma 2006 (II ed.).

the results of correspondent archaeological inquires of the artifacts considered as the first and direct sources to be used in order to reconstruct their past history;

- meticulous analytical and diagnostic studies, collecting and organizing data concerning the physical state of the artifacts, as regards the building materials, their state of deterioration/conservation, conducted with rigorous empiric methodologies supported by sometimes very sophisticated laboratory tests (mineralogical and petrography characterization, physical and chemical analysis, biological, botanic and zoological inquires…), faithfully visualized and synthesized in "thematic maps" of sure communicative and perceptive impact;
- analysis and interpretation of the constructive techniques, throughout the instruments of the "history of material culture" and of the archaeological methods applied to architectural structures (see also the experiences of the "medieval archaeology" and Harris's stratigraphy);
- basic or sophisticated and instrumental structural analysis using specific interpretative numeric models and non destructive tests;
- refined and reliable "virtual simulations" of the designed interventions, regarding the built materials and elements, but also the spaces and the layout of the ancient buildings we are working on;
- more and more accurate and dynamic systems for monitoring (in situ or in remote) the microclimatic conditions of our monuments, in strict relation with the environment in which they are inserted, which must be studied and understood as a fundamental condition to explain their present status and to design their future.

These aspects, at the end, can be essentially used exactly in order to understand not only the building as it is today but, above all, to discover why it is in the present conditions and this is one of the main goals of any historical enquiry (that is the "anamnesis", by the way) considered as a preventive and accompanying phase for any conservative intervention.

Every day, on the other hand, we discover that is almost impossible (dangerous or even useless) limiting our look to the conservation's culture, considering it as a withdrawn, self-sufficient or self-related world. It tracks a route between searching and understanding marked by profound connections, polarities and reflected images.

The emphasis should furthermore be placed on the need for an affective "programmed conservation" and on the "conservation of the whole", that is to say of the systems of cultural goods, more than on the need of intervention on single artifacts interpreted as "masterpieces of art", especially if the intervention intends to bring them back towards ancient and lost splendors (impossible, fake and always obtained by destroying their status present and their values). These concepts have remarkable implications because they pay attention to the "system" of goods that constitute our built heritage (from the single artifact to the city, till the rich and irreplaceable landscapes we are living in), going beyond its single and separate elements. This situation nevertheless requires new competences and professionalisms, which we have to create in the University and in the world of professional training. In front of the challenges proposed by the destiny of our

monuments, cities and cultural landscapes, on the other hand, are really needed not only some new "technical professionalisms" (analytical, diagnostic and design oriented) but a different cultural attitude. We rather have to avoid that this crucial field for the future of the world be reduced to a simple and indistinct sum of separate responses to the various emergencies every day occurring. These last, in fact, could be at the end acceptable but they are always arguable (on the cultural, economic, technological, technical, functional or political field). It is therefore necessary that the "training" sector create new professional competences, by promoting a strong sensitivity for the strategic aspects of the tutorship, in terms of structural and long term governance of the "system" of goods of our interest. This will not reduce the spaces devoted to the cultural and scientific debate in this field or to our experimental and professional work, as architects, even out the technical side of the question that remains crucial in the search for a more open and shared quality of future interventions. This goal, nevertheless, will be easily achievable only thanks to the existence of new professionals capable of facing the pre-existing problems together with the new ones emerging during and after the single interventions, by rationalizing the employable resources, improving the possible technical solutions, exploiting the unexpected but fundamental synergies between different attitudes and capabilities, accepting and capitalizing the several confrontations and corrections that can only result from a clear, recorded and widely shared accumulation of experiences. The work to be made in this direction is every day more urgent, facing the new challenges our Heritage will be invested by, like those proposed by the needs for a true environmental and energetic sustainability of its recovery and uses, for a real universal accessibility of our monuments and sites, for their effective defense against the risks of fire, earthquake or other natural and human disasters.
A clear help, in this perspective, can be found:

- in the several computerized systems applied to surveying and cataloguing the existing cultural goods (if they are not self-centered or exclusively directed to a passive administration of tutorship bonds);
- in the progressively developing technical databases used as a necessary reference by the operators (in the analytic, diagnostic and intervention areas, but only if they are not self-directed and interpreted as simple collections of meaningfulness data);
- in the emerging expressions of interest for their practical experimentation towards a real and efficacy management and improvement of the goods themselves (in the planning, administrative, didactic and divulgation fields.

If really we will work within such a perspective, the full recognition of the global (systemic) and not occasional nature of any intervention (yet in the respect of the local specificities) will perhaps emerge. Above all, a new awareness will develop regarding the quality of the interventions themselves that are carried out on the existing artifacts (small or big, famous or unknown), sometimes considered as insignificant by our traditional and insufficient means of evaluation, while they are certainly important for the communities they belong to.
Unfortunately, one of the main problems is represented in this perspective by the circumstance for which the problems that have been here highlighted should require,

to be really faced, a new attention and a real commitment, that the world of the University, of the Institutions and of the professionals involved within the field of Conservation/Restoration of our Built Heritage still find hard to express loud and clear. This simply means that we still have to work a lot in the suggested directions.

ICT and Conservation

In this field we are experimenting, on the other hand, a challenging relationship between the so called “Information Communication Technologies” and the disciplines that, for their statutory duties, deal with the knowledge and the care of the material and immaterial depot of our cultural and, more specifically, architectural Heritage[1].
It is important, in this regard, to immediately point out the need for a clarification. We are so accustomed to using the acronym “ICT” that we often forget that each of the terms to which its letters refer should be clarified every time it is used in that specific context. We should explain, in essence, to what kind of "information" we refer and for which purposes of “communication” we intend to use those “technologies”. None of these terms is in fact neutral and each of them leads towards complex conceptual frameworks, to rich and complex theoretical reflections and towards a field equally vast and constantly evolving of operational processes. We cannot ignore this fact and we have to fulfill a requirement for clarity also to check if the goals, ways and means of each application of these technologies are appropriate to the primary objectives that the protection of Cultural Heritage should pursue. The means should never take the prevalence over the goals, in fact, as the contemporary philosophical/epistemological thinking denounces. And in this regard, I believe that all we can agree at least on one basic fact. All efforts and all the resources we use to exploit the capabilities offered by the modern ICT, to broaden the knowledge, understanding, appreciation and enhancement of cultural heritage would be unnecessary costs if in the meantime the goods that we want to preserve, disappear. This means that everything will be useful only if the “meta-data” do not eat (that is to say do not metabolize), till their disappearance, the data (taking into account, of course, of the naïf distinction between these two categories and concepts only apparently well separated). After at least two millennia of reflection on what is “reality” (if there is indeed “a reality outside of us”), with the revolution of the so called digital era (of which we still do not fully understand the real meanings and impacts, the implications and the possible developments), this fundamental question opens towards unexpected answers. We do not longer talk only of "virtual reality",

[1] As for the impact of ICT on heritage conservation see also: Stefano Francesco Musso (2011), *Information Communication Technologies and conservation of Cultural and Architectural Heritage*, in: *“Safeguard Of Cultural Heritage: a Challenge from the Past for the Europe of Tomorrow”*, Florence, Italy, on July 11th-13th, 2011, p. 217-220,Firenze University Press, ISBN: 9788866550587; and Stefano Francesco Musso (2011), *Innovation in Conservation of Architectural Heritage,* in: “Safeguard Of Cultural Heritage: a Challenge from the Past for the Europe of Tomorrow”, Florence, Italy, on July 11th-13th, 2011, p. 223-225,Firenze University Press, ISBN: 9788866550587

but now also of "augmented reality". Someone imagines for example (and in part has already realized thanks to the basic research and applied), some “virtual field trips”, conceived to visit museums, monuments or archaeological sites, without having to move from where we are and this can change radically our sense of time and space. It is argued that move, touch, see and experiment in direct relationship with places and objects that are far and different from us is no longer necessary. In other cases someone imagines exhibition spaces in which various kinds of sensors stare and immediately identify the directions in which the visitors’ eyes move and then offer, in different forms and media (increasingly engaging and friendly) a selection of information available on what has attracted their attention. Comfort and efficiency may so well hide the abdication to any critical thinking, the pre-ordained control of the possible ways for the fruition of the Heritage, of which we are discussing, with potentially very sad implications for human beings and behavior.
They are new and fascinating frontiers of research, no doubt full of developments potentially useful to humans. They can certainly help even our efforts toward the preservation of the Heritage on condition, however, that the construction of new “virtual realities” or of “augmented realities” does not take place at the expense of a perhaps uncertain “factual reality” that surrounds us and to which belongs even the Heritage, in its perishable materiality. Although, in ontological and epistemological terms, this statement can be and has been repeatedly challenged several times.

New Needs

For these reasons some new needs emerge:

- need of clearer and deeper links between the ICT applied to Cultural and Architectural Heritage (considered in its material consistency) and the physical conservation of the various artefacts belonging to it. This would be, in fact, a fundamental condition to really save, together with their material bodies, also their immaterial values and meanings of which we are equally interested , according to the most updated theoretical and ethic international elaborations on this topic (see the several charters, documents and declarations proposed by UNESCO, ICOMOS and ICCROM);
- need for a stronger and more evident link between the competences and the professional skills, within the ICT applied to Cultural and Architectural Heritage and those involved by the design and realization processes of the conservation and maintenance interventions;
- need for a stronger integration, in terms of funding policies, of the several researches developed by various Research Bodies, on one side and the real actions that can be developed, starting from their results, for the effective protection of the artefacts entrusted to our care. This means, in other words, that we need a clearer way to link and to support the two sides of the common field: that is to say of the concrete safeguard and of the tutorship of our Heritage and that of the ICTs applied to it, in terms of study, monitoring, management, evaluation and enhancement (or “mise en valeur”).

For all the recalled reasons, it is important furthermore to stress the following recommendations towards those who are concerned by the duty to decide “where”, and “for which goals”, allocate the future funds in this field, so that some new efforts should be made in order to:

- develop comprehensive vocabularies, procedures and methodologies for documentation of Cultural and Architectural Heritage in Europe, which consider the aspects of data gathering, processing, dissemination and archival, always ensuring a strict link and coherence with a rigorous knowledge of the artefacts involved (and of their current status);
- assessing and define the boundaries of multimedia applications and documentation for safeguarding Cultural Heritage, avoiding the risk that their use could be resolved in itself, as auto-referential or, even worst, as a self-sufficient goal that may provoke a detriment for the safeguard and protection of the Heritage itself;
- develop low-cost approaches to Cultural Heritage documentation, to allow a real diffusion of the tools we can imagine and realize at the service of the Heritage and for the benefit of a true improvement of the public consciousness of the values that the Heritage has and, even more, can have for our future;
- create digital repositories of Cultural Heritage resources (possibly based on open-source software, at least in ideal terms), to prevent the fragmentation and duplication of information. This could in fact provoke a painful loss of the invested resources and, further, a dangerous lack of effective results for a sort of diminishing of the comprehension of our general goals on the part of the public opinion. Such a repository should also ensure the archival and transmission to future generations of which we take care;
- Promote a stronger support for actions that can put in relation the ICTs applied for Architectural Heritage with the researches carried out in the field of real policies for conservation. This is essential to prevent the risk that the efforts and resources human, the technical and economic conditions that are used in this crucial area may go on in themselves, while the actual artefacts o f which we're talking about and of which we want to take care, disappear, for lack of care and maintenance, or as a consequence of wrong actions;
- allocate sufficient resources, for the mentioned reasons, to training activities, in cooperation with Universities, local authorities, professional bodies and with industry, to create “new competences” in the fields of analytical and diagnostic studies, of planned conservation and maintenance and of designing some rigorous conservative interventions on historic buildings and, last but not least, of the monitoring and management of Cultural and Architectural, after any intervention.
- The complex of actions here briefly highlighted could in fact help us in ensuring the permanence of this Heritage and its transmission to the future generations. It is even more crucial that that Heritage may arrive to our descendants with all the material signs and the immaterial features, the values and the meanings (already known or still hidden within their bodies) that history stratified upon (and within) the several artefacts belonging to our built environments, so that these

last can be really conceived as Cultural Landscapes in which our societies can find a consistent reason for surviving and consciously developing in the future.

New research perspectives

The new and still evolving technologies offer us undisputed advantages to the management of information and data of various nature but have also evident limits, which are often inherent to the development of some models that struggle to acknowledge and to represent complex architectural structures.

Technological innovation was introduced in the management of the information collected on the architectural heritage and its protection at the end of the 1990s for the purpose of developing a culture of the programmed conservation and maintenance. This innovation has also improved the organization, effectiveness, and efficiency of the technical and administrative aspects of the projects.

Therefore, there is a growing need to have access to complex and efficient equipment for the professionals involved in the project, into the actual restoration work, and into the management of the buildings. Suffice to think of equipments universally accessible and interoperable and that permit the effective and fast linking of information from diverse sources and of diverse nature, acquired during the preliminary analytical and diagnostic stage, during the planning phase, and throughout the entire process of restoration.

The creation of 3D models in the field of conservation and protection of Architectural Heritage is now almost defined and used. The transition from 3D modeling BIM (Building Information Modeling), with the same purpose, on the contrary, still registers sporadic applications because the technology has been originally conceived for the design of the "new" and for the management of its construction process.

For these reasons some new researches are now aimed at exploring the possibility of transferring tools such as the BIM to the Heritage's context, adapting them to the complexity of the historical, monumental, and non-monumental buildings, by using innovative models to manage diverse categories of information, data and processes connected to the “three-dimensional spatiality” of the architectural structures and not only to their surfaces.

These tools are not yet widely employed, except in the Anglo-Saxon countries or in northern Europe and in the United States, where they are also used for managing the protected historical heritage. An effective coordination of the professionals involved in the construction process, with regard to its phases, times and costs can be hopefully achieved by using the BIM. If these tools are well-designed and properly used, in fact, they could also improve the quality of the work carried out, eliminating the risky margins for discretional or invasive procedures and could therefore have positive impacts on the protection of Heritage.

The so named "Green BIM", furthermore, introduces into the management of the construction process, some parameters linked with the sustainability of the entire life cycle of the buildings, with clear impacts for the environmental assessment. These themes are nevertheless not yet perceived as crucial in the traditional architectural restoration field. Until now, the built heritage has in fact been excluded from any specific reflection on these aspects. This situation is made evident even by the

European Directive on energy-saving measures, which has relieved this heritage from the obligation to comply with the directive's provisions, not only due to problems regarding compatibility, respect, and historical and cultural aspects; but also to the lack of interest which the scientific community involved in its enhancement commonly expresses towards technological innovation.
With the integrated work of experts in different fields, guided by common interests and objectives (first and foremost the protection and appropriate management of the historical and monumental heritage), an innovative research pathway may emerge from this concise picture. The result would be a BIM specifically conceived for the bodies responsible for the Architectural and Landscape Heritage, rich of data, information, and assessments relating to the history of the building, as well as to its constructive elements and materials (analyzed with the methods and tools employed for the archeology of architecture) and to the sustainability of each work carried out on it, in terms of resource-saving measures, and of impact on the environment, during the entire life cycle of the building, including the disposal of materials and components on the construction site.

Communication and promotion

At the end we must also acknowledge that, in a national and international context in which, with increasing speed of changes, also the dynamics and techniques of disseminating information continuously change, and it is therefore crucial conceive and apply new strategies for the promotion and the communication of the various and complex contents related to the Heritage. It is in fact of crucial importance to ensure that more and more people will know and make frequent use of it and will appreciate it, thus increasing the cultural awareness of its crucial importance for the future.
This goal is common to any actor involved in the protection, safeguard, conservation, management and enhancement of our Heritage, each one of them while he works within the limits of its competences, duties and powers, starting from the State (at the central or at the peripheral level), to the Regional and Local Authorities, involving also the private operators.
In order to reach, in a more effective way, these general goals it is of crucial importance know and correctly use the tools and mediums of communication contemporary that, in the recent years, thanks to an unstoppable technological innovation, are revealing new and really effective potential applications also in the field which we are dealing with. Also for this reason, in addition to traditional communication practices, it is necessary and useful looking to the new media (ICT), in order to reach large audiences with no limits of space and time, bettering our capability to inform, educate, move the interests and the responsibilities of all the Citizens that, at the end, are the unique and real owner of those cultural goods. Of course, many questions are open and regularly they are re-proposed for scientific reasons and not only for communication ones. The main one is strictly linked to the possible risks that this kind of evolution and these forms of communication can hide in themselves the more they are frequently used (or abused) in the field. Let’s think, on the one hand, to the need to preserve the rigour and scientific seriousness of any content and information that can be communicate or transferred to a great public

using these new tools, whilst it could seem a compulsory goal their simplification. It is a real matter of research and of experimentation that involves nowadays many protagonists, like scholars, experts in communication, administrators, and politicians. If we lose the custom to tend towards our main goal (i.e. the preservation or protection of our Heritage for the future generations), we could risk to assign more attention, and to invest more economic resources, in the communication process than in the real safeguarding of that same Heritage. It is necessary, at this regards, to avoid the risk that what we do for the willing to enhance the immaterial side of the Heritage we want to preserve, does not take the final prevalence on the real conservation of its “material” permanence.
Facing the growing demand for cultural information, furthermore, there is an equal growth of the maturation of the recipient of that information, so that he becomes more and more expert of new languages, that is to say, more and more able to assess the quality and the quantity of the information that he receives. The diversification of the media channels and tools, therefore, serves to offer the maximum possible information to the public in order to promote and diffuse the knowledge and the promotion of goods and sites cultural. This is a crucial issues for all those who are involved in the “safeguard" and in the "promotion” processes, that is to say, all the devoted Institutions (or bodies), at a National and regional or local level.
The adoption of several new combined media thus aims to optimize the level of information dedicated to each and every good or event, trying to increase the public awareness of the dimensions and of the importance of our Cultural Heritage for a future and sustainable life on the Planet Earth.

SESSION 8

21 November 2014 Friday, 15.45-17.00

ARCHITECTURAL TECHNOLOGY IN HISTORY CLASS

Ali Uzay Peker[1]

'Technology' according to Webster's is "the science of the application of knowledge to practical purposes" and "the totality of the means employed by a people to provide itself with the objects of material culture".[2] In both definitions, technology share angles of a triangle in reciprocity with knowing and doing.

Vitruvius (1st century BC) finds scientific training a must for the profession of architecture: structures like machinery for festivals "require careful thought and planning by a well-trained architect"[3]. In keeping with this, he puts physics under philosophy, a branch of study that the architect should be equipped.[4] Vitruvius underscores inseparableness of manual skill and theory (scholarship):

"It follows, therefore, that architects who have aimed at acquiring manual skill without scholarship have never been able to reach a position of authority to correspond to their pains, while those who relied only upon theories and scholarship were obviously hunting the shadow, not the substance."[5]

Webster's above-stated concept of 'technology' recuperates Vitruvian entrenching of theory in practice, or science in doing.

In the US, since the publication of a report in 1995 by National Academy of Sciences with the title "Education of Architects and Engineers for Careers in Facility Design and Construction", integration of technology in curricula of architecture schools became a central issue. This report has a high tone of criticism targeting the existing scene:

"The committee concluded that both engineers and architects leave school with inadequate knowledge of technology. Many schools of architecture place emphasis on aesthetics, the art of architecture, and broad design concepts, and, as a matter of policy, leave the teaching of practical technology to the practitioners who hire their graduates. For architects, the problem is integrating academic design with applied technology. Architectural schools tend to separate design from the production process. Students may know how to design, but they do not know how to put things together in an efficient and practical way using the minimum amount of material... The committee believes the situation can be remedied by placing considerably more emphasis on technology -especially construction methods and materials and building systems- and that technology must be integrated into the design studios."[6]

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1 *METU Department of Architecture*

2 *Webster's Third New International Dictionary of the English Language* (Springfield: Merriam-Webster, 1986).

3 Vitruvius, *The Ten Books on Architecture*. Trans. M.H. Morgan (NY: Dover Publc., 1960) 281-2.

4 Ibid., 8.

5 Ibid., 5.

6 *Education of Architects and Engineers for Careers in Facility Design and Construction*, by Board on Infrastructure and the Constructed Environment, Committee on Education of Facilities Design and Construction Professionals (Washington, DC: National Academy Press, 1995) 51.

The report instigated educators of architecture to rethink technology track in the school. As a matter of fact, the report came two thousand years after the Vitruvian postulate. This article is not the place to discuss how the place of technology came to be questioned in architectural education in the end of the 20th century. It is about how inventiveness has been technological in manifestations of architectural innovation that accordingly needs to be rendered central to architectural history class in departments of architecture.

Watson in a paper on the topic notifies that "any architectural curriculum that does not integrate design and technological inquiry can be considered absolute."[7] He suggests that technological knowledge base of architecture needs to be presented through inquiry based on physics, chemistry and environmental sciences, and this knowledge is also gained through empirical experience and design.[8] This approach reminds the definition of Vitruvius, whose education model becomes clearer when we visit Graham Pont's treatment of the concept *fabrica* (practice). Pont is against the translation of the term *fabrica* as referring directly any kind of manual art. According to him "*fabrica* yields the kind of professional knowledge and experience that is derived from thoughtful study of...various constructive arts", and it is "practical know-how".[9]

Technological awareness can be efficiently instilled in architecture school earlier than professional experience teaches it in the field. We know from history that new technologies promoted innovation in architecture. Zeniths in architectural history need to be profoundly studied and thought on the way to create insight about the role of innovative technology.

Recent advance in horizontal construction through strengthened cantilever trivialized uprights, and resulted in open plans and floating configurations.[10] Given this and further high tech tools for construction, contemporary architects like Zaha Hadid (1950-) reached convoluted formal expressions and spatial dimensions by computational design.

Industrial revolution invigorated recurrence of innovation. Le Corbusier's (1887-1965) acclaim of machinery and construction methods in the beginning of the twentieth century reveals architect's thrill before technology. Manifestly discovering new design and building opportunities in new materials, Le Corbusier finds steel and concrete revolutionary: "…steel and concrete have brought new conquests, which

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[7] Donald Watson, "Architecture, Technology, and Environment," *Journal of Architectural Education*, 51/2 (Nov., 1997) 120.

[8] Ibid., 123, 125.

[9] Graham Pont, "The Education of the Classical Architect from Plato to Vitruvius," *Nexus Network Journal*, 7/1 (2005) 77-78. M.H. Morgan translated *fabrica* in the *Ten Books* as 'practice'; and '*manibus*' as manual work: "...Practice is the continuous and regular exercise of employment where manual work is done with any necessary material according to the design of a drawing. Theory, on the other hand, is the ability to demonstrate and explain the productions of dexterity on the principles of proportion" (Vitruvius, The Ten Books, 5), (orig. *...fabrica est continuata ac trita usus meditatio quae manibus perficitur e materia cuiuscumque generis opus est ad propositum deformationis. ratiocinatio autem est quae res fabricatas sollertiae ac rationis pro- portione demonstrare atque explicare potest (Frank Granger, "Vitruvius' Definition of Architecture*," The Classical Review, 39/3-4 (May - Jun., 1925) 67).

[10] Manja van de Worp, "On Technology and Architecture: In Pursuit of Floating: The Cantilever." http://nocloudinthesky.wordpress.com/tag/zaha-hadid/. 03 November 2014

are the index of a greater capacity for construction, and of architecture in which the old codes have been overturned."[11] A few decades later, a contemporary in the States, F. L. Wright (1867-1959), by the same token appraised new materials and machines in calling them "substitute for tools" in the age of steel and steam.[12] According to him "machinery, materials, and men –yes- these are the stuffs by means of which the so-called American architect will get his architecture…"[13] And he goes:

"Plasticity is of utmost importance. The word implies total absence of constructed effects as evident in the result. This important word, "plastic," means that the quality and nature of materials are seen "flowing or growing" into form instead of seen as built up out of cut and joined pieces." [14]

Surely Wright's anticipation draws a picture of the path Zaha Hadid and other moderns trek now.

We have a tendency to regard technology a subset that reigns in realms like structure and amenity systems, and associate its development with industrial revolution and ignore the fact that technology is embedded in every material property created by man today and in the past. Architectural inventiveness is closely tied to innovative technologies developed in building material and structure and the other way round. Structurally innovative buildings of the past incorporated such technologies, a number of which also developed during the design process.

Selected examples:

Roman architectural revolution arisen from the use of cast concrete for primary load-bearing structures in the 1st century. It resulted in Pantheon (A.D. 123).

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[11] Le Corbusier, *Towards a New Architecture*. Trans. F. Etchells (NY: Dover Publc., 1986) 271.
[12] F.L. Wright, *The Future of Architecture* (NY: Meridian, 1970) 84.
[13] Ibid., 82.
[14] Ibid., 107.

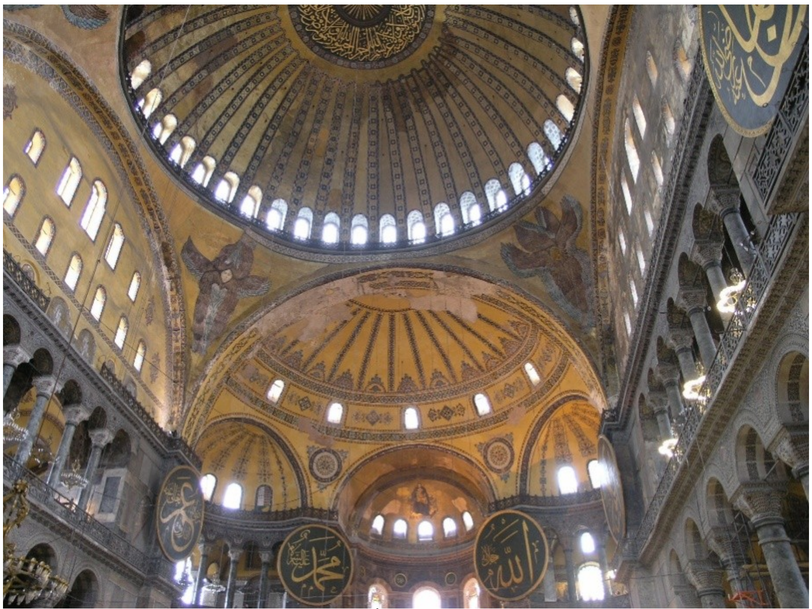
Pantheon in Rome (2^{nd} c.), interior (Painting by G.P. Panini 1691-1765)

According to Mark and Robison, innovative aspect of this building reigns in the structural form instead of structural conception, since it was unreinforced; monumental Roman buildings in concrete nourished mainly from traditional building practices.[15] Though structurally sterile, Pantheon became the largest domed space (43 m.) in the Roman world by means of supporting pozzolana concrete walls and proved to be a new technology-driven configuration of form. In Hagia Sophia (532-537), Pantheon's concrete replaced by traditional brick with mortar layer in the walls, domes and vaults and stone in piers.[16] Its interior underneath the dome and half domes is 1.5 times larger than Pantheon.

[15] R. Mark and E. C. Robison, "Vaults and Domes," in *Architectural Technology up to the Scientific Revolution*, ed. R. Mark (Cambridge, MA: The MIT Press, 1993) 141-5.

[16] R.J. Mainstone, *Hagia Sophia: Architecture, Structure and Liturgy of Justinian's Great Church* (London: Thames and Hudson, 1997) 67-70.

Hagia Sophia in İstanbul (6th c.), western facade (Photo: A.U. Peker)



Hagia Sophia in İstanbul (6th c.), interior (Photo: A.U. Peker)

Technological innovation of the Hagia Sophia rather lies in the way two conflicting structural features brought together: oblong basilica and central dome with half domes (supporting cubical/spherical covering systems). Since, this encounter was not backed with technological innovation but Justinian's great aspiration and its scientist-designers' vigor, the dome collapsed a number of times and massive external buttresses later added impeding integration of the building. Anyhow Hagia Sophia with its great dome of 32.5 m. wide and 56 m. high is still above a colossal rectangular naos verifying its makers' command of existing agglomerate building technology that they resolutely challenged through an innovative design concept. They did their best to manufacture an elaborate supporting structural system of arches, half domes, pillars and buttresses at the same time perforated massive walls to obtain transparency underneath the dome. If we disregard safeguards introduced later to keep the building on its feet, Hagia Sophia in its pristine state was truly an innovative design.

In Anatolia, a less known architectural tradition was created by builders under a Turkic dynasty named Seljuk (1037-1307). Traditional building technologies ruled their architecture. Their role as innovators reveals when we inspect the way they collated two grand building technologies: brick and stone, Iranian and Anatolian.

Yazd Friday Mosque in Iran (12th c.), entrance portal (Photo A.U. Peker)

Divriği Great Mosque and Darüşşifa in Turkey (13th c.), western façade with portals (Photo: A.U. Peker)

Seljuks of Iran penetrated Anatolia after 11th century where their builders encountered a deep-rooted ashlar masonry building technology. They adapted kilned brick construction of Iran to Anatolia.[17] Local aisled basilica in stone covered with uniform vaults transformed in their hands to domed and exquisitely vaulted halls with bare walls, typical features of the brick building tradition in Iran.[18]

[17] For a study of this transformation see Ö. Bakırer, "From Brick to Stone: Continuity and Change in Anatolian Seljuk Architecture," in H.C. Güzel et al., eds., *The Turks*, 2 (Ankara, 2002) 729-36

[18] For the local basilica architecture in Anatolia and its impact on Seljuk mosque architecture see A. U. Peker, "Anadolu Bazilika Geleneği ve Anıtsal Mimariye Etkisi," in A.U. Peker and K. Bilici, eds., *Selçuklu Uygarlığı: Sanat ve Mimarlık*, 2 (Ankara: 2006) 55-65.

Isfahan Friday Mosque in Iran (11th c.), star-vault in southeastern hall (Photo: A.U. Peker)

Divriği Great Mosque in Turkey (13th c.), vaults over piers and unadorned walls (Photo: A. U. Peker)

This “technological adaptation” is innovative since led to unique structural solutions and formal inventions in the Ottoman age later.

In Europe, Gothic architectural design owes its creativity to a series of technological innovation achieved by pointed arch, ribbed cross-vaulting, flying buttress and increased fenestration.

St.Vitus Cathedral in Prag (14th c.), eastern façade (Photo: A. U. Peker)

St.Vitus Cathedral in Prag (14th c.), nave (Photo: A. U. Peker)

Ashlar stone integrated in an innovative construction technology, which manifested higher, lighter and more profusely illuminated surfaces. This provided builders prospects for improvement, as a result the evolutionary path from Early to High Gothic exhibits how innovations in technology progressed leading fulfillment.
Our last but not least example is Süleymaniye Mosque (1551-57) in İstanbul built by Architect Sinan (1490-1588). Scholarship on the building sufficiently demonstrated contributions of Sinan in this mosque in terms of organizational innovativeness.[19]

Süleymaniye in İstanbul (16th c.), western façade (Photo: A. U. Peker)

[19] For a description of the Süleymaniye Mosque in the lineage of other Sinan buildings see Aptullah Kuran, *Sinan : The Grand Old Master of Ottoman Archıtecture* (İstanbul:ITS, 1987)

Süleymaniye in İstanbul (16th c.), interior (Photo: A. U. Peker)

In our opinion most prominent contribution of Sinan's architectural design is his use of proportions in relation to human scale. This is the reason his grandiose buildings look less colossal than they are. Sinan at all times avoided to create dominating interiors with gigantic dimensions. Sinan's main occupation in the Süleymaniye was integration of the Hagia Sophia's structural system of domed-basilica to Seljuk/Early Ottoman iwan-court configuration in a robust building of pure stone. The Süleymaniye's well-thought load bearing system facilitated a stabile lower structure. Furthermore, transfer of the galleries of the Hagia Sophia to the facade conduced the inner structural system join the surrounding walls reproducing the carrying system on planar facades.

İhsan Mungan finds the success of Sinan in his *baumeister* role, who balanced partial rigidities in the load-bearing system and created a fine buttressing system around dome and walls beneath it.[20] It is evident that structural inventiveness of the Süleymeniye also stems from the use of new ashlar stone construction technologies, which can be observed in masonry details.

Creativity in man-made matter (or material) has always been technological. From Pantheon to Hadid's contemporary designs history teaches us that architectural inventiveness thrived when new technologies developed and/or embraced by the builders. Knowledge of new technologies needs to be promptly and appropriately assimilated to architectural education. Architectural history course is more effective when past architecture is thought in reference to the technological triumphs of grand

[20] İhsan Mungan, "Strüktür Çözümü," in Selçuk Mülayim, ed., *Süleymaniye Külliyesi: Bir Şaheser* (Ankara: KT Bakanlığı, 2007) 91, 94-7.

works and traditions. But, one might still ask: If innovative technology is so decisive what would be the purpose of such a course focusing on outdated technologies of the past? Straightly speaking, its function is to teach new generations the formula often failed to be noticed that architectural inventiveness is contingent upon new technologies (and vice versa).

THE MOCK-UP OF THE "RATTO DELLE SABINE" BY GIAMBOLOGNA: MAKING AND UTILIZATION OF A 3D MODEL

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ABSTRACT

Within a project for the knowledge and preservation of the mock-up of Giambologna's Ratto delle Sabine housed in the Galleria dell'Accademia in Florence, the GeCO laboratory has made laser scanner acquisitions to create surface models at different resolutions for structural analysis, on which to check the coverage of the photographic campaign and to create a three-dimensional thematic mapping of data relating to investigations and restoration works. The PDF3D file format has been used to easily manage data on a platform immediately available to all operators.

Key words: Laser scanning, 3-D modelling, PDF3D, Cultural heritage, Mesh

1. INTRODUCTION

The present paper, promoted by the Galleria dell'Accademia within the project of restoration of the sketch of the "Ratto delle Sabine", constitutes an anticipation of the complete documentation of the restoration that will be published soon.
The creation of digital surface models is now a widespread practice for the most diverse applications of documentation, preservation and communication of cultural heritage (Guidi et al, 2009, Trinchão Andrade, Mazetto Mendes, 2012, Arbace et al. 2013). When we design a model, two conflicting requirements must be considered: on the one hand, obviously high resolution models reproduce at best the tiniest details, on the other hand, small files are preferable for viewing on non-dedicated hardware and software or on-line. It is therefore necessary to optimize the models in order to reduce the file size while maintaining a proper resolution.
The survey of the mock-up done by Giambologna for the "Ratto delle Sabine" ("The Abduction of the Sabine women"), was run as support to different lines of research, each of which requires outputs with different characteristics. Initially, the Galleria dell'Accademia (that is the Museum in Florence which houses the statue) demanded a model for structural analysis, for which a very simplified model is usually sufficient, because the structural simulations and Finite Element Analysis software are not able to import surface models consisting of very complex meshes.
It also emerged the need to verify the completeness of the existent photographic documentation and to summarize in a visual way the analyses and restoration

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interventions, applications requiring more detailed models. In this way, the case study has also offered the opportunity to study how to create three-dimensional maps of the restoration works, overcoming the limitations of most GIS 2D tools used for this purpose, and our 3D model was put at the disposal of the other working groups for referencing the results of their investigations.

2. THE KNOWLEDGE AND RESTORATION PROJECT OF THE ABDUCTION OF THE SABINES

The Galleria dell'Accademia in Florence hosts the preparatory sketch of Ratto delle Sabine, made with clay by Giambologna around 1580, whose final version in marble is located in Piazza della Signoria under the Loggia dei Lanzi. This statue is one of the few still existing sketches of large sculptures in full scale.
The sculpted group, 4.30 m tall (without the pedestal) is characterized by the a-whirl movement of three figures, whose bodies spin around their axes, intersect and overlap, and is considered a masterpiece of Mannerist sculpture.
The artist created this model as a training to face the most demanding challenges for sculptors, both ancient and his contemporary ones: get many figures from a single block of marble, balance masses of a figure who supports another one, create a perfect composition from everywhere you look. (Avery, 1978).
In addition to this full scale maquette, there were other small models which testify to the attention of Giambologna for this statue originally without name, if we rely on the writer Vincenzo Borghini who reports that he had personally recommended to Giambologna the name of “Ratto delle Sabine”. The famous Latin legend tells that the first generation of Roman men (who were descendants of the Trojan survivors) kidnapped some girls from the neighboring Sabine families to acquire wives for themselves. So the bent figure could represent a Sabine father, the standing young man could be the Roman Thalassius and the raised woman one of the abducted girls (Borghini, 1584).
For the restoration of an artifact whose characteristics and construction materials are little known and that is in poor condition, the Galleria dell'Accademia considered essential to have a team of specialists a wide diagnostic and learning campaign. For this project, developed between 2011 and 2014, both restorers and research institutes (including the ICVBC-CNR, the IUAV and the GeCO lab) were involved.

3. ACQUISITIONS

The data acquisition was made by two operators on November 21, 2011. The digitization was done as a complementary part during the survey of the Galleria dell'Accademia, where the statue is located. So the scanner employed has been the same phase-shift scanner (Leica Geosystems HDS7000) used for the architectural survey, whose resolution was adequate for a surface model for structural analysis, as requested by the Client at first.
Although it is known (Tucci, Bonora, 2007) that the triangulation scanners allow to scan large statues with greater accuracy than with phase-shift or TOF tools, the

resolution obtained proved to be suitable to the expected goals, as described below, for each of them was indeed necessary to reduce the amount of data. Furthermore, with that tool was possible to do scans from a longer distance, without risks for a very delicate artwork, and to complete quickly acquisitions without interference with the normal museum activities.
During survey project, eight scan positions were identified to capture completely the surface of the sculpture: four scans at the sides of the pedestal and four at the corners from about 3 m away. From these locations two sets of scans were made, one on the ground and another at about 4,50 m height using a scaffolding for a better acquisition of the highest parts of the statue from different points of view. Three additional ground scans were done to also acquire undercut areas not visible from other scan positions. All project metadata are recorded on a sketch and a log.

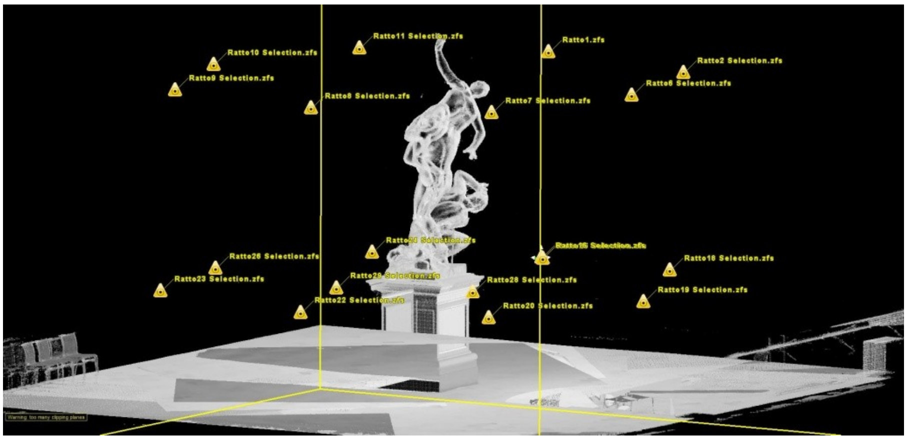

Figure 1: Scan position network.

4. SURFACE MODELLING

The 19 scans were taken at 360° to use the geometry of the room for a more accurate registration. The alignment was made using natural points; the complete model includes more than 164 million points. Selecting only the statue and its pedestal, the point cloud was reduced to about 66 million points.
After cleaning, resampling and merging (all these steps were made with Leica Geosystems Cyclone software, as the alignment), it has obtained a model of 3,563,629 points that it was imported in Geomagic for mesh creation. The overall mesh was then segmented separating the statue and the pedestal, as they require different processing and decimation.

Figure 2: Alignment of pictures on mesh: an image of the photographic campaign (left); mesh model (center); aligning with *Image alignment* tool(right)

The two meshes have been optimized and made watertight by closing the small holes located mostly in hidden places. It was obtained a 2,162,114 triangles mesh for the sculpture and a about 780,000 triangles mesh of the pedestal.
As FEA software is not usually able to process meshes with so many triangles, other simplified models (with different percentage of decimation) were made for static studies.
The model of the statue has been decimated to 1,000,000, 500,000 and 50,000 triangles meshes, and from the pedestal model simplified meshes of 350,000 and 35,000 triangles were got . The structural studies, carried out by the Laboratory of seismic risk analysis of IUAV in Venice, are forthcoming.

5. ASSESSING THE COMPLETENESS OF THE PHOTO CAMPAIGN

The Museum requested to verify if the photographic campaign, carried out to record the artwork before the restoration, showed entirely all the sculpture.
Since the images were taken without a proper photogrammetric project with an uncalibrated camera and using a zoom lens, it was deemed sufficient to locate the point of view and orientation of the 77 images using *Image alignment* tool included in MeshLab (ISTI-CNR) software. It uses a Mutual Information algorithm to optimize the alignment between the 3D high resolution model and 2D images. This function is not very accurate but allowed to meet quickly and effectively the requirements.
By backprojecting all pictures on the mesh, it has obtained a texture that leaves uncovered, for difference, the areas not shown in the photos.
It was calculated that gaps area is about 0.28 sq. meters, that is 1.8% of the surface of the statue, which is 15.5 sq m. Gaps were very small and located in very close areas as between the limbs of the figures. Acquiring these parts of the statue with

optical sensors is difficult, since camera and laser scanner both require direct visibility.

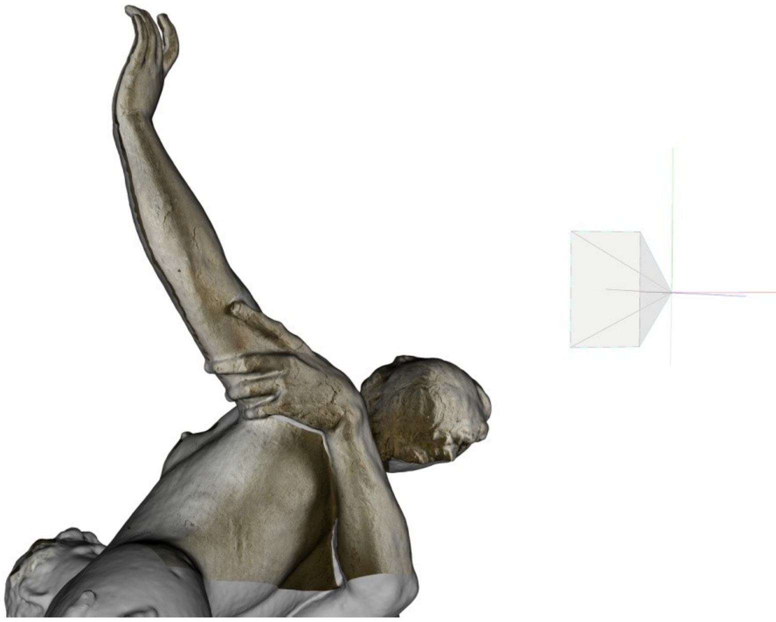

Figure 3: Backprojection of an image on the mesh.

6. 3D REFERENCING OF INVESTIGATIONS, ANALYSIS AND INTERVENTIONS ON THE SURFACE MODEL

As it's usually done in restoration sites, the restorers recorded their diagnostic tests and interventions drawing directly on prints of the images of the photographic campaign. These drafts were scanned selecting nine thematic queries (kind of materials, deterioration, etc.) and projected onto the 3D model, attributing to each image the same orientation parameters that were identified in the previous phase. For the best viewing, it was used the full-resolution 3D model.

The sharpness of thematic overlays has been improved using MeshLab tools for radiometric color processing. In this way we obtained many models, each one textured according a single theme.

By selecting only the textured triangles and by superimposing them as layers on the overall model (in Bentley Microstation CAD software), was obtained a three-dimensional thematic mapping. It's also possible to insert hyperlinks and annotations to attach further data to 3D geometry.

Figure 5: Points of view of all the images of the photographic campaign

7. DELIVERABLES

An obstacle to the widespread use of 3D models to a non-specialist audience is that they require to handle large data sets whose management often requires specialized software.

The most widely adopted solution is therefore the spread, for broader purposes, of geometrically simplified versions in file formats viewable on- or off-line with a special plugin. The drawback of this solution is the quick obsolescence of technologies, formats and plugins, so, sometimes, models become no more viewable in few years.

For a simple and immediate management on most hardware and software platforms, the Universal 3D (U3D) open format was chosen, on which the PDF3D technology is based. It can be viewed (also on the Internet) with software already present on virtually all computers, like Adobe Acrobat or other non-proprietary applications (Manferdini, Garagnani, 2011). This format allows to organize the themes as separate layers in a hierarchical structure, enabling the semantic data organization and maintaining hyperlinks to other PDF pages, which in turn can include additional 3D views of the same or other models. The final model, optimized for off-line view, consists of 1,570,750 triangles in 11 layers and takes up 33 MB. Although it consists of many overlaid high resolution meshes, it's relatively small and therefore easy to view. It is planned the realization of more decimated 3D models for online view. Using Acrobat Reader Pro it's also possible to use measuring tools and transect the model according to user-defined plans.

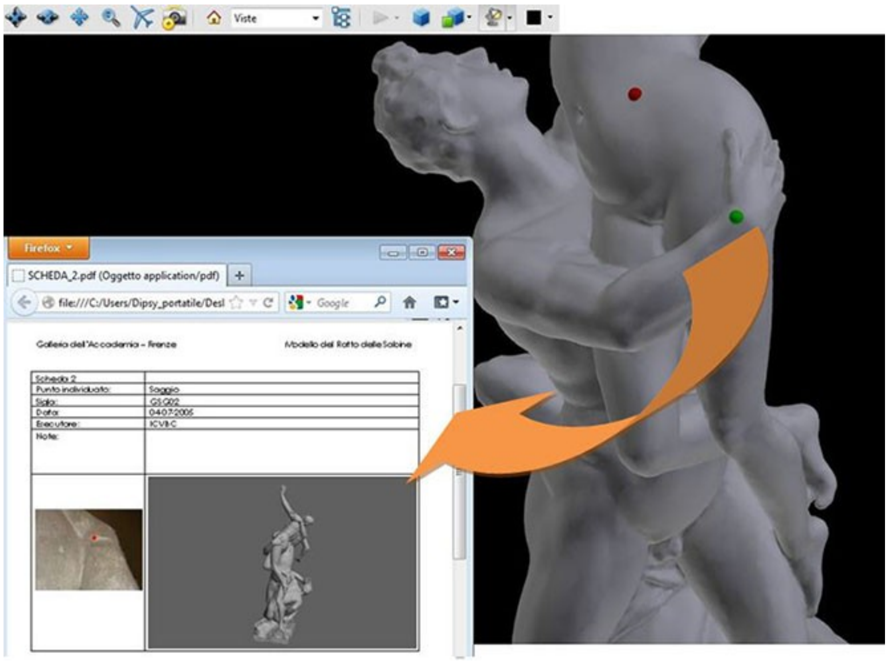

Figure 5 : Links between 3D models and other PDF files

8. FURTHER DEVELOPMENTS

As the ISTI-CNR research institute had previously produced a model of the final marble statue (which is located in Florence under the Loggia dei Lanzi), it has been possible during the work a comparison of the two versions. The result, (to be published), showed that, even if they appear similar, the artworks have significant differences, especially in the different twisting of the body and position of the arms of the female figure.
This example of "second thought" is rarely witnessed in sculpture and therefore is an important indication of the creative process of Giambologna. The ongoing analysis can help to understand whether artistic, static or technical issues prevailed.

9. SOFTWARE

This work was done using the following software:

Leica Cyclone	alignment
Geomagic	meshing
Meshlab (ISTI-CNR)	mesh elaboration
Bentley Microstation	model optimization and PDF3D creation
Adobe Acrobat Pro	PDF3D optimization

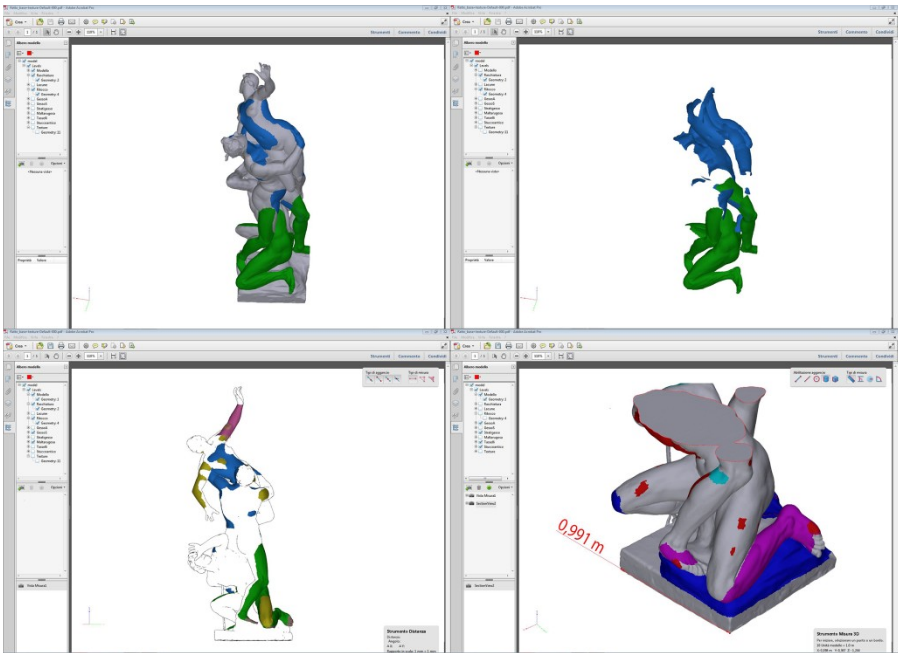

Figure 6 : PDF3D model visualization in Acrobat Reader Pro

10. CONCLUSIONS

The paper shows some applications of 3-D models for investigating cultural objects with a high three-dimensionality. In addition to models for static analysis, a methodology was found to get 3-D multilayer models to show thematic queries using PDF3D format. Each layer consists of a portion of the surface that is possible to view alone or together with the others. In this way it’s possible to understand the relationships and overlapping of materials and deterioration.

Unlike other software for recording restoration interventions, which only allow a 2-D mapping on photographs, in this way we can get a real 3-D description of the requested phenomena on a detailed model.

In addition to cultural heritage applications, this technique can be easily applied in all fields in which a 3-D mapping is useful, as in architecture and archeology.

11. ACKNOWLEDGEMENTS

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UAV SYSTEMS FOR DOCUMENTATION OF CULTURAL HERITAGE

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VALENTINA BONORA[1] , WOLFGANG NIEMEIER[3], BJÖRN RIEDL[3]

ABSTRACT

Architectural documentation is an activity which requires getting information from different sources for complete and comprehensive analysis. In the field of architectural documentation different innovative systems have been developed in survey like digital photogrammetry and Terrestrial Laser Scanning (TLS). One of these techniques Unmanned Aerial Vehicles (UAVs) equipped with a digital camera have become one of the most promising techniques in last years. It opens various new applications in large scale and close-range and so becoming progressively common due to the considerable potentials in terms of accuracy, costs and abilities. Their capability of data acquisition with high resolution allows texture mapping on DSM (Digital Surface Model), 3D models and orthophotos. It is also possible to create mosaics, maps and drawings which can be used for image interpretation. These data can be applied to several applications including 3D documentation of environment, cultural heritage, monitoring and recording landscape data and infrastructural assets for risk analysis and management process.

This paper discusses the potentials of UAVs in order to analyze, interpret and manage cultural heritage data through a case study (carried out before). It also presents the procedure of processing UAV data in order to create digital surface models and photo-realistic outputs for digital reconstruction models and visualization. The obtained results have been demonstrated with case study and general discussion has been made for evaluating potential of UAV technique for cultural heritage documentation.

Key words: : UAVs, Cultural Heritage Documentation, DSM, Orthoimage.

1. INTRODUCTION

Heritage documentation process involves huge multimedia data containing different information such as photographs, photographic panoramas, rectified photographs, orthophotos, technical drawings, different 3D models including point clouds and other kind of data such as videos, reports, pictures, texts etc. This process can be

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considered mainly in five main parts as (1) planning documentation, (2) data acquisition, (3) data processing, (4) data management and (5) dissemination of the data. All these steps involve diverse and intensive use of digital technologies. In this case, choosing the appropriate technology, procedure and workflow is always a challenging and depends on the size, complexity and the level of required accuracy of the project (Patias et al., 2008).

Even though traditional survey methods are still important and useful in some cases, technological possibilities have given opportunity to support traditional techniques in different ways. As hand measurement can provide dimensions and positions of objects and scenes of a few meters, sketches in small size, it is sometimes more impractical and not enough for larger objects. In this case, photogrammetry and terrestrial laser scanning could be more suitable by covering larger areas and enabling a large quantity of three-dimensional measurements to be collected (English Heritage, 2007). The studies have shown that photogrammetry has advantages for large amount of data, accurate data, possibility to texture in high resolution and detail, geo-reference data with stereo-viewing capability of the 3D data (Grussenmeyer et al., 2002, Patias, P., 2006). Similarly Terrestrial Laser Scanning technology has high performance in terms of data acquisition speed (Russo and Guidi, 2011) in different field of uses and has advantageous when used appropriately (English Heritage, 2007; Russo and Guidi, 2011). Even each technology has pros and cons., in most cases the combination of these technologies and related methodologies regarding their benefits may be the best solution (Russo and Guidi, 2011; Grussenmeyer et al., 2008; Patias, 2006.).

These both techniques has made it possible to obtain a high level of detail and accuracy and result to be very effective for small and medium-extension areas. However for large areas close range photogrammetry and terrestrial laser scanning are not always the most suitable techniques. Here, the information obtained from aerial or satellite images provide an overview of the study area to complete the documentation. Even they have been used for a long time; such images have some limitations linked to the geometric resolution, inadequate for detailed studies, to the periods of acquisition and to the cost (Lo Brutto et al., 2012). Besides, another challenge of these methods is the difficulty involved in acquiring reliable radiometric information of the complete surveyed area, which can easily be obtained by means of traditional aerial photogrammetry. However, the costs of aerial photogrammetry are usually too high in relation to the limited extension of the surveyed areas. Even the aerial techniques can be an optimal solution in the case of medium-sized and large sites, since the possibility of raising sensors and capturing the information, in many cases it is rather difficult to obtain data at ground level, which can increase the performance of photogrammetry. But these surveys generally require working with large scales and high resolutions. As result, conventional aerial photogrammetric surveys can be unfeasible because of the limited site extent, the large scale required, the expected low flight height, speed of the aircraft and the relatively high cost of the technique (Mozas-Calvache et al., 2012). In this case the use of alternative techniques based on close range photogrammetry and laser scanning from light and low height platforms can be a solution for these problems.

In the last years relatively low-cost Unmanned Aerial Vehicles (UAVs) have become popular for rapid and accurate documentation of cultural heritage.
The aim of this research is to study the potentials of UAVs for documentation of cultural heritage and analyzing the data in detailed scale. Particularly this paper focuses on application of a UAV system for inaccessible and dangerous areas of cultural heritage. One old building built as hotel in 19 th century in Bad Harzburg, Germany was chosen as case study. The research consists of the steps of the project and final outputs of the project. The study also provides the definition of UAV, advantages of the systems, potential use fields of the systems in cultural heritage domain as well as in general.

2. UAV SYSTEMS

2.1. UAV Definition

As a simply definition, UAV is an aircraft without aircrew and replaced by a computer system and a radio-link. It mainly comprises
-a control station (CS) which holds the system operators and the interfaces between the operators and the rest of the system.
-an aircraft carrying the payload which may be in different types
-a system of communication between the CS transmitting control points inputs to the aircraft and returning to payload and other data from the aircraft to the CS.
-support equipment (may include maintenance and transport items) (Austin, 2010)

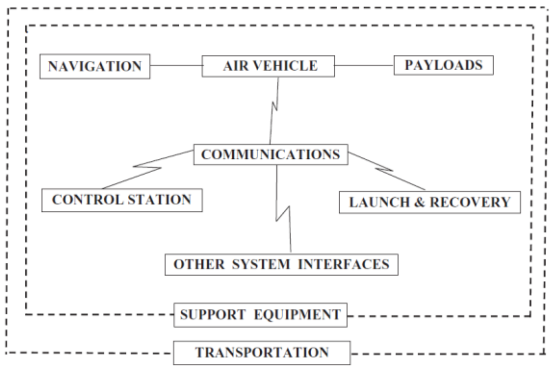

Figure 2. UAV system – functional structure (Austin, 2010)

These systems can be remotely controlled, semi-autonomous, autonomous or have a combination of them. They have a photogrammetric measurement platform with a measurement system including small or medium size still-video or camera, thermal or infrared camera systems, airborne LIDAR system or combination of them. This term was firstly used during 1970's and 1980's in United States Department of Defense and their most effective classification was done by the Unmanned Vehicle Systems International Association (International Unmanned Aerial System

Community) in 2008. Depending on this classification, they have mainly three categories based on their possible use which are; *tactic, strategic* and *special purpose* (Eisenbeiß, 2009).

UAVs have been used for different applications in many countries. They have diverse application fields mainly civilian and military ones. Beside their use in military in navy, army and air force, they have a great potential in observation, maintenance, surveillance, monitoring, remote sensing and security tasks (Eisenbeiss, 2004). Especially in environmental field they have been used for detection of environmental areas at risk, monitoring pollution, land, forestry, water course and level besides road traffic control, analysis of forecasting, power line inspection and pipe line security (Austin, 2010). Moreover, vegetation monitoring like coffee plantation and as an integral part of farm equipment in Japan, in road accident simulations and in many cases of forest fire monitoring, to monitor volcanoes and traffic fields are examples of UAVs use fields (Everaerts, 2008). As well as environmental tasks, they can also be deployed in surveillance applications against civilians, such as applications in policing (for missing persons, security and incident surveillance), border surveillance (Finn and Wright, 2012) and three-dimensional cadastral and transportation map updates, reconstructing mountain rock faces and calculating volumes of stock piles (Haarbrink and Eisenbeiss, 2008) and also in the last years for slope studies because of the reality in three-dimensional (3D) (Anuar et al., 2013).

However, the development of UAVs has been strongly motivated by military applications, during the World Wars balloons, pigeons and rockets were used for spying. Also after World War II, some nations were looking for aerial vehicles, which have the capability for surveillance, reconnaissance and penetration of hostile terrain without the deployment of human beings in areas of high risk (Eisenbeiss, 2004). The development of these systems have evolved with levels of technology of ever-higher performance and they have become a part of research field and opened new areas (Rinaudo et al., 2012). The first aerial photographs were taken by Gaspard Tournachon in 1858 from a manned balloon in Paris (Newhall, 1969). By the years, manned balloons and later model balloons were a part of this evolution. Wester-Ebbinghaus was the first to use a rotary wing UAV for photogrammetric purposes in 1980 (Eisenbeiss, 2009). But that time, these systems have several problems especially related to vibration because of wind and manual control which caused these system not to be acceptable as photogrammeric platform (Eisenbeiss, 2004). During the evolution of UAVs different kinds of balloons, kites, model helicopters and UAVs have showed high potential in process.

3. UAVs for CULTURAL HERITAGE

Photogrammetry has a long history of successful achievements in 3D recording and documentation. Since the first steps of photogrammetry, unconventional documentation problems could be dialed with the help of remotely taken images for 3-dimensional mapping in high accuracy. From that time on, close-range photogrammetry developed innovative and novel tools, techniques, and best practices to handle special and extreme, in some cases, technical problems in 3D mapping. Inaccessibility of monuments, visibility problems, highly oblique images, low texture objects, restrictions in time and/or budget etc. made for a search for the new technologies. A major technology boost with the introduction of digital images and the universal use of laser scanning, along with the development of new digital image processing techniques, offered new solutions (Rinaudo et al., 2012).

Following the developments in image capturing and processing, Unmanned Aerial Vehicles (UAVs) have become an alternative in cultural heritage domain and have been started to be successfully used in different projects. Since they have the ability to perform in high risk situations without any danger for researcher and they can reach the places where men cannot, they have become standard platforms in cultural heritage sector. Their cost-effectiveness, less economic limits, real time data capability, fast data acquisition and small-size features have made them as a strong alternative in heritage documentation projects. In cultural heritage area their applications are mainly focused on documentation, observation, monitoring, mapping, 3D modelling and 3D reconstruction (Remondino et al., 2011) as well as digital maps, digital orthophoto, digital elevation model (DEM) and digital surface models (DSM) (Patias et al., 2008).

In documentation and modelling of buildings, images are generally taken from the ground level for façade information and to detect the features on façades. However in many cases, it is difficult to get the photos of the roof of the buildings and to get an overview from the top with the building surrounding. In this sense UAVs enable to capture the images from the roof and to see the surrounding of the building in larger view. Additionally, with the help of oblique images, it is possible and easier to get information and observe also building façades with these systems. Oblique images make possible to record of historical objects with a vertical direction and they may be used for 3D photorealistic model production and façade views which also give opportunity to make analysis and determination of materials. Here, high accuracy recording should be considered so the details have to be recognized. In addition to such details, with the help of oblique cameras, it is possible systematically to take photos of the cities and then to arrange them in high quality and to share (Höhle, 2013). When needed, their combination with infrared and thermography cameras can be preferred for special purposes. Infrared and thermography cameras have valuable information for further data interpretation and object analysis in cultural heritage field in terms of spatial and spectral information. The applications with the integration of UAVs with such systems are considered as successful practices in cultural heritage study areas (Patias et al., 2013).

Archaeological documentation is other research and application field in which UAVs have been effectively used in cultural heritage domain. In 1970 Whittlesey reported on the use of a tethered balloon for archaeological documentations in the first time, which he actually started in 1967 (Eisenbeiß, 2009). After this experience, during the history, many systems like kites, balloons etc. have been used for archaeological area documentation. In parallel to this evolution, in last years, increasing particular attention has been especially paid to archaeological areas in cultural heritage field in order to obtain complete documentation. In addition to terrestrial laser scanning and photogrammetry, UAVs applications has shown considerable progress in the field of aerial photography, laser scanning technology and thermal and ultraviolet imagery. In this sense generated RGB orthophotos, DEMs and 3D models have started to be used for observation of archaeological areas (Brumana et al., 2011; Rinaudo et al., 2012) and documentation of archaeological excavations (Eisenbeiss and Sauerbier, 2011; Brumana et al., 2013; Anuar et al., 2013), several ancient Greece sites (Skarlatos et al., 2004), for burial mounds (Hendrickx et al.2012), combination of UAVs and terrestrial systems for monuments (Püschel et al., 2008; Eisenbeiss et al., 2005; Lambers et al., 2007) and to document architectural remains (Zischinsky et al., 2000) and for modelling archaeological cultural heritage (Verhoeven, 2009).

4. CASE STUDY

4.1. Site Description

Harzburger Hof is an old Hotel in Bad Harzburg, Germany. It was built as Deluxe Hotel with casino on 1874 and unfortunately was destroyed by a fire in May, 2014. The building is planned to be renovated and reused as hotel in the future. The fire started on the roof of the building so we made a survey to check the situation of the roof with UAV.

(a)

(b)

(c)

Figure 3: (a): Harzburger Hof Hotel (www.panoramio.com) (b) The fire from the top (www.beobachter-online.de) (c) After the fire (www.goslarsche.de)

The application of UAV system aimed to document the building after the fire and to merge the data from laser scanner with UAV data. The interest was more focused on the roof.. In the field survey, 11 ground control points were measured with total station and terrestrial laser scanner survey was carried out. Two kinds of UAVs were used: the first one equipped with laser scanner and the other one with SLR camera. This study presents the first results of this experience.

4.2. Data Acquisition and Processing

Before starting to survey, 11 ground control points (GCP) were arranged a part of the area and 4 targets were put on a part of the building. RIEGL VZ-1000 Terrestrial Laser Scanner and Leica TS09 Total Station was used for the measurements.

The UAV system is a prototype Quadcopter based on a DJI F450 frame produced by GRAVIONIC[1]. The system is equipped with Canon IXUS 220HS 12MP camera calibrated before.

Figure 4: Quadrocopter

Figure 5: Flight path in Mission Planner 1.3.7.

Figure 6: Riegl VZ- 1000 TLS

Figure 7: Leica Total Station

Figure 8: A4 targets as GCP

The system overall weight is 1,5 kg with the dimension 50x50x40 with propellers. It is able to fly up to 45 minutes depending on payload. The electronic equipment includes APM2.6 autopilot with external GPS and magnetometer. In our case study the flight was about 9 minutes from 45 meters high and image overlap was 86%. For the flight, Mission Planner 1.3.7. software was used for managing flight path. Orientation of the images and orthophoto creation were prepared in Photoscan software.

[1] GRAVIONIC- German Geo Services- was founded in 2007 as a spin off of the Institute of Flight Guidance and Control (IFF) of the Technical University of Braunschweig, Germany. http://www.gravionic.com/

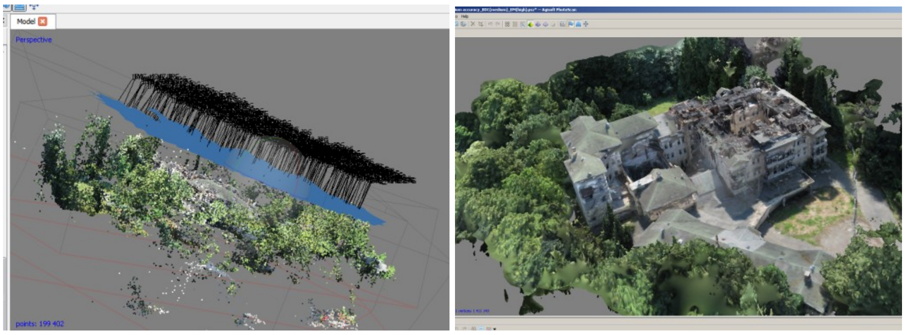

Figure 9: (a) Photo Alignment (b) Dense Point Cloud

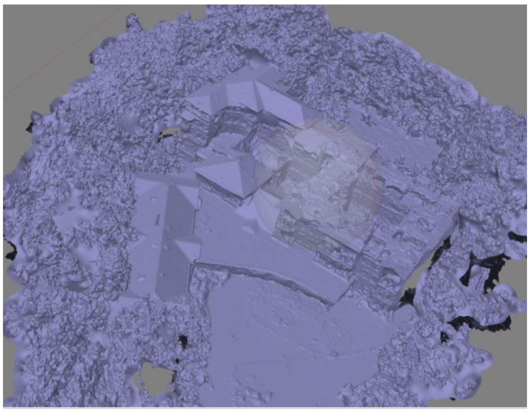

Figure 10: (a) Mesh Model

(a)

(b)

Figure 11: (a-b) Details from textured model from the roof Figure 12: Orthophoto

5. CONCLUSION

The use of UAVs in cultural heritage domain has showed increasing interest in last years. They have been started to use in many applications including archaeological areas, historic sites and cultural heritage buildings. They have become preferred platforms for documentation, modelling, mapping and monitoring purposes. Related to costs, flexibility, high resolution data and point density potentials they have become a strong alternative for geodetic surveys, risky surveys and dangerous and inaccessible places.

The case study presented in this paper is only the first results of the documentation of a historical building. It was a kind of experience to see the potentials of UAVs in order to get detailed documentation for especially inaccessible areas or dangerous/risky places. The use of UAV platforms can be an optimal solution for these kinds of places. Besides, they can be efficiently used to generate orthophotos and 3D models with or without texture. In some cases, the use of other techniques in order to support UAVs could have better results for a complete documentation. In similar cases to this building, it would be better to get also vertical images for façades details. It gives more opportunity for analyzing and observing the façades. Related to this study, the next step will be to combine UAV data with terrestrial data for complete documentation.

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RESTORATION LABORATORY CLASS AND THE ROLE OF GEOMATICS IN CULTURAL HERITAGE EDUCATION

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ABSTRACT
Conservation-restoration education has been discussed in context of teaching methods, curriculums, quality of courses and interdisciplinary relations since Bologna Declaration has started. Conservation-restoration classes are generally devoted to give general knowledge about theoretical background of restoration and to make some practices related to theoretical part with preparation of restoration project. In recent years, innovative technologies have given different opportunities to conservation-restoration practice and its education as well. University of Florence Restoration Laboratory class gives both theoretical and practical courses with innovative approach and interdisciplinary study. In this course GECO[3] Laboratory provides methodologies and tools with new techniques in documentation/surveying and analysis of cultural heritage. This support would be very effective for students' future studies and practices in their professional life. The aim of this paper is to represent an approach to conservation-restoration education adopted by University of Florence, to explain possible integration between different disciplines and to emphasize the significance of geomatics laboratories in conservation-restoration education.
Keywords: Conservation-Restoration Education, Geomatics for Architecture, University of Florence, Educational Activities

1. INTRODUCTION

Conservation-restoration education is a part of contemporary architecture education and a practice of architecture directly affected by social, technological and cultural transformation of today. Valuable monuments, sites and landscapes are increasingly being threatened by large scale or uncontrolled developments of the built environment (Verpoest et al., 2008). Recent environmental and cultural degenerations prove that conservation-restoration practice has become more important than in the past. Conservation-restoration education as a combination of diversity theoretical knowledge and practical skills is expected to find appropriate balance between the theoretical knowledge and practical training in basis of this education (Crăciunescu, 2008). Moreover, since this education has strong relation with some cultural, historical, aesthetic and technical issues (Hutchings, 2009; Loughlin, 2008), conservation-restoration education can be organized with interdisciplinary curriculum which includes theoretical background of conservation-

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restoration practice, solutions for some problems of cultural heritage, knowledge of materials properties and their behaviors in different conditions, techniques related to preventing deformations, different restoration techniques, new design methodologies in historic building/environment as well as documentation of cultural heritage.

Context of cultural heritage education has been discussed over the last two decades and several methods have been used for conservation-restoration education. During Bologna process, the conservation-restoration education programs in most European countries have undergone great changes including adoption of University of Florence structure. The original recommendation of Bologna Declaration was a call for an introduction of a common two-tier education; three years undergraduate and two years graduate studies. This recommendation was based on shared academic values and principles and the goal of it was to foster mobility of student, teacher and researcher for enriching education (Winter and Ogleby, 2008). Addition to Bologna recommendations, European Minister of Education has a declaration aimed at creation of a single European Higher education commonly referred to Bologna declaration. E.C.C.O. (European Confederation of Conservator-Restorer' Organization) involves guides and recommendations on conservation-restoration education and professional competences of cultural heritage area. This guideline addresses its own requirements for professional work including education qualification. Some of European universities have already deep experiences on conservation-restoration education and have been changing their education systems based on Bologna declaration and European Union suggestions.

Recent researches have shown that studies related to conservation-restoration education commonly concentrate on development of education and professional work quality. Observation of learning outcomes can change academic emphasis of education from what educators wish to teach to what graduates need to know. These learner-centered approaches can be reorganized in courses that require a well-defined curriculum in order to provide access to professional working platform (Hutchings, 2009). This is directly related to how an educator should convey concept and forms during teaching. It's one of the aim to teach students how regularly attendance to a class can help to tackle with many problems in professional life both culturally and technically. Restoration project class is a main course generally most of the universities give knowledge to students both in main theoretical field and how to come across with different problems. An integrated and multi discipliner curriculum is followed in Restoration Laboratory class for 3-year bachelor degree students in University of Florence. Main important part of this curriculum is devoted to documentation of historical buildings with modern techniques.

Data collection and recording is very important and the main part of cultural heritage studies related to ICT (Information and Communication Technology). Especially 3D data acquisition has been important for analyzing data, recognizing of problem, education activity and dissemination knowledge in recent decades (EPOCH, 2008). In this context, with awareness of future technological development and innovations, most of educators believe that new techniques and innovative approaches should take place in conservation-restoration education. This approach is not just a documentation process of architectural heritage; it is also related to full understanding of cultural heritage and ICT relation. In this context, Geomatics laboratory provides teaching to students who will be professional profiles after graduation of university. This paper aiResearch Agendams to present that Geomatics education as a part of architectural education should be a way in order to prepare students better for their professional life shaped by fast developing technology.

2. CONSERVATION-RESTORATION EDUCATION IN UNIVERSITY OF FLORENCE

Italy is a rich country to find different kinds of programs related to cultural heritage for researchers and students. Conservation-restoration education in University of Florence teaching approach has deep relations with establishment of Conservation Institute (1960) and the founder of the institute Piero Sanpaolesi (1904-1980). Sanpaolesi played a major role in growth of the international conservation method in 1960's and 1970's in Italy. Sanpaolesi, primarily suggested to rediscover of historic architecture built in previous centuries by different nations. After awareness of historical architecture, he promoted crucial discussions in international level on restoration criteria and methods. In these discussions, people tried to find a compromise on what would be considered as acceptable restoration work. According to Sanpaolesi, restoration education needs to integrate theoretical learning and some experiences gained on the field works. Sanpaolesi also emphasized that restorer architects had a main coordinator role in various types of projects and constructions in order to control their preservation measures and their compatibility with historic context. Moreover, he mentioned that restorer architects are guarantor of restoration works quality and operations of preservation institutions in different places and at different levels (Devita, 2008). In this historic background, it should be emphasized that conservation-restoration education in University of Florence has continued without any interruption since conservation institution was established. Main objectives of teaching activity in University of Florence can be summarized as:

- to improve learning, research for active protect of cultural, historical and natural heritage.
- to understand cultural heritage with in its physical consistency and construction process.
- to get potential in order to exchange knowledge and experiences with different disciplines related to cultural heritage.
- to have ability to solve problems related to cultural heritage by modern techniques, concepts, restoration and preservation methods.
- to improve capability for using modern acquisition and dissemination techniques in cultural heritage field.
- to increase knowledge regarding to cultural heritage and its behavior in different conditions in order to improve the restoration.

Table 1. Summary of Conservation-Restoration Teaching in Italy (De Naeyer, 2008).

	Summary of Conservation-Restoration Teaching in Italy	
1	Bachelor degree in Conservation of Cultural Heritage:	Three-year full time education aiming at good professional competences in the field but without important civil responsibilities.
2	Introductory courses for architectural and urban conservations.	This course integrated in master programs in order to give a basic acquaintance with some principles of conservation (Theoretic and technical). Generally 1 hour in a week in one semester (3ECTS course).
3	Master in Architecture	Regular architectural education consists of 5-year program (3-year bachelor followed by 2-year appropriate master). This master program is in the second part of regular architecture education with specialization in conservation-restoration.
4	One year Master Programs	These programs are different from master in architecture and the alumni are not allowed to take the civil responsibilities of an architect in architectural projects. These type of master programs (with entrance of student into diverse fields) have the advantage of offering a widely inter and multidisciplinary approach in the study program. 1 year: (60 ECTS) or 2 years: (120 ECTS)
5	Postgraduate academic master programs or Master after master Programs.	These are multidisciplinary specialization from 60 to 120 ECTS organized for architects, engineers or who have masters from human sciences to get specialized in architecture and urban conservation of monuments. The condition to start such postgraduate master programs is to have a first master diploma related to conservation of build heritage.

6	Phd programs.	Such studies can start after an academic master degree and always consist of authentic and original scientific researches.

3. ICT AND GEOMATICS LABORATORY FOR CONSERVATION-RESTORATION EDUCATION

Progress in Information &Communication Technology (ICT) has quickly changed our standard of life, the way of working, teaching, studying and the way of carrying out research. Cultural heritage studies cannot neglect these technologies as they are a way to reach a new and greater population of users and to get and share more information (Petrone, 2012). Also in education field, the role of ICT in teaching and learning brings changes to digitalization of cultural heritage artifact, to view them as 3D in digital platforms and to share data with different stakeholders (Ott and Pozzi, 2011). This sharing is significant for e*ffective interpretation and presentation of cultural heritage for enhance personal experience, increase public respect and understanding and communicating* (ICOMOS, 2007). Geomatics Laboratory (GECO) organizes a sort of atelier aiming to emphasize the role of innovative techniques in documentation and conservation of cultural heritage.

Main objective of teaching activity in this geomatics laboratory are:

- to give general information related to new techniques for cultural heritage and environmental documentation (small object documentation, photogrammetric techniques for building and large areas and laser scanning techniques).
- to use modern survey techniques to understand of whole morphology of buildings and site to make decisions (with topographic survey, laser scanning and photo-base modelling).
- to produce 3D models and ortho-images to analyze shape of objects, anomalies, material differences and structural problems and to transfer these data to related disciplines .
- to get some experiences with interdisciplinary study in restoration project class (with geomatic engineers, construction and environmental engineers, historians and restorers).
- to understand how important dissemination and sharing of data for education and scientific proposes.
- to get practice to present all data with different graphic expressions (3D modelling programs and graphic design programs).

These objectives also contain some on-site analysis, diagnoses as well as preparing some reports for actual situation of building and sites for conservation and restoration process.

4. SOME EXPERIENCES FROM CONSERVATION-RESTORATION LABORATORY CLASS

Traditionally, conservation-restoration education is based on both theoretical and practical approach in department of architecture. Teaching conservation-restoration education aims at giving basis of conservation and restoration history, analyzing of historic architecture, giving methodology for survey techniques, understanding of spatial units and geometry of building, figuring out structural and material features of building and site besides drawing a restoration project analyzing with all acquired data. Conservation-restoration laboratory class in University of Florence consist of three different courses and three different steps: Theoretical background, Field work, Restoration project.

Table 2. Restoration Laboratory Course Sections.

	Restoration laboratory course sections and their descriptions	
	Section	**Description**
1	Geomatics for Conservation/Restoration	Modern survey techniques
2	Restoration	Theoretical background & project
3	Static and Stability for Conservation	Material and Structural Behaviors.

-Theoretical Background

Each year, as educator, which theoretical and technical principles are leading conservation-restoration classes and educational goals which should be persuaded are discussed. The beginning of course is generally dedicated to intervention on historical architecture. History and theory of conservation, legislations related to conservation-restoration practice are given more in theoretical part of the course. Subsequent work of conservation-restoration works are exemplified and critical commentary of conservation-restoration works and some good or misrepresenting works are evaluated and interpreted in the class. Current theoretical debates and most recent themes and solutions dealt with in Italy and the rest of Europa are debated in theoretic part of this course. New approaches for conservation-restoration works and reusing of historical buildings, restoration techniques, new scientific academic researchers are presented to students for helping their restoration projects.
Conservation-restoration should be taught as heritage care application in which different kind of disciplines can take part of this didactic activity (Torsello, 2008). In this part, some interdisciplinary presentations are carried on in our curriculum. Depending on the case study, some history and art-history, environmental relations, landscape and urban planning presentation take place in theoretical part. Historical and most common current materials for restoration applications, technical and structural characteristic of buildings, urban conservation and related regulative references are studied in conservation-restoration class with structural and material engineers, urban planners and historians. About thirty years ago, architectural heritage was primarily understood as a single building or building groups that were

valuable for conservation in the Charter of Venice (1964). Today a more in depth approaches are advocated which identify various dimensions and aspects of architectural heritage. Recent studies represent that cultural heritage issue is very complicated and it clearly needs interdisciplinary studies.
In theoretical part, connection with practical part, educators are tried to answer general questions regarding consolidation, maintenance, modification, integration, new additions and technical operation in context of destiny of built heritage, of an environment, of way life, of a landscape through a clear design process (Franco, 2008). In this class, description of architectural buildings peculiarities, surface analyses, analysis of deformations, crack analysis, sign of material decays and long-time behaviors of material and building components are studied. Students can apply this theoretically developed knowledge in their individual conservation-restoration projects as thematic maps to recognize and represent structural problems, material differences, anomalies, cracks and risky parts. The material evidences of the monuments in theoretical part are especially focused on conservation and restoration projects.

-Field Work and Metric Survey

The training courses are process of connection between theoretical considerations and operational answers that are direct examinations (manual or instrumental surveys, geometrical technological and material studies, structures and walls) and studying on bibliography and sources (Fiorani, 2008). The practice runs parallel to theoretical lessons with building survey and analytical studies. Students develop a field study for diagnosis and analysis of current situation of building and study on historical changes, different additions and authentic situation of building. Acquired data is collected in an analysis report for using design phase or restoration project. Different possible restoration techniques are compared and discussed using on-site study report. On-site study consists of these steps:

- Survey of historical building
- Diagnosis of problems and historical studies.
- Synthesis of acquired data as a report for using restoration project.
- Elaboration of restoration project using with this data.

Traditional metric survey and modern documentation techniques are taught in restoration laboratory. In contrast to photogrammetry and laser scanning technology, direct survey and topographic survey are taught as traditional survey techniques. Choosing single subjects for small study groups study independently on a survey project for leaving them free to follow theoretical part supported by laboratory educators. Direct measurement techniques are basis of survey projects and still used in most of restoration projects and are given in different courses in department of architecture. In conservation-restoration class, students use direct measurements supported by topographic measurements. Basis of topographic survey techniques and equipment, how restorer can manage topographic survey and elaborate topographic data in office or CAD programs are in this process.

Terrestrial laser scanners and photogrammetry are increasingly being used for 3D cultural heritage documentation works. It is not possible to know or understand some problems of building without complex survey including whole building. These new technologies provide detailed knowledge related to whole building. One objective of these courses is to get student familiar with these kinds of technologies for their future professional life and education. Photogrammetry is generally used for obtaining ortho-images for drawing of building façades easily. Façades of case study are studied in photogrammetric software, and then elevations of building are drawn with ortho-images. This technique is very effective for thematic drawings and analyses of building facades. Similarly, some part of case study is scanned with students to explain laser scanning technologies and its working principles. After scanning of building, in laboratory, management of laser scanning data is explained and some section, elevations and plans are prepared for students to draw and to use in their survey project. Thanks to facilitation of the laboratory, it was easier to teach students how to use nondestructive techniques for acquiring data of historical building and diagnosis of their conservation conditions as a fundamental support of conservation-restoration education.

-Restoration project

Restoration project is main part of conservation-restoration education. Student can find an opportunity to solve same problems and to combine theoretical and practical requirements as a one goal of the restoration laboratory. This part of the project concern how can be kept a historical building alive with some conservative, maintenance, re-using interventions. Student can try possible different restoration alternatives in this process discussing with educators.

Another goal of architectural restoration project is to examine re-using alternatives with comparing physical character of building by preserving with authentic space character or reusing building with new additions. This is more related to design activity in historic district or building with modern restoration approaches. The design activity related to historical building and site contains trans-disciplinary approaches in order to cope with some problems of design area especially regarding old and new relations in historical area. In addition, design activities combined with restoration projects have interdisciplinary dimensions related to cultural studies, sustainable activities in building and its environment. In the restoration project, educators aim to be sure that attendance of the class make correct assessment of the links between cause and effect in analyzing process and it is expected to use this data in restoration project to find solutions for cultural, technical and operational domain.

5. CONCLUSION

University of Florence has deep conservation-restoration background starting from the contribution of Piero Sanpaolesi. Recent years conservation-restoration education has been improved by objective of Bologna declaration process and European Union suggestions. Following this suggestion, University of Florence conservation-restoration education is getting more interdisciplinary and focusing on different related areas. We always consider that how can we improve quality of this courses in context of administrative structure, over all concept of curriculum and methods of teaching. After 3+2 years architecture education in University of Florence, students can be familiar with some very important classic and modern issues related to the conservation-restoration:

- General theoretical background of conservation-restoration practice.
- General knowledge of technical and scientific methods for cultural heritage documentation: from direct survey to laser scanning technologies.
- General knowledge related to legislations for conservation-restoration.
- Critical awareness of knowledge related to different issues between conservation-restoration field and different disciplines (material studies, structural problems, analysis of all anomalies and graphical expression of these topics as a project or deformation maps).

It is clear that the use of geomatics technology provides a significant contribution to conservation practices. This technology is getting increase and in near future, it will be essential for all discipline in cultural and environmental documentation. Architectural schools/departments/institutes should provide this technology for their student as a main profile which will need this technology in cultural heritage studies. This technique is not a measurement of objects/buildings; it also contains some opportunities for extensive researches on studied objects. In order to get common use of innovative technologies in restoration projects, it has been concluded that adequate training/education should be given in universities and this technology should be taken place in architectural education. This course inspires graduated students more to use this technology in their professional works and to apply it to interdisciplinary programs related to documentation of historical building and sites.

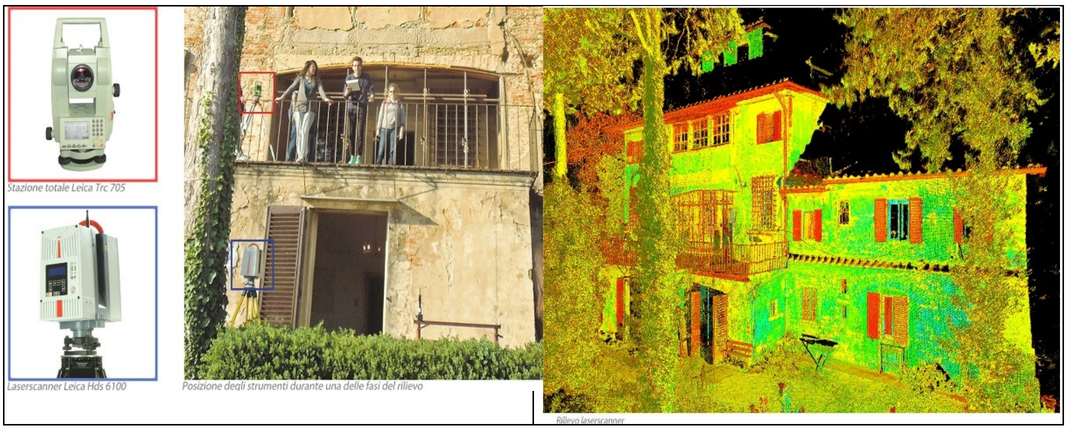

Figure 1. Topographic survey and laser scanning for support to restoration laboratory (GECO Lab.).	**Figure 2.** Students getting familiar with working on laser scanner data (GECO Lab.).

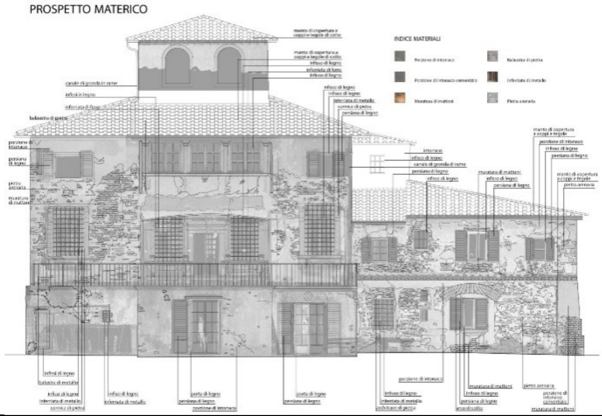

Figure 3. Ortho images for thematic maps for material analysis (Restoration Lab. 2014).

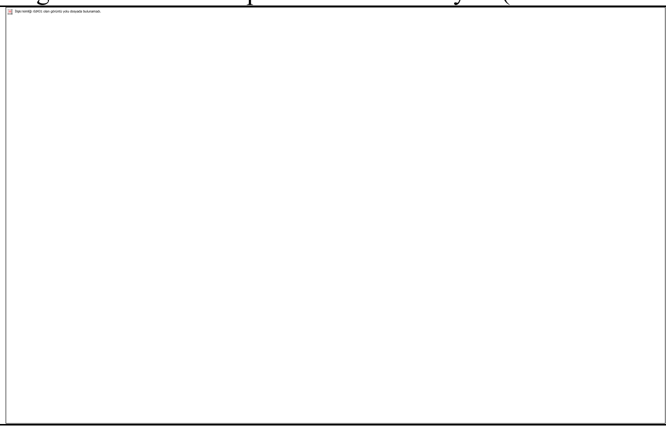

Figure 4. Ortho images for thematic maps for deformation analysis (Restoration Lab. 2014).

Figure 5. Restoration project with new design approach in historic building (Restoration Lab.

2014).

Figure 6. Some graphical expression of student for restoration project in graphic software (GECO Lab.).

Figure 7. Point cloud data for elevation, section, plan and 3D models (GECO Lab.).

Figure 8. 3D model of building, created by using point cloud (GECO Lab.).

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SESSION 9

21 November 2014 Friday, 17.15-18.30

GEOMATICS: NEW TECHNOLOGIES FOR AN INNOVATIVE PLANNING APPROACH

GRAZIA TUCCI[1], VALENTINA BONORA[2]

ABSTRACT

The paper discusses the technical and cultural evolution of the approach to environment, landscape and cultural heritage, providing a short review of the international charters, recommendations and conventions focused on those themes. It presents some innovative ways for collecting 3D metric documentation, such as digital photogrammetry from UAV systems and mobile mapping, since 3D models are widely used in cultural heritage to create accurate records of individual monuments and buildings as well as complete sites, and they are of great interest both for research and for dissemination purposes.
The topic of the re-use and promotion of digital cultural resources is proposed as a challenge for the near future.

Key words : Geomatics, New Technologies, Digital Heritage, Drones, Mobile Mapping

1. INTRODUCTION

Traditionally, the architect's work is strictly related to the environment, meant as a place of changes and historical processes, as well as a spatially defined territory.
With time, there has been an increase in the sensitivity shown towards the context where the engineer works, as can be seen by the progressively broader and more complex meaning attributed to terms such as *environment*, *landscape* and *cultural heritage*. Indeed, the contemporary meaning attributed to *environment* has systemic connotations that highlight the relations between geographical area, populations, resources, physico-climatic conditions, etc..
Over the last century, an interesting cultural debate has also expanded and structured the term *landscape*: "in Europe the concept of landscape and the words for it in both Romance and Germanic languages emerged around the turn of the sixteenth century to denote a painting whose primary subject matter was natural scenery" (Cosgrove 1993).

For long time the idea of landscape was close to "a cultural image, a pictorial way of representing, structuring or symbolising surroundings" (D. Cosgrove, S. Daniels, 1988) following a so-called structural approach (K. Benediktsson, K. A. Lund,

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2012); the European Landscape Convention, signed in Florence in 2000, moved to a phenomenological approach, bringing attention to the mutuality of human-landscape encounters, to consider landscape as "an area, as perceived by people, whose character is the result of the action and interaction of natural and/or human factors" (Chapter I, Art. 1)

Lastly, the term *cultural heritage* appeared for the first time in the international field in 1954, with the Hague Convention. It has extended in time, as illustrated in figure X (from Vecco, 2010) and summed up in the extracts from the International Charters, Recommendations, and Conventions in the next paragraph.

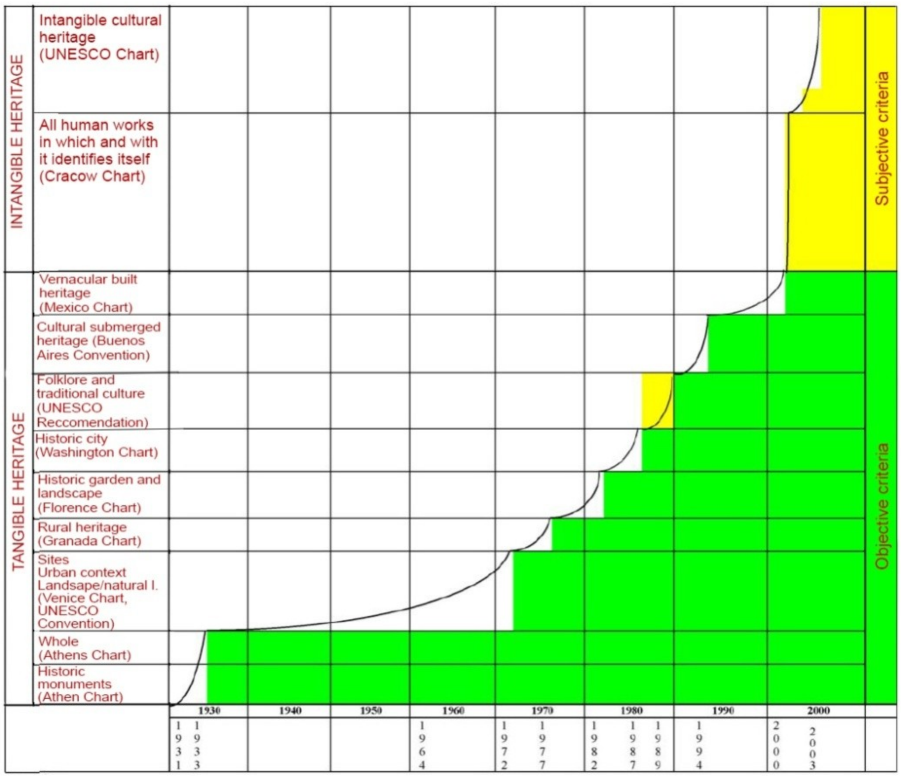

Figure 1 - The evolution of the concept of "heritage" following the International Charts, Recommendations and Conventions (from Vecco, 2010).

2. RECCOMMENDATIONS AND CONVENTIONS

2.1. Le Corbusier, commented version of the CIAM Athens Charter (Athens, 1933), published in 1942/43 (La Charte d'Athènes)

"The life of a city is a continuous event, expressed through the centuries by hardware works, drawn or built, which provide its own personality and which comes little by little his soul. These are precious witnesses of the past to be respected for their historical or sentimental value first; then because some carry with them in a plastic virtue under which the highest degree of intensity of human genius was incorporated."

2.2. 1964, Venice Charter

"The concept of an historic monument embraces not only the single architectural work but also the urban or rural setting in which is found the evidence of a particular civilization, a significant development or an historic event. This applies not only to great works of art but also to more modest works of the past which have acquired cultural significance with the passing of time."

2.3. 1972 UNESCO World Heritage Convention

"With respect to cultural landscapes, the Committee has furthermore adopted the following guidelines: Cultural landscapes represent the 'combined works of nature and of man'; they are illustrative of the evolution of human society and settlement over time, under the influence of the physical constraints and/or opportunities presented by their natural environment and of successive social, economic and cultural forces, both external and internal. The term 'cultural landscape' embraces a diversity of manifestations of the interaction between humankind and its natural environment."

2.4. Recommendation concerning the safeguarding and contemporary role of historic areas, adopted by UNESCO in Nairobi, 26 November 1976

"'Historic and architectural (including vernacular) areas' shall be taken to mean any groups of buildings, structures and open spaces including archaeological and palaeontological sites, constituting human settlements in an urban or rural environment, the cohesion and value of which, from the archaeological, architectural, prehistoric, historic, aesthetic or socio-cultural point of view are recognized.

The 'environment' shall be taken to mean the natural or man-made setting which influences the static or dynamic way these areas are perceived or which is directly linked to them in space or by social, economic or cultural ties."

3. GEOMATICS: NEW TOOLS FOR HERITAGE DOCUMENTATION

In recent times, those disciplines that have always been involved in the creation of documentation projects have had to deal with revolutions brought about by the advent of electronics first of all, and then digital technology. Now, in the latest development, they are summed up under the newly diffused neologism of '*geomatics*'. Geomatics includes the techniques traditionally used to document the territory and the artefacts that persist there, such as topography, photogrammetry, cartography, plus more recent systems such as GNSS, scanning systems, remotely sensed imagery from satellites and GIS. With the technological evolution comes an expansion in the discipline's fields of interest. No longer is it only finalised towards the morphometric description of the object under investigation, but also the management of various kinds of phenomena in which spatial referencing is important: traffic flows, climate changes, structural deformation, etc.. Many of the studies conducted in numerous disciplines make use of geographic or, more generally, spatial data, and geomatics often finds itself in an area of overlap between various competences. Nowadays, surveys no longer need to be "static", defining documents with a metric value, located in time, valid for an instant in the history of the object under survey, an instant later already recounting a past story, albeit in many cases these approximations may be tolerable for even long periods of time. Time is now a variable taken into consideration both in the data acquisition and elaboration phases. On the tiniest scale, for example, the form of the Earth is described in relation to systems of reference with a collocation in time, which must be progressively updated owing to the movements of the tectonic plates. On a much more enormous scale of analysis, it is possible to monitor the micro-movements of structures of particular interest with sensors connected in real time to alarm systems that can be triggered when safety thresholds are exceeded.

Albeit with the inevitable approximations produced through the reduction to diagram form, today we can distinguish both range-based measurement techniques and image-based techniques.

The former include total stations, an evolution of the optical-mechanical theodolites, as well as the more modern satellite systems (initially GPS, now integrated with other satellite constellations), radar systems and land and air laser scanners.

The second group consists of digital photogrammetry, with the same principles as traditional analogical photogrammetry, but with a work flow completely innovated by the introduction of algorithms that permit both the automatic orientation of the photograms, and automatic graphical plotting, as well as the possibility to use drones for the filming that can fly at a low altitude even in urban areas or in environmental contexts that are risky for operators to access directly.

While without doubt advantageous in terms of productivity, these changes at times risk overshadowing the need for a rigorous measurement approach, namely an accurate design with the necessary resolution. Careful post-checking is also required so that the appeal of the graphical products obtained – generally they are 3D models – does not make one forget that they are nevertheless representations of the real world and that, despite being uniform and certified, their correspondence with the real world is inevitably approximate.

Figure 2 - Optocopter AeroMax 800 tested by Lab. GeCo for a digital photogrammetric project

Figure 3 -Different vehicles for Mobile Mapping Systems (from: http://www.fgi.fi/fgi/research/mobile-mapping-platforms)

Today the techniques quoted above work alongside so-called "mobile mapping" systems in which different sensors are placed in a single vehicle moving along the city streets. 2D laser scanners are used (profilometers) in order to document shape and sizes; cameras and video cameras for textures; and GNSS systems, inertial platforms and odometers are used to position all the data collected instant by instant. Further sensors can be positioned on the vehicle to acquire specific information, such as thermal imaging cameras, profilometers to measure the wrinkles in the road surface, radar to evaluate buried elements, etc..
There are multiple possible applications for the data found with mobile mapping systems and they involve aspects linked to documentation, management/maintenance and communication. In particular:

- documentation of the state of shores, banks and overlooking buildings;
- management/maintenance of the structures of bridges, the road surface, sub-installations, lighting systems, road signs;
- aid in planning interventions, also in emergency situations, on historic buildings;
- communication and promotion of the existing built heritage (and its urban context)
- simulation of interventions, in multiple sectors: lighting, realizing scaffolding and relative shielding;
- modelling and risk assessment in situations such as flooding, crowd movements, etc..

GeCo Lab. has recently gained some important experience in photogrammetic surveying, with cameras mounted on both multirotor and fixed-wing UAVs, and it is set to acquire 3D and multisensor documentation of the urban rivers in Florence with a mobile mapping system.

4. GEOMATICS: NEW TOOLS FOR SUSTAINABLE CULTURAL ENHANCEMENT

Over recent years, numerous digitalisation projects have been set in motion on both environmental contexts and monumental buildings, sculptures and artefacts of various dimensions.
An important European project has been Europeana, whose goal was to provide content and technology demonstrators. In the Europeana archive, with an impressive collection of millions of objects, it is possible to find books, paintings, films, museum objects and archival records that have been digitised throughout Europe. Some specific projects focused on 3D digitisation: CARARE (http://pro.europeana.eu/web/carare) and 3D-COFORM (http://www.3d-coform.eu), up to the most recent 3D-ICONS (http://pro.europeana.eu/web/3d-icons), whose goal is to digitise in 3D architectural and archaeological monuments and buildings identified by UNESCO as being of outstanding cultural importance.
In addition, we cannot forget the numerous initiatives carried forward by research centres and private companies. GeCo Lab. has been involved in the MusInt project (virtual INTeractive MUSeum of the Aegean and Cypriot collections in Tuscany, on

line: http://musint.dreams.sns.it), and in the 3D documentation of the Gallery of the Accademia and the Baptistery of San Giovanni in Florence, the Basilica of the Holy Sepulchre in Jerusalem, some historical buildings in the city centres of Multan in Pakistan and La Habana in Cuba, and other significant architectural and natural contexts.
Now the question for the near future is "how can the digital cultural heritage be used and enhanced?". The open call for European projects focuses on the use and promotion of digital cultural resources by businesses and citizens and on the exploitation of cultural digital resources, providing clear rules for their use and re-use, especially in the fields of education, tourism and leisure.
The first draft document from the latest UNESCO Forum, held in Florence in October, is entitled “Culture, Creativity and Sustainable Development. Research, Innovation, Opportunities”. The Declaration requests that culture be given due consideration in the post-2015 development agenda and identifies "the key role of cities and regions as actors of change and where the culture in and for human development acknowledges the monetary and non monetary aspects of the economy through cultural expression, artistic practice, safeguarding of tangible and intangible heritage, promotion of cultural diversity, urban planning and architecture." (Florence Declaration, 2014)

4. CONCLUSION

3D models are widely used in cultural heritage to create accurate records of individual monuments and buildings as well as complete sites.
Thanks to the innovative ways of documenting the city, its streets and its buildings, the traditional codes of cartography and drawings can now be surpassed to instead produce digital, 3D, texturised maps that at the same time are able to describe the material consistency of roads, structures, infrastructures and their relationships with each other. What is more, they have an added value thanks to the fluidity with which the digital data can be used, transmitted, integrated and updated. The new maps are no longer just technical drawings characterised by objectivity and accuracy; today they have dynamic and captivating interfaces and they can present new images of the city.
At the same time, a big challenge for the near future will be to manage heritage and culture [Barthel-Bouchier], while redefining some past strong power relations and encompassing more players in the process.
Already available digital assets should become accessible, high-quality, well-organized and attractive information used for creative ends by cultural industries, supporting culture and sustainable development.

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A STUDY OF TECTONIC CULTURE AND TECHNOLOGY OF RELIGIOUS MASONRY ARCHITECTURE IN WUHAN

RU CHEN[1]

ABSTRACT

Western style masonry architecture had been much promoted because of western influences since the mid-nineteenth century, and the well preserved Griffith Church in Wuhan was a representative to investigate its tectonic culture and technology. While the various masonry methods applied in its brick wall, its door and window openings, and its main structure, were largely western in nature, the Chinese or the local methods were incorporated where appropriate. This shows that the tectonic culture and technology of contemporary religious masonry architecture in China could not be fully understand without a consideration of the Chinese architectural tradition and the social context. Also, with respect to construction technology and spatial expression, Griffith Church could provide invaluable lessons in the exploration of construction potential and architectural treatment of the brick masonry.

Key words: Tectonic culture and technology, Masonry architecture, Griffith Churth

1. INTRODUCTION

Brick is a common building material and plays an important role in the design and construction of masonry architecture. As it is well known that Chinese traditional architecture was of a wooden structure (Guo, 2000; Li, 2003), it is interesting to investigate Chinese masonry architecture in bricks which had been much promoted because of western influences since the First Opium War (1840-1842) in the mid-nineteenth century when China was forced to open its door to foreign trade. In this process, many treaty ports were opened in strategic coastal and riverside locations, and Wuhan was one of the most important treaty ports, where some western style masonry architecture was established. Among these, church, a kind of religious architecture, became popular for preaching purposes of missionaries. While some other architectural types that emerged in contemporary treaty ports have been extensively explored, there is much scope in the study of religious architecture (Johnston, 1996; Cheng, 2008; Guo, 2009; Tong, 2011), particularly in respect of the issue of building material and its tectonic culture and technology (Hackett, 2014; Jung, 2013). This study sets out to make up this deficiency.

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The concept of ‘tectonic’ is the theoretical basis for this study. According to Kenneth Frampton, ‘tectonic’ should be understood as the technological aspect in construction and the way to create meaningful spaces or places (Frampton, 1995). It should be noted that in architectural history, innovation and advances in these two aspects often brought forth new architectural forms or expressions. As such, this study of the tectonic culture and technology of masonry architecture is not only about architectural aesthetics or style, but also about the integration of building process and architects’ design aspirations. It concerns the construction potential and architectural expression of the brick material, and therefore fundamentally the essence of architecture and construction.

2. THE GRIFFITH CHURCH

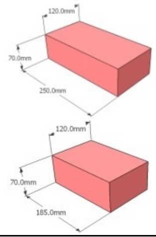
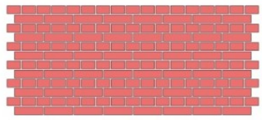
The churches in Wuhan from the mid-nineteenth century were almost western style masonry architecture. But they were regretfully almost not well preserved. Some of them were torn down, some became derelict and abandoned, and some others were subjected to functional change, which resulted in damages in various degrees.

Among them, Griffith Church is the best preserved. Built in 1880, it was the principal church of the London Missionary Society in central China. It was originally the Flower Mansion, located on Jianghan Road at the juncture of the British Concession and the Chinese community. It was moved to Yunqiao Road (now Huangshi Road) in 1931, and in order to commemorate Griffith John (1831-1912), the earliest Christian missionary in central China, was renamed Griffith Church. The church was built with plain brick wall, and its window openings were largely made with pointed arches. With a floor area of 1,191 square meters, it was the biggest church in Wuhan with a seating capacity for 1,000 people. The church was renamed Rongguang Church in December 1951, closed during the Cultural Revolution (1966-1976), and not re-opened until November 1980. It has now become a popular place for Christian activities and regularly receives 1,000 or so people per day.

3. THE BRICK WALL: THE FUNCTIONAL AND THE SPIRITUAL

The bricks used in the construction of Griffith Church were all red ones imported from the West, with a standard dimension of 250 millimetres in length, 120 millimetres in width, and 70 millimetres in height. In Griffith Church, door or window openings, arches, pilasters, and cornices, were all made with such standard bricks. Most of the bricks were arranged in cross bond, the so-called ‘English style’, which was popularly implemented for its simple and easy manipulation. Besides cross bond, there was also Gothic masonry method, the so-called plum style (figure 1, 2).

The thickness of the walls of Griffith Church was varied in different part of the building. It was normally 250 millimetres thick, but it might be 380 or 520 millimetres thick at door or window openings, pilasters or constructional columns. The latter treatment largely showed a functional concern about the safety of the building structures, and in some other instances an aesthetic concern about the effect of the façade. But more importantly, since the church was built to serve Christians and hold religious activities, it was clear that the intention was to follow the church style in the West in order to meet religious purposes and in this case the spiritual end.

Cross bond	The normal dimensions of the brick	The effect of the façade
This was the normal masonry method in Wuhan churches. İt was of some grandeur visual quality and greatly influenced masonry architecture in Wuhan.		
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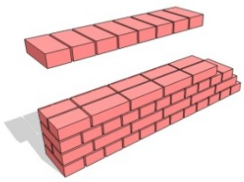
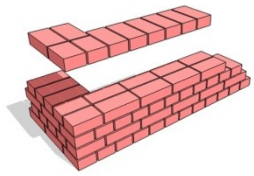
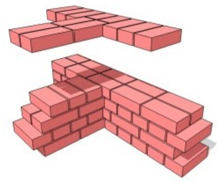
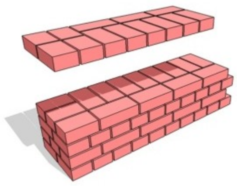
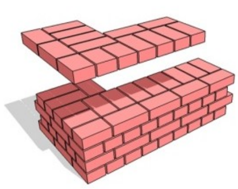
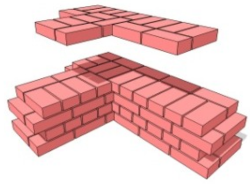
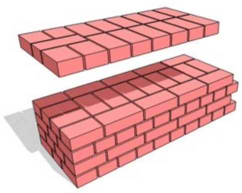
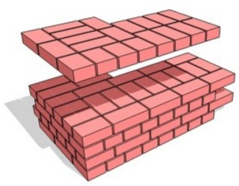
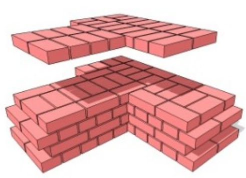
		
		
		

Figure 1. Cross bond in the construction of Griffith Church
Source: drawing author.

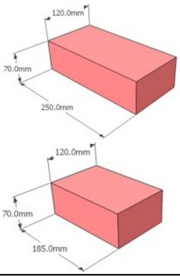
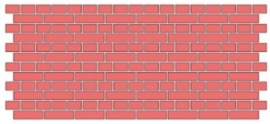
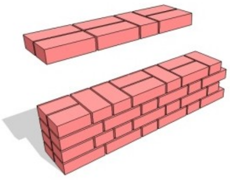
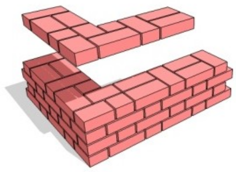
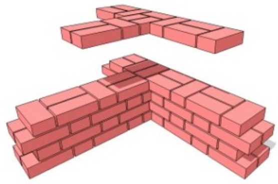
Gothic masonry method	The normal dimensions of the brick	The effect of the façade
With this masonry method, it was easy to produce colour variations in brick walls. The method was also popular in the construction of residential architecture in Wuhan.		
The masonry of a single wall	The masonry at the corner	The masonry of a T-shaped wall
		

Figure 2. Gothic masonry method in the construction of Griffith Church
Source: drawing author.

4. THE DOOR AND WINDOW OPENINGS: THE IMPORTED AND THE LOCAL

There were two masonry methods for the door and window openings of Griffith Church, the flat arch and the pointed one. While the flat arch could be found in Chinese traditional architecture, the pointed one was a clear characteristic of Gothic architecture in the West. This thus showed a mixture of the Chinese architectural culture and that of the West in contemporary masonry architecture of Wuhan. It seemed that the tectonic logic of the flat arch was contradictory to that of brick masonry. But due to the bonding role of mortar, the wall itself could maintain an appropriate structural strength, and as a result the flat arch does not need to sustain the weight of the wall above them. As such, the flat arch only needs to sustain the weight itself, and the bonding strength of mortar is enough to achieve this. Thus while the flat arch seemingly violate the tectonic logic, they actually demonstrate a unique tectonic characteristic of brick masonry. This kind of treatment could be found in today's brick buildings, but the walls are often equipped with reinforcing bars in order to ensure structural strength. This is a direct result of the development of architectural technologies, and also a result of local building acts and codes.

The pointed arches of the door or window openings of Griffith Church were made through multi-layer brick masonry. The number of layers was determined by the position or importance of the door or the window, the visual effect, or the desired spatial characteristic. This brick masonry is very much like the corbelled arch in traditional Chinese architecture. While the two are of similarity in masonry method, their masonry purposes and effects are clearly different (figure 3).

Figure 3. The brick masonry of the door or window openings of Griffith Church
Source: drawing author.

5. THE MAIN STRUCTURE: TWO DIFFERENT TECTONIC EXPRESSIONS

The main structure of Griffith Church is a brick-wood one, which was the earliest construction technique imported from the West (Tong, 2011). This structure often comprises a combination of load bearing brick wall, arch, and wooden beans. It should be noted that the application of red bricks and arches, and the masonry method of cross bond, as demonstrated in Griffith Church, marked the introduction of such structure.

With two different materials, there are two different tectonic expressions in Griffith Church. Its vertical load bearing element is brick columns, and the horizontal load bearing element is wooden truss with a span of 15 meters. The construction of brick columns is similar to that of pilaster in modern frame structure. It is attached to the building envelope of brick walls with regular spans, whilst protruding from the walls. There are brackets on top of the brick columns to support the wooden truss. In order to ensure the strength of the whole structure, horizontal steel pulling cables are added to the wooden truss. The two tectonic expressions not only show distinguished tectonic characteristic, but also the difference of historical contexts which the material embodied (figure 4).

Figure 4. The main structure of Griffith Church
Source: photo author.

6. CONCLUSION

This study of brick masonry of Griffith Church shows a significant change of tectonic culture and technology in Chinese architecture that was traditionally of a wooden structure, due to the western influences since the mid-nineteenth century. While the various masonry methods were largely western in nature, the Chinese or the local ones were incorporated where appropriate. This showed a much needed adaptation to the specific Chinese circumstances in the church's construction. Thus while the western influences were crucial in its construction, the tectonic culture and technology of contemporary religious masonry architecture could not be fully understand without an examination of the Chinese architectural tradition and the social context.

As for the tectonic culture, this study mainly concerns about construction technology and spatial expression. As shown in Griffith Church, different masonry methods brought about different spatial qualities, and there was a subtle connection between the technological approach and cultural connotations. While this demonstrated the necessity of a more careful reading of the church, it highlights an interesting research perspective for contemporary Chinese architecture in general.

On the other hand, different tectonic logic of the same material or different construction materials would bring about varied visual quality and architectural experiences. The former was manifested in the effect of cross bond and that of Gothic masonry method, and also in the different width of the walls, door and window openings in different part of the church for functional or spiritual purposes. The latter could be exemplified by the combination of the brick-wood structure and the steel cable feature. As such, the case of Griffith Church could provide invaluable lessons in the exploration of construction potential and architectural treatment of the brick masonry.

ACKNOWLEDGEMENT

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INNOVATIVE TECHNOLOGIES FOR THE PROTECTION OF HISTORICAL STRUCTURES AGAINST EARTHQUAKES

FUAT ARAS

ABSTRACT

Cultural heritage buildings are special structures and must be protected from natural disasters preserving at the same time their authenticity. In the seismic areas, one of the building classes that is consistently exposed to seismic risk is the one constituting the architectural heritage of the region. To minimize further destruction under future seismic activity it is necessary to reinforce the existing structures that are more vulnerable. As a consequence, new technological systems are needed, able to provide solution not only to specific structural or architectural problems, but also aiming at improving the global performance of the construction. Similarly, great attention is paid not only to reliability and durability of intervention methods, but also to the possibility to be easily monitored and removed if required, according to the widely shared policy, aiming at the safeguard of existing buildings, in particular in case of historical and monumental works, from inappropriate restoration operations.

This study aims to represent innovative technologies and strategies to preserve the cultural heritage structures against earthquake effect. In particular, the application of fibre reinforced polymers and structural control systems are explained. Suitability of the strategies to architectural, historical and structural features and reversibility aspects are evaluated. As a case study the application of these strategies to a historical building in Istanbul is discussed.

Key words: historical structures, preservation, reversibility, innovative methods.

1. INTRODUCTION

With its permanent occupancy over 8000 years Anatolia is the cradle of civilization. Since Hittites, different tribes, resulting with the establishment of many countries and empires, have occupied the region. Roman, Byzantine, Seljuk and Ottoman empires are the most significant civilizations in the history that had brought Anatolia to its historical structure stock. There are many churches, bridges, school, mosques, cisterns, public baths, palaces and pavilions, defying the centuries with their magnificence. Istanbul, as the capital of Byzantine and Ottoman empires has an important and special place among the other cities in Turkey with respect to cultural heritage.

As well known, Turkey is greatly exposed to seismic hazard, which causes its large and valuable buildings to be strongly at risk of severe damage or even destruction due to earthquake. This problem mostly stands for historical and monumental constructions, due to the fact that most of them frequently lack basic anti-seismic features. In one of the latest seismic event, 1999 earthquakes, 36 historical monumental structures including Fatih mosque have been damaged in Istanbul. Only this situation is enough to underline the necessity of special care for the preservation of the cultural heritage structures (Aras 2013).

Heritage structures should be passed on to future generations in its authentic state and in all its variety as an essential part of the memory of the human race. Otherwise, part of man's awareness of his own continuity will be destroyed (Amsterdam Charter, 1975). For the protection of the historical structures the best available protection strategy must be aimed. For this reason the problem must be analysed well and the solution should be effective to provide desired safety with minimum intervention. In that respect the technological and innovative solutions should always be used, bearing the authenticity of the structure in mind. This study aims to represent innovative technologies and strategies to preserve the cultural heritage structures against earthquake effect. Recently two main applications for the preservation of the heritage structure are the strengthening and rehabilitation of dynamic properties of the systems. For the strengthening of the systems use of Fibre Reinforced Polymers became very popular strategy for the historical structures and Base Isolation technique is seen as an effective and applicable.

Great attention is paid not only to reliability and durability of intervention methods, but also to the possibility to be easily monitored and removed if required. Aiming to safeguard the existing historical structures from inappropriate restoration operations, the key parameter is named as reversible technologies. The use reversible technologies in the protection of the historical heritage buildings are also assessed briefly in this study.

2. EARTHQUAKES AND HISTORICAL BUILDINGS IN TURKEY

Over the course of history Anatolia has been the site of numerous destructive earthquakes. At least 70% of the region is under-risk of earthquake. Between 1902 and 2005, 128 earthquakes hit the region causing more than 80.000 deaths. The recent Van and Erciş earthquakes also confirm the destructive effects of the seismic activities in Turkey. Most of the historical documentation is related to damages suffered in Istanbul. The earthquake history of the city reveals that; it experiences with a medium earthquake (I0 = VII – VIII) in every 50 years and with a strong earthquake (I0 = VIII - IX) in every 300 years. Moreover recent extensive geophysical studies have clearly delineated the presence of a single major tectonic entity crossing the Marmara Sea. The probability of having an MW 7 + earthquake is in the vicinity of 70% in the next 30 years (Erdik et al 2004).

Historical structures in Turkey can be classified based on the construction material as masonry and timber structures. Masonry structures are brittle and heavy, and their substantial masses impose significant seismic loads on the walls. The typical damage in a masonry structure is in the form of a crack on load bearing structures. The depth the extent of the crack determines the severity, and failure is brittle. On the other hand, well-designed wooden structures, with timber frames and floor systems, have generally performed well in earthquakes because of the ductile nature of the wood. Failures are often due to insufficient foundation anchorage or unbraced cripple walls and soft stories. Figure 1 shows damaged masonry and timber structures under earthquake loads in Turkey.

Figure 1. Earthquake damage for masonry and timber structures (Prohitech 2004)

3. INNOVATIVE TECHNOLOGIES FOR CULTURAL HERITAGE

Any strategy, used for the rehabilitation of historical structures should have some superiority over a common one such as the efficiency of the strategy should clearly be set, the application must not disturb the cultural value of the structure and it should be reversible. Meeting these requirements needs to use the best available techniques, materials and strategies. As a result, technological developments introduce innovative products for the protection of historical buildings. An extensive literature survey has resulted with identification of different contemporary materials and method such as use of shape memory alloys, active and passive control techniques, use of fibre reinforced polymers, health monitoring techniques, use of damper braces or use of tuned mass dampers for the protection works. Apart from the others, this study aims to presents the technical details about the use of fibre reinforced polymers and base isolation techniques since they are applied to the historical buildings efficiently.

3.1. Fiber Reinforced Polymer Overlays (FRP)

Structural intervention with FRP overlays is one of the most widely used strategies to upgrade the performance of masonry structures. The application increases the strength and ductility of the masonry. They can be regarded as innovative because the FRP material is new in seismic retrofitting, because it's very good mechanical characteristics and because it offers a wide range of attractive technical solutions (Calado et al. 2006; Beg et al. 2006).

There are two basic approaches to FRP strengthening of the masonry walls. The first one is the application of FRP overlays on the surface of the wall (for normal masonry walls). The second one is the application of FRP overlays on both surfaces and connecting the overlays with metallic tie rods to induce larger confinement action. FRPs are composite materials constituted by two core materials, namely fibre material with high mechanic properties and matrix acting as a binder. The role of the fibre is to resist the external loads, while the matrix has both the function of guarantying the adhesion to the support and transfer the stress: the result is a lightweight material with high strength capacity (Beg et al. 2006). A wide range of mechanical properties can be covered by selecting different types of fibre and matrix (i.e.: Young modulus and strength capacity). Commonly, fibres used for the realization of composite materials are glass, carbon and aramid fibres (Figure 2).

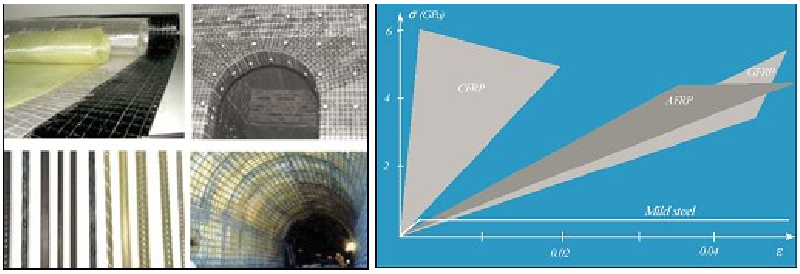

Figure 2. FRP applications and stress-strain relationships (Beg et al. 2006)

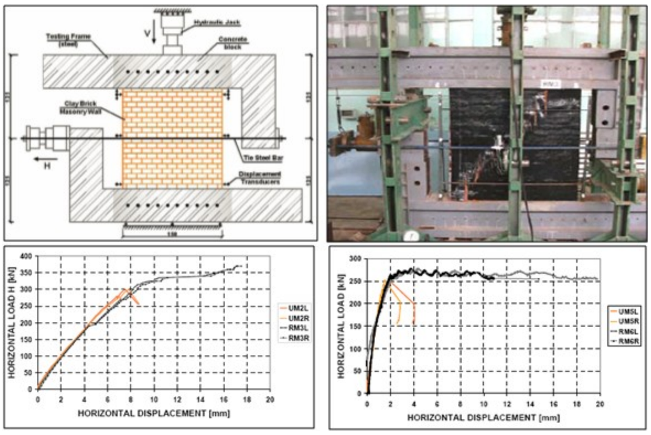

Figure 3. Experimental study of FRP strengthening (Stoian et al 2003).

In order to prove the useful effect of FRP applications many experimental studies have been carried. 1/6 scaled model of Mustafa Pasha Mosque has been tested on tri-dimensional shake table with its original and strengthened forms with FRP and the strengthened model by FRP has shown very good performance (Prohitech 2004). Figure 3 shows another experimental study to prove the application of vertical and horizontal FRP strengthening for Un-reinforced Masonry (UM) walls. Increase of strength and especially ductility is evident (Stoian et al 2003).

3.3. Base Isolation

For in-plane and out of plane loading masonry walls are very stiff and brittle. Typical inter-storey drifts at the initiation of cracking are in the range of few millimeters (2-3mm). Secondly small periods in the dynamic behaviour may cause the structure to be affected from ground motion severely. For this reason, base isolation technique is one of the most effective strategies to upgrade the performance since it restrict the relative displacements of the within the wall and lengthen the period.

Isolation devices can be classified as Elastomeric Devices, High Damping Rubber Bearings (HDRB), Lead Rubber Bearings (LRB), Added Damping Rubber Bearings (ADRB), Friction Pendulum System (FPS), Sliding Devices, Flat Slider Bearings, Curved Slider Bearings, Elasto-plastic Bearings and Wire-Rope Bearings (Figure 3).

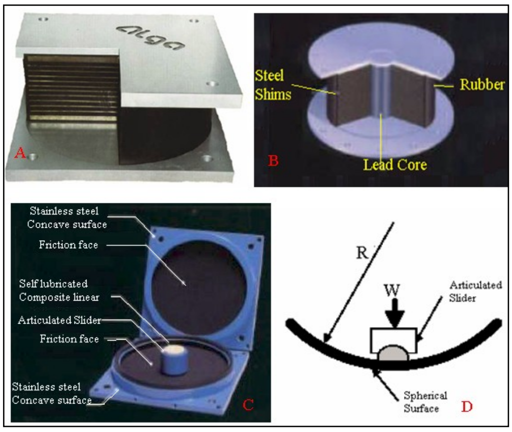

Figure 3. Base isolation devices (A : HDRB, B:LRB, C, D : FPS)

Basically, the effect of such devices is to shift the fundamental vibration period of the building upward, so as to reduce the value of the maximum spectral acceleration. For this reason seismic isolation is very appropriate for structures with short periods and low damping like masonry buildings. The devices themselves can dissipate a given amount of input energy, when these devices possess special dissipative features, or can be absorbed by additional damping devices.

The first historic structure seismically retrofitted with base isolation, the Salt Lake City and County Building, drew attention to the use of isolation for sensitive existing buildings. Later on, seismic isolation was applied to many vulnerable masonry buildings of historic significance, including the Ninth Circuit U.S. Court of Appeals building in San Francisco, Due to the possibility of efficiently improving the seismic capacity with minimal disruption to its architectural features, base isolation system has been recently suggested as an innovative retrofitting strategy (Aras and Altay 2014).

4. REVERSIBILITY

As a consequence, new technological systems are needed, able to provide solution not only to specific structural or architectural problems, but also aiming at improving the global performance of the construction. Similarly, great attention is paid not only to reliability and durability of intervention methods, but also to the possibility to be easily monitored and removed if required, according to the widely shared policy, aiming at the safeguard of existing buildings.

Reversible Technologies are based on the integration of structural members of different materials and/or construction methods into a single construction. The basic feature of them is that their application should be always completely recoverable, that is reversible, if required. This is considered as an essential design requirement in order to prevent historical and monumental buildings from unsuitable rehabilitation operations (Prohitech 2004).

5. CASE STUDY - BEYLERBEYI PALACE

As a case study earthquake performance and rehabilitation of Beylerbeyi Palace is briefly discussed in this study. Detailed information can also be found in the recompleted journal papers (Aras et al 2011; Aras and Altay, 2014).

5.1. Architectural and structural system of Beylerbeyi Palace

Beylerbeyi Palace is the largest and most elegant Ottoman palace in Asia. Great importance was given to this palace and its decorations. Figure 4 illustrates the palace with exterior appearance and interior spaces.

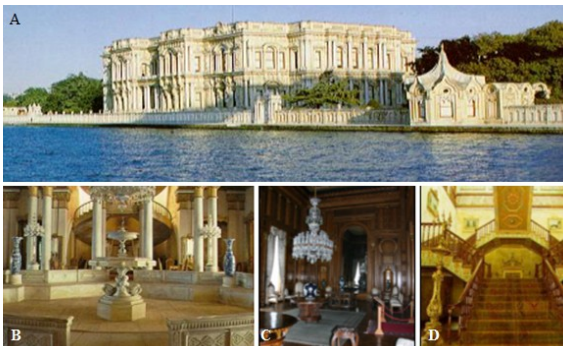

Figure 4. Beylerbeyi Palace (A: Exterior appearance, B, C, D: Interior spaces)

The palace consists of two main floors and a basement containing kitchens and storage rooms. In the basement floor storey heights vary between 1.5 and 2.2 m whereas in regular floors, they vary between 6 – 9 m. The building has a 72 m length along the shore and 48 m in the perpendicular direction. The total height of the structure, excluding the timber roof, can be approximated to 20.60 m. The load bearing system is mainly made of masonry walls and timber slabs. The basement floor of the palace enables to identify the masonry, which is composed of lime mortar, brick and stones. These walls are also forming the foundation system of the palace. The thickness of the walls in the basement floor is generally 1.4 meters whereas it is 80 cm in the first floor and 60 cm in the second floor of the palace. Timber slab systems constituted by oak and fir have been used. Figure 5 shows the structural masonry walls and timber slab system in the foundation of the palace.

Figure 5. Masonry walls and timber slab system in Beylerbeyi Palace

Beylerbeyi palace is used as a museum now. A damage survey, carried out in the palace has shown that, the palace is presenting the sign of earthquake-oriented damages. For this reason, the palace is investigated within the PROHITECH project.

5.2. Analyses of the Palace

Dynamic properties of Beylerbeyi Palace are identified with ambient vibration survey (AVS) and the results are used to calibrate the finite element model of the palace constructed in SAP2000-V10. Presented in another publication (Aras et al. 2011) in detail, the tuning process has resulted in three different moduli of elasticity for brick masonry in the palace (Figure 6). To determine the earthquake hazard level for Beylerbeyi Palace, the hazard maps obtained by Erdik et al. (2004) have been used. Maximum Considered Earthquake (MCE), which has 2% probability of exceedence in 50 years and approximately 2500 years of return period, has been used to check the safety of the palace. The constructed response spectrums for 2%, 5%, 10% and 20% damping ratios are illustrated in Figure 7. AVS has indicated the damping ratios are between 1 % and 2.7 % for the first eight modes of the structure.

Response spectrum analyses have been performed for both transversal and longitudinal directions. The safeties of the masonry walls, which are the main structural elements, were concerned. Figure 8 shows the horizontal stresses (S11), vertical stresses (S22) and shears stresses (S12) under Maximum Considered Earthquake for 2% damped structure. The high stress concentration regions (in yellow and green colours) are clearly seen. For horizontal stresses the upper portion of the structure is under risk. These stresses reach to 7 MPa. Obviously these S11 stress stem from the out of plane movement of the walls. The magnitudes of the vertical stresses are less than those of horizontal stresses and high stress concentrations are gathered on the lower levels as expected. Additionally wall segments between two openings are under high stress. S22 stresses are beyond 3.5 MPa. The magnitudes of shear stresses are less than that of vertical stresses.

Generally its maximum value is about 1.5 MPa and on the corners of the opening shear stress concentration is observed.

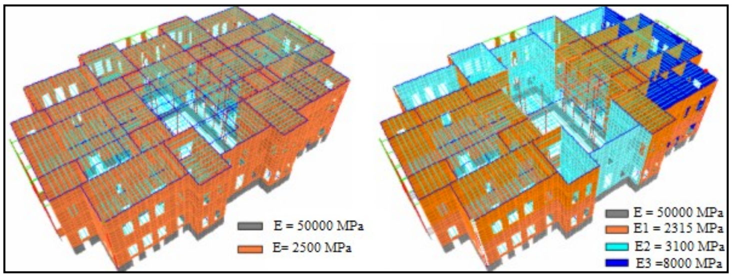

Figure 6. Numerical model of Beylerbeyi Palace before and after the modal tuning

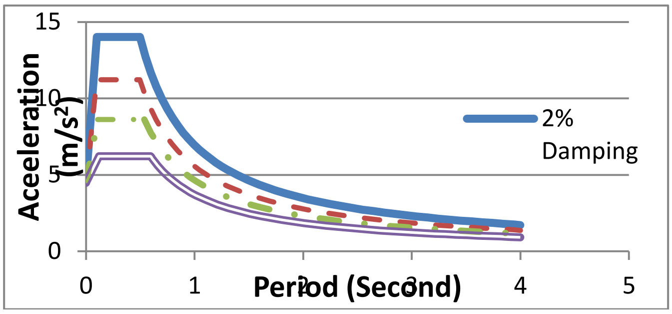

Figure 7. Response spectrum of MCE for different damping ratios

The experiments over the wall and mortar specimens made in the laboratory have given the strength properties for the masonry walls in the palace as 10 MPa for compressive strength and 0.85 MPa for tensile strength. As the result of out of plane action of the walls, S11 stresses are well beyond the tension strength of the masonry. Secondly the compression stresses (S22) are less than the compressive strength of the masonry. Finally the shear stresses on the masonry walls exceed the tensile strength of the material however the shear strength of the masonry depends on the compression stress on the masonry as stated in Equation 1, where τ_{safety} is the expected lateral shear strength, τ_0 is the masonry cracking shear obtained experimentally, μ is the friction coefficient and σ is the vertical stress on the masonry wall in the system. τ_0 and μ values can be accepted as tensile strength and 0.5 respectively. Evaluation of the stress values showed that, most of the walls in the palace are safe under S12, shear stress but there are many masonry wall segments on which the shear stress exceeds the shear strength of the wall.

$$\tau_{safety} = \tau_0 + \mu\, \sigma \qquad (1)$$

The result of the safety evaluation has shown that, Beylerbeyi Palace is safe under vertical stresses. On the other hand horizontal and shear stresses exceed the strength parameters of the material. It can be concluded that, the structure is not capable to resist the earthquake ground motion, according to MCE.

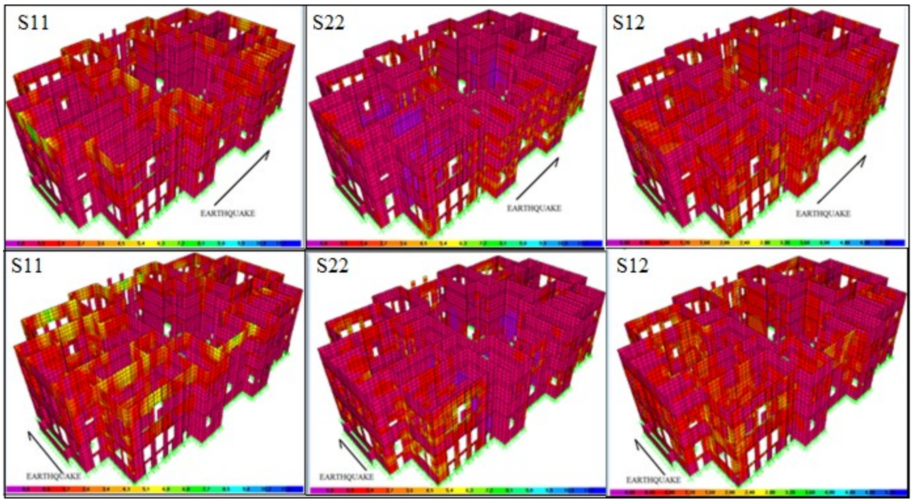

Figure 8. S11, S22 and S12 stresses under RSA of MCE for 2% damping

5.3. Strengthening of Beylerbeyi Palace with FRP

The FRP application for Beylerbeyi Palace is based on the computed horizontal and vertical tension stresses by Response Spectrum Analysis (RSA). The critical locations of the horizontal and vertical stresses were determined as the regions on which the stresses exceed the tensile strength of the masonry. (Figure 9).

For the strengthening fabrics type of FRP is appropriate because of their simple application. Main fibres of FRP fabrics should be horizontal. Horizontal fibres are effective to carry out of plane stresses on the top part of the structure. The wall between two windows can be treated as a column and it can be fully confined by FRP fabrics. These increase the vertical load capacity and ductility of the wall. MCE requires that, almost every wall should be covered by FRP. In that respect each wall in the first and second storey of the palace should be covered by FRP along with horizontal direction. Here the FRP is applied to the walls from one face. One face application is important with respect to historical and aesthetics appearance aspects of the palace.

The reversibility of composite materials is a very important aspect. These types of materials, in some cases, reach the “complete reversibility”. Composite materials using different bare materials and construction technologies can reach three different degree of reversibility (e.g. small, medium and large). The aspect that must be controlled for having a good degree of reversibility is the type of resin used (Beg et al. 2006).

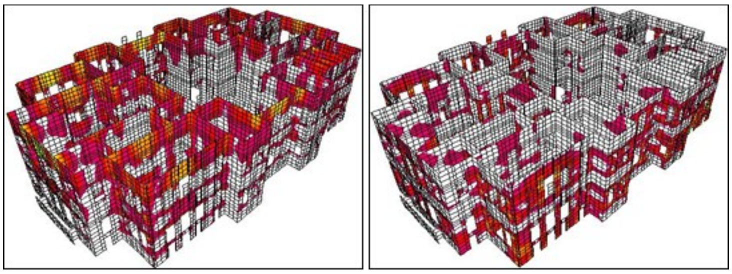

Figure 9. Critical regions of stress according to MCE

In case Beylerbeyi Palace, it was noted that the walls are covered from one face. This requirement is very important with respect to aesthetic appearance. For the external walls, FRP can be applied between küfeki stone façade and masonry walls. In that condition all application would be hidden. For the internal walls the stucco plaster is in main concern and application side of the wall depends on this covering. For the timber-covered room FRP can be applied underneath the timber surface. Finally for normal plastered walls there is no problem since plaster can be applied over the FRP application.

5.4. Rehabilitation of Beylerbeyi palace with base isolation

Dynamic modes of Beylerbeyi Palace showed that; the first 44 modal frequencies of 60 modes are on the flat plateau of the response spectrum. For this reason shifting the fundamental periods is going to result in significant reduction in spectral acceleration. Secondly the small damping ratio of the existing palace is another source deficiency. In these respects, High Damping Rubber Bearing (HDRB) is preferred to isolate the structure.

The isolation devices are planned to be inserted in basement walls of the palace since the basement walls are also suitable to insert the isolators with respect to safety and historical texture concerns. The isolator should be distributed to the plan of the structure in a way that it does not disturb the load flow and cause torsional behaviour. The selected distribution of the devices is shown in Figure 13-A. Total number of bearing is determined as 123. Isolator design for the palace has been done according to the procedure defined in Yang et al. (2002) and FEMA 302 (1997). Details of the procedure have been presented in another study (Aras and Altay, 2014) and designed HDRB device is illustrated in Figure 13-B. The diameter of the circular elastomeric portion of the device was determined as 90 cm and 13 rubber layers of 12 mm thickness were used. The steel plate thickness was determined as 2 mm. Finally, two rectangular steel plates (1 m * 1 m) with a thickness of 3.5 cm have been used on the top and bottom-side of the isolator. Figure 13-C shows the insertion of the devices to the structure.

Response Spectrum Analysis (RSA) has investigated the efficiency of the base isolation. The numerical model was revised to contain the determined device properties. The response spectrum, used for the isolated model, has also been revised according to effective damping of isolator (Figure 7). The application of isolation has altered the overall behaviour of the structure significantly. Mode shapes of the structure turned to simple rigid body motions with a period of 2 second. Figure 11 shows the S11stress values, which was the maximum stresses, for the isolated Beylerbeyi Palace under MCE for two orthogonal directions. The stress values have been reduced significantly under maximum considered earthquake.

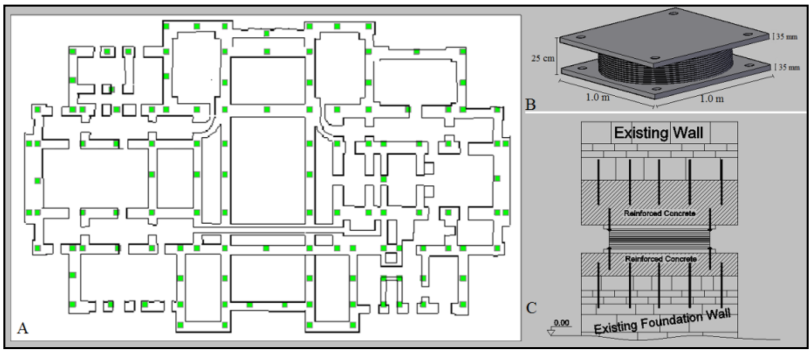

Figure 13. Details of HDRB application in Beylerbeyi Palace

The proposed base isolation strategy, at the level of foundation, is an irreversible intervention. Reversibility means the ability to undo the change without harming the original structure. Although base isolation intervention is irreversible, it does not touch the historic fabric of the palace and other historical resources.

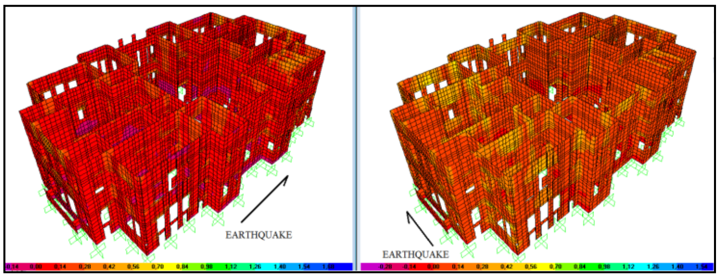

Figure 11. S11 stresses under MCE for isolated Beylerbeyi Palace with HDRB

The proposed intervention is limited to the foundation level of the building. The facade and the interior characteristics, including frescoes, paintings and other architectural elements are fully preserved. Application of base isolation system also requires the separation of the palace by a 25 cm gap from its surrounding to ensure the serviceability after expected earthquakes. Moreover all lifelines, ducts and the other required links must be connected to the palace via flexible connections.

6. CONCLUSION

Importance of the historical structures and preservation of them from earthquake ground shaking is outlined in this study. For the preservation the use innovative strategies, namely use of fibre reinforced polymers and base isolation techniques investigated in detail. Moreover the reversibility concept and its key role in the preservation are explained.

As a case study, one of the most important structures in Istanbul, Beylerbeyi Palace has been investigated. The earthquake performance of the palace is found inadequate. Strengthening of the palace with FRP and rehabilitation of the dynamic properties by the application of base isolation techniques has been investigated. It is shown that the earthquake safety of the palace can be ensured by the strategies without damaging the palace's historical authenticity.

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CONTEMPORARY TIMBER WINDOW SOLUTIONS IN TRADITIONAL TURKISH HOUSES

FATİH YAZICIOĞLU

ABSTRACT

Traditional Turkish houses are known with their unique architectural character within a wide perspective, comprising different detail solutions. The character of these houses is mainly shaped by the place and context they are located. Geographical conditions, such as climate, sun, and wind, together with the cultural factors dominate the planning of these houses in different scales. Organization of the facade and especially the windows and doors, are some of the important attributes of these houses. Within this framework, this paper aims to question and analyse timber window solutions of traditional Turkish houses. Because of the different configurations of traditional Turkish Houses this paper is limited with the houses located in Istanbul, Bosporus. Firstly, traditional wooden houses, called 'köşk', of Bosporus will be introduced. The visual relation of the house with the outer world and mahalle, starts from the road they are located in with their entrance door and continues through their inner hall 'sofa'; and continues back to the road with the views from the windows. This introduction shows the importance and dominance of the windows in traditional Bosporus houses. The timber window solutions of these houses allow the visual relation with their wide openings which bring several challenges about the details of the windows. The weight of the sashes is an example for these challenges. Without a mechanical support operating the sashes are a hard and tiring activity, hence sometimes counterbalance systems were used in the original details. Today in the restoration and reconstructions by using contemporary technological solutions these kinds of side effects can be surpassed. In the paper, a traditional house reconstruction in Bosporus is introduced by focusing its timber window solutions. In this project, the form and size of the windows are the same as the original traditional house so that the visual relation of the house with its surrounding, and the overall original character of the building continues. By the implication of contemporary detail solutions for its timber window, like the usage of hydraulic pumps, double glazing, aluminium roller shutters, etc. its performance is improved significantly. The performance of the window system is evaluated and tentative proposals for the reconstructions, and restorations will be made.

Key words: windows; u-values; emissions; counter-balance systems, Traditional Turkish houses

1. INTRODUCTION

The design of one building element critically affects the function of the entire building. External walls, which are parts of the envelope systems, are mainly designed to be a barrier between the natural outdoor and the artificial indoor, and they may perform a structural role (Binan, 1975). On the other hand, external walls are far more inclined to be pierced with holes, better known as windows and doors (Harris, 2001). Windows are the most critical parts of the envelope as several different performance requirements are expected from them. They are both expected to stay as an opening but on the other hand to stop unwanted conditions of the natural environment (Pearce, 2007). The resulting output is a complex building element with several components.

Bosporus has its unique architecture with unique window details. After 1983 it has been protected by a special law through which new building constructions are forbidden (TBMM, 1984). It is only possible to make restoration or reconstruction of old buildings. The details used in the reconstructions of the Bosporus region is a challenging field to study as the typical requirements of windows are also expected from them, with the same appearance of their original design.
In this study, the details of the window system of a reconstructed original Bosporus mansion is examined. 4 main implementations have been realized in the reconstruction of the window system to better its performance. The examinations are focused on those 4 main implementations. A performance assessment has been realized to find out the usefulness of the implementations. The assessment is mainly based on a self-reflection. At the end tentative proposals have been made to guide the architects about the reconstruction of the window systems.

2. METHOD

The method adopted to this research consist of 3 parts. The first part is the detailed documentation of the detail design of the case building's window. The second part is the analysis of the window, determination of the important implementations to the original detail and the explanation of those implementations.
In this second part 4 important implementations have been determined and explained:

1. The chemically treated and laminated wooden parts,
2. The double glazing,
3. The operation components, locking system and counter balance system,
4. The aluminium roller shutters.

In the final part a self-reflective performance assessment of the implementation have been realized. 6 different performances were assessed in this part:

1. The structural performance,
2. The thermal performance,
3. The acoustic performance,
4. The water & moisture related performance,

5. The durability performance,
6. The sustainability performance.

At the end tentative proposals for the detail design of the window system of reconstructions have been made considering the assessment of the performances.

3. THE CASE

In 1980s, the case mansion was partly damaged because of the lack of maintenance and in 1992 it was damaged entirely because of a fire. The necessary architectural drawings for restoration were then prepared, and by the year 2004, the necessary permissions were granted. In 2005, the reconstruction works was started and completed at the end of 2008. The external wall core was built of vertical perforated bricks. Gypsum plastering was applied internally and a wooden siding externally. The entire facade was constructed similar as the original façade visually, in terms of the type of the main material, which is wood. The structural system of the roof was also changed into steel in order the attic to be used. Clay roof tiles were applied as the roof covering. But, the new roof system was detailed to have a thermal insulation and waterproofing membrane.

The window system of the house is constructed mostly with the original wooden window details. Double glazed glass, new lock systems, new counter balance systems and new vertical aluminium roller shutter systems were preferred for windows, as the primary differences from the original details (Fig. 1).

Fig. 1. (a) General view of the Case a house; (b) View of the window system with the aluminium roller shutters are half closed from outside, Case a; (c) View of the window system from inside, Case a; (d) view of the aluminium roller shutter box with the lid of it open, Case a.

In Figure 2, the reconstructed window elevation (a) and the window section detail drawings (b) are given. In the section, different parts of the window system, including the window sill, frame & sash, glazing, and roller shutters are marked with a1 – a11, in order to be separately taken into consideration in the calculations. The list of the components of the window system which comprise each part are: a1. Wooden frame; a2. PU filled aluminium shutters, air cavity, and head of the wooden sash; a3. PU filled aluminium shutters, air cavity, double glazing; a4. PU filled aluminium shutters, air cavity, and overlapping transoms; a5. PU filled aluminium shutters, air cavity, and double glazing; a6. PU filled aluminium shutters, air cavity, and head of the wooden sash; a7. Wooden siding, PU filled aluminium shutters, and head of the sash; a8. Wooden siding, PU filled aluminium shutters, air cavity, and wooden head of the sash; a9. Wooden siding, air cavity, rock wool, cements plaster, R.C. lintel, and gypsum plaster; a10. Wooden siding, air cavity, rock wool, cements plaster, aerated concrete, and gypsum plaster; a11. Wooden siding, rock wool thermal insulation, cements plaster, aerated concrete, and gypsum plaster

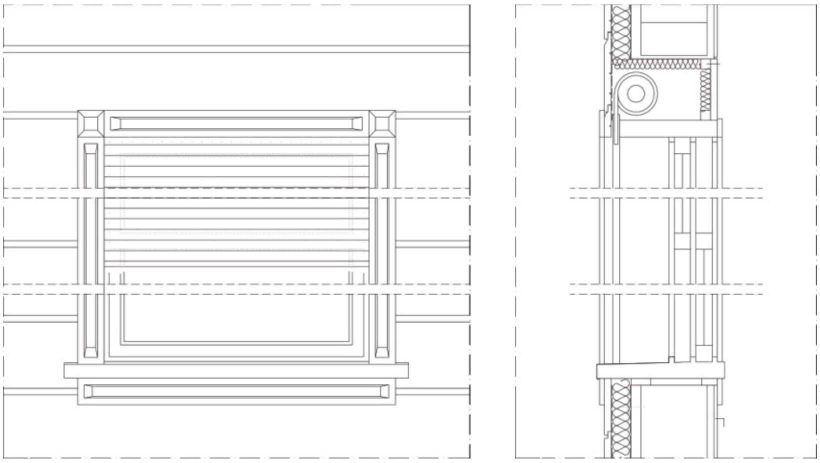

Fig. 2. (a) elevation of the window, (b) section of the window

3.1. Wooden Component

The wooden parts of the window can be analysed in 3 parts, jamb, rail & stile, and roller shutter box.
The first part is the jamb of the window. The total depth of the jamb is 30cm with a thickness of 5cm. Thus this part is formed by laminated wood to minimise the deterioration of the jamb in time. The parts of the laminated wood are placed to make the annual rings perpendicular and is glued to each other with a polyurethane timber glue. The vertical and horizontal components of the frame is attached to each other by timber glue with screws. The external wooden sills of the window is covered by copper to increase the durability of the window against wet conditions of the atmosphere.
The second part is the rail & stile of the window. These are made from wood of 5x5cm. These are single piece of wood and they are both glued and screwed to each other.
The third part is the roller shutter box. To place a roller shutter will improve the thermal performance of the window system but the volume left for it to be rolled up is a critical part decreasing the thermal performance. In order to improve the performance of this part a solid wall is placed at the back of the volume, and the external face of it is covered by an insulation. Hence the total depth of this part is 15cm with a thickness of 5cm.

3.2. Glazing

In the first sample window manufactured a standard double glazing is used, which consist of 6mm of glazing, 12mm of air space and 6mm of glazing. But the total weight of a sash has become about 19kg which is much for a standard counter balance system. So it is decided to use a specially manufactured double glazing with 4mm of glazing, 6mm of air space, and 4mm of glazing. Although this will decrease the thermal performance of the glazing of the window the performance related with the ease of usage is accepted to be more critical. The double glazing is dimensioned with the exact same size of the sash, this is rare in window designs and only in wooden windows it is possible to do so. In other materials the difference between the expansion capabilities of the materials usually deteriorates the glazing. This detail make the integrated working of sash and glazing better and removes the need of a nail to hold the glazing in its place. Once the glazing is placed, a glazing lath is nailed to the rails & stiles, and silicone is applied in between.

3.3. Operating Components

There are 2 main operating components in the window systems; the lock mechanisms, and the counter balance system.

The locking mechanism used in the window systems are specially produced to be fit in the windows. They are working by tying the upper rail of the lower sash to the lower rail of the upper sash. A pin attached to a spring is the component which ties them. The resulting tying is strong and durable as the pin enters inside the upper sash about 1cm.

The counter balance system used in the windows are also specially manufactured as they should be critically designed to carry the exact same weight of each sash. The working principle of the counter balance is simple but inspiring. A plastic tube of about 1cm of diameter is hosting a spring. The spring is the critical component which should be precisely manufactured to carry the load of the sashes. Though the spring is adjustable it is limited to 0.5 kg. At the end point of the tube 2 small plates is connected perpendicular to the spring. When these plates are screwed to the sashes they start to tension the spring when the sash is open and loose the spring when the sash is closed. The tube is placed in a space inside the jamb, next to the sash. Both the upper and lower sashes of the window is operable so 4 counter balances are used in each window.

3.4. Solar Control Component

Aluminium roller shutters are used in the window system. The casing used to store the shutters when rolled up has been explained in section 2.1. The shutter is made of aluminium and the lamellas of the shutter is filled by polyurethane thermal insulation material which results a considerably improvement in the thermal performance of the window system. A previous study has shown that the total U-value of the window system is about 0.30W/m2K which is about 10 times better than the U value of the wooden windows of 3.00W/m2K (TSE, 2008), (Yazicioglu, 2013). In order to make the air space between the shutter and the sashes contribute to the thermal performance it should be a closed space and the related standard only accepts an open space of about 0.4mm. In order to achieve this a brush is added on the intersection point of the shutter and the frame (ISO, 2012). It is for sure that the shutters won't be kept close all along but it will make significant contributions. The rails the aluminium shutters are moving in are also made of aluminium and they are placed inside the jamb near to the front. The shutters are operated with a tubular electric motor which is activated from the buttons placed next to the inner face of the jamb.

4. PERFORMANCE ASSESSMENT

The reconstruction of a historic building is always a difficult and problematic activity. The reason of this is the intention to keep the buildings appearance and character the same as the original building, but at the same time improving almost all performances of the building and its elements. This makes the detail design activity even more complicated because the original details limits the usage of most detail patterns available and the architect should find a new way for almost all simple detail parts. The windows are the most critical parts of these reconstructions as they are both giving the main character of the building and they are most critical part of the building in terms of performances. In this section of the paper the performance of the parts of the window system is going to be evaluated. In each sub-section firstly the main performances expected from that component is going to be listed according to their priority, and then each component is evaluated according to each performance. Charts has been generating showing the success of the component according to each performance. If a component is very successful it is going to get a "+", if it is moderate it is going to get a "0", and if it is not successful it is going to get a "-".

4.1. Performance Assessment of the Wooden Components of the Window

The main performance requirements expected from the wooden components of the window are; structure, thermal, water & moisture, acoustics, durability, and sustainability. Firstly the structural performance; loads coming onto the window, both static and dynamic loads are transferred to the wall by the help of the wooden components of the window. The wooden component of the window are very successful against static loads. But it is not as strong as the static loads against the dynamic loads. Depending on the amplitude of the wind the sashes may sometimes make cracking noises. The reason of this is the absence of a rubber joint sealant but in these kinds of sliding windows it is not possible to place a sealant as a space should be left between the sash and the jamb to make sliding possible. There is only a felt between them but under strong wind conditions that becomes insufficient. Secondly, the thermal performance of the window is very successful both about the low heat transfer, and the sense of surface heat. That is a natural benefit coming from the wood material. Thirdly, acoustic performance of the window is moderate. Especially because the rails and stiles of the window is considerably small in size they do not perform well about airborne sounds, and the sashes may not be closed tightly the acoustic performance is not well. The impact sound performance of the wooden components are also insufficient as under the effect of roaring engines of the trucks passing nearby the wooden components vibrates as well. Fourthly, the water & moisture related performance of the wooden component is sufficient. Especially the copper flashing used on top of the external sill has great contributions to the performance. Another important factor improving the performance is the appropriate usage of the overlaps between the sashes and the jamb of the window. Fifthly, the durability performance of the wooden components is sufficient. The unpressurized impregnation against biologicals performs well and a defect has not been observed. The paint has stayed very well and cracks/peelings of the paint haven't been observed which results the mechanical movement performance of the wooden components to be sufficient. Finally, the sustainability performance of the wooden components are moderate. Although wood material is very sustainable excessive amount of paint should be used which decrease the production CO2 footprint of the window. Wood has a low heat transfer capacity which make it a sustainable material, but as the rails and stiles are small in size this positive speciality of the wood has a limited effect on minimising the usage CO2 footprint of the window. Recycling performance the wooden component is insufficient as all of the components are connected to each other permanently.

4.2. Performance Assessment of the Glazing of the Window

The main performance requirements expected from the glazing of the window are; structure, thermal, water & moisture, acoustics, durability, and sustainability. Firstly, the structural performance of the glazing is sufficient. As there is not any space between the glazing and the sash the loads coming onto the glazing is directly and successfully transferred to the sash. Secondly, thermal performance of the glazing is moderate. In order to minimise the weight of the glazing a double glazing of 4mm of glazing, 6mm of airspace, and 4mm of glazing is used which is thinner than the appropriate dimension of 6mm of glazing, 9mm of air space and 6mm of glazing. The sense of surface heat is insufficient as glass transfer heat easily in other words heat transfer coefficient of glass is high. Thirdly, acoustical performance of the glazing is moderate. The acoustical performance of the glazing is related with the number of the sheets of glazing used and the thicknesses of them. The glazing of this window consist of 2 layers of glass with a total of 8mm which is insufficient for a sufficient acoustic performance. Fourthly, the water & moisture related performance of the glazing is sufficient. The connection of the glazing and the sash is covered by a glazing bar and the bar is adhered to the glazing with silicone which don't let any water penetrate inside. The double glazing used in the window is sufficient to stop the occurrence of moisture. Fifthly, durability performance of the glazing is sufficient, deformation hasn't been observed on the glazing. Sustainability performance of the glazing is moderate. Glass is a material which needs high energy to be manufactured or recycled. Hence production CO2 footprint performance is insufficient and recycling performance of the glazing is moderate. The in use CO2 footprint of the glazing is moderate as the thermal performance of it is moderate.

4.3. Performance Assessment of the Operation Components of the Window

There are 2 operation related components in the window system, locking mechanism and the counter balance system. The locking mechanism is placed in the internal side of the window and the counter balance system is buried inside the jamb which makes them irrelevant with thermal, acoustic, and water & moisture related performances. The main performance requirements expected from the operation components of the window are; structure, durability, and sustainability related. The performance assessment of the locking mechanism is going to be made firstly. The structural performance of the lock system is sufficient. It doesn’t let sashes to be opened when closed. The durability performance of it is moderate because there the lock is working by the help of a spring inside the lock system. That spring sometimes loosens which results a malfunction. The sustainability performance of it is also moderate as it is made of aluminium and although aluminium is a recyclable material it needs high energy to recycle. The performance assessment of the counter balance system is going to be made secondly. The structural performance of the counter balance system is sufficient. The counter balances holds the sashes in the desired height without a failure. They also make the operation of the sashes easy and smooth. The durability performance of them is also sufficient as a failure or malfunction hasn’t been observed. Finally the sustainability performance of the counter balances is moderate as it is made of plastics and steel which are both recyclable but need lots of energy to be produced and recycled.

4.4 Performance Assessment of the Roller Shutters of the Window

The main performance requirements expected from the roller shutters of the window are; structure, thermal, water & moisture, acoustics, durability, and sustainability. Firstly; the structural performance of the roller shutters are sufficient. The roller shutters may operate easily. The only moderate thing about them is under the effect of strong winds some cracking noises may come from the shutters which decrease its structural performance a little bit. Secondly; the thermal performance of the shutter are sufficient. It gives great contribution to the thermal performance for the window system with the help of the PU filling inside the lamellas. They also act as a shading device in summer conditions and minimising the heat gains from sun light. Thirdly, the acoustic performance of the shutters are moderate. As they do not have a large mass their contribution to acoustic performance of the window is limited. Fourthly, water related performance of the shutters is moderate. The shutters mainly blocks the penetration of water on the internal side of the shutter. But on the internal joints of the lamellas moisture may sometimes be observed. Fifthly the durability performance of the shutters are sufficient. Malfunctions related with the movement of the shutter were not observed. Lastly sustainability performance of the shutters are moderate. The shutters are made of aluminium with PU filling inside both of which have very large CO2 footprints because of the energy needed to produce the materials. But they have significant contributions to the thermal performance of the window system which minimise the in use CO2 footprint of the system. On the other hand recycling the lamellas are also not convenient as separating the PU and aluminium is not easy (Yazicioglu, 2013).

5. CONCLUSION

In 2005 a traditional Bosporus mansion has been reconstructed. The character, the overall appearance, and the main material of the window has been kept same as the original window but some modifications have also been made to improve the performance of the window system. The main modifications realized are the usage of treated wood, double glazing, new counter balance & lock, and the implementation of an aluminium roller shutter. The new window system has been observed for 4 years, the maintenances realized has been observed and interviews were realized with the users of the windows. The data obtained has been analysed and a critical performance assessment has been made about the new implementations. Table 1 demonstrates different performances of the implementations. 6 different performances have been taken into account for the assessment, these are; structural, thermal, acoustics, water & moisture related, durability, and sustainability. If the implementation is sufficient about the performance than a "+", if it is moderate about the performance than a "0" has been marked, and if it is insufficient about the performance than a "-" has been marked to the designated space in the table.

Table 1. Performance assessment of the implementations of the window.

		wooden component	glazing	operation components	aluminium roller shutter
Performance related with structure	static loads	+	+	+	+
	dynamic loads (wind)	0	+	+	0
Performance related with thermal issues	low heat transfer	+	0	/	+
	sense of high surface heat	+	-	/	/
	shading	/	/	/	+
Performance related with acoustics	impact sound	0	0	/	0
	air born sound	0	0	/	0
Perf. rel. w. water & moisture resistance	water resistance	+	+	/	0
	moisture resistance	+	+	/	0
Performance related with durability	resistance to biologicals	+	/	/	/
	res. to mechanical movements	0	+	+	+
Performance related with sustainability	CO2 footprint of production	0	-	0	-
	CO2 footprint of usage	0	0	/	+
	recycling	-	0	0	-

The structural performance of the implementations of the window is mainly sufficient. Only the usage of wooden component and aluminium shutter is moderately satisfying the performance. In order to slide the sashes vertically a space

should be left between the sash and the jamb which results a decrease about the dynamic loads. The same kind of a situation also exists in roller shutters, as they consist of small and light lamellas they perform slightly insufficient under the effect of dynamic loads. The thermal performance of the implementations of the window is mainly sufficient. Only the glazing used has a moderate thermal performance. The reason is the need of lightening and minimising the window and in order to lighten it thin layers of glazing is used and in order to minimise a thin layer of air space is used. The acoustic performance of the implementations of the window is mainly moderate. The joints between the sashes and the lamb and the minimal design of the window are the main reasons of this. Water & moisture related performance of the window is mainly sufficient. Only when the roller shutters are closed rainwater or moisture may pass between the lamellas of the shutter, but as the passing rain water or moisture is still in the external environment this is not a critical performance failure. Durability related performance of the window is sufficient. Although there are several working pieces in the window a critical failure has not been found. And finally sustainability performance is moderate. Treating wooden component with chemicals, painting them, usage of aluminium with PU fillings are the main factors decreasing the sustainability performance.
Although further quantitative studies should be made, with this qualitative assessment the overall performance of the window system is found to be sufficient. There isn’t any major performance failures in the window system. The most important performance requirement, which is the appearance or appropriateness to the original character, has also been satisfied sufficiently. Hence the details implemented for this window may be used for other reconstructions’ windows.

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POSTER SESSION

A WAY TO CONSERVE CULTURAL HERITAGE IN ARCHITECTURE CREATION

RAHMANI KELKOUL LEILA[1]

ABSTRACT

Using definitions of the type and model and through some architectural works this presentation proposes an approach and a way to preserve the architectural heritage through the architectural creation not by reproducing and copying but considering it as a referential reservoir of ideas and architectural principles.

Key words: architectural heritage - architectural creation- model- type- reference.

INTRODUCTION

The architectural heritage question is often inquired in terms of physical and technical conservation then all the reflections are oriented towards this direction. We can also approach this issue from a different point of view; wich is the role of this heritage in the architectural creation. What is that role? And how architectural design can tap into that legacy without being in a movement such as mimicry, kitsch, culturalism or post modernism? Are there any examples of architectural creation that can support this speech? This topic will try to answer these questions by taking the architectural legacy as a reference model to the architectural design which transforms it into a new type. Using definitions of the architectural type and model as presented by Quatremaire de Quincy and having for example a few architectural works as the Pyramid's Louvre of Pei, the Defence Arch of Johann Otto Von Spreckelsen, and the Arabic World Institute of Jean Nouvel.

The architecture constitutes the living witness of what every society has built, it thus reflects its way of living and being throughout the different periods of history. It is therefore a considerable legacy and has a value that ranges it in what we can call ‘'heritage'. To ensure the transmission and continuity of this heritage, disciplines are appeared to recognize, preserve and safeguard it. Recognition is done by the archeology, the history of architecture and the history of the arts. The backup is done mainly by the restoration which experienced a boom and considerable development since the need was felt. So to evoke patrimony and cultural heritage guide implicitly and explicitly to the evocation of its backup and thus the use of conservation and restoration. However the recognition of the architectural value of

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any object and the transmission of its legacy can also be done in a different way. A dynamic way where it is highlighted through the present and the future and where it plays a key role through the architectural creation and where the creation by referring to this architectural heritage, demonstrates creativity and innovation while remaining within the contemporary. How to get to take this challenge? Are there examples of authors who held it? Refer to architectural heritage, requires first and foremost a good knowledge of this heritage and its history. Thanks to architectural archaeology, history of architecture could be built and was able to offer us a concrete body of reference models. However knowledge of these models and their use as reference does not mean copy them and imitate them as what. But and this is the entire role innovative creative architectural, is using these models to invent and build new types that are part of the present and the future. And this is all the distinction between the model and the type in architecture, established for centuries since the writings of Quatremaire de Quincy until our days. Indeed Quatremaire d. Q defines the model and type as follows: “The model, heard in the practical execution of the art, is an object that must be repeated as it is; the type is on the contrary, an object from what everyone can design structures that look not like them. Everything is accurate and given in the model; everything is more or less vague in the type.” («Le modèle, entendu dans l’exécution pratique de l’art, est un objet qu’on doit répéter tel qu’il est ; le type est au contraire, un objet d’après le quel chacun peut concevoir des ouvrages qui ne se ressembleraient pas entre eux. Tout est précis et donné dans le modèle ; tout est plus ou moins vague dans le type»).He also said "the Word type presents less the image of a thing to copy or imitate completely, that the idea of an element that must it self be used as a rule to the model" (« le mot type présente moins l’image d’une chose à copier ou à imiter complètement, que l’idée d’un élément qui doit lui-même servir de règle au modèle ») (Quatremaire D. Q 1832). Later, references to these definitions have been included and well developed with C Aimonino and the typo-morphological approach, Wittkower, Brinkmann , Schmarsow and much later by Portoghesi, C.Norberg Shulz...with the idea of establishing the elements of scientific analysis of architecture different from the aesthetic approach (Panerai P., et Al 1980). The dictionary definitions are not far from these definitions they are given as follows «model: which serves as the object of imitation...» and for" type: model abstract in a high degree the essential traits of all objects of the same nature” («Modèle : ce qui sert d’objet d’imitation… », « type: modèle abstrait réunissant à un haut degré les traits essentiels de tous les êtres ou de tous les objets de même nature ») (Larousse 2000). This distinction is fundamental and it is allows the architectural creation to be always in contemporary by creating new types from existing models, without however lapsing into culturalism (largely explained by Françoise Choay and others as watershed in the tradition) or trends such as postmodernism (established by Robert Venturi and other authors as picking up items from the past), mimicry or even kitsch. The creation of the type requires scientific knowledge of the model and its adaptation to the context environmental, social, technique, economic, and cultural of its application. This is what attributes to the architectural creation innovation and contemporary. Ignore the distinction between the model and the type and the scientific ignorance of what is the template leads to such reproduction without adapting it to its context; It is which accuses the architectural creation by mimicry. The resumption of some formal elements without being actually the fundamental characteristics of the model this is what taxes the architectural creation of the production of the image of kitsch.

Since antiquity the architectural creation has steadily innovate drawing references from models that preceded it. Therefore, we cite the example of the evolution of the pyramid of Egypt which referring to the Mesopotamian Ziggurat and the Mastaba of Egypt, it was able to combine between them and evolved through time to constitute later a reference to the pyramid of the Louvre. The pyramid of Egypt as the Mastaba is a funerary temple sheltering inside intimate the mortal remains of the deceased gods, however it is not sufficient for Pyramid to have the parallelipedique block appearance of the Mastaba but as the image of the Ziggurat, it superimposes floors until reach the Summit. This is what gave the pyramid of degree that has evolved in the bent pyramid then the pyramid in its perfect form, which the concept was revived later by the pyramid of the Louvre. Although the idea of creating a pyramid at the Louvre Museum dates from the 18th century it has seen its design and its realization in the current form in 1989. The architect Ieoh Ming Pei proposed a modern and innovative glass and metal pyramid using references in the pyramid of Cheops. Several studies have tried to find the similarity and the references of the pyramid of the Louvre in the pyramid of Egypt. They cited the reference to the measures; the resumption of the idea of small pyramid next to the largest and especially the idea of the basement of the Louvre which houses the treasures of the past of the civilization to the idea of the treasures of the Pharaohs gods sheltered by the pyramid of Egypt. (refer to the figure1 and 2).

The idea of the Arch to celebrate the victory of the Romans was also taken in many regions of the world; the most innovative is witch the architect Johann Otto Von Spreckelsen appropriates at the Big Defense Arch of Paris. He took the idea of the Arch of triumph in the wanting rather than a victory but a modern opening and a window on the world, as says the author "the Arch is first the Arch of the brotherhood, which is the motto of the Republic as that of masonry." **(**« L'Arche est d'abord l'Arche de la Fraternité, qui est la devise de la République comme celle de la maçonnerie.»**)** (On line 2014http://archives). (Refer to the figure 3)

Even modern architecture which is known for having revolutionized the architectural language by providing a new vision of the world, a new relationship, new forms and new composition... this architecture doesn't cease to refer in its creations to the architectural heritage. The Work of the Pyramid of the Louvre, and the Big Defense Arch are examples that illustrate their references to architectural heritage while being in modernity. We also quote at this effect two great names of modern architecture, Le Corbusier and Jean Nouvel. The most eloquent of Le Corbusier references to the ancient legacy was his conception of the Modulor witch the idea of proportionality and scaling architecture had been borrowed from the Or Division (Section d'Or) of Greek architecture. The Modulor was the leitmotif of the measurement of the architecture projects of Le Corbusier and of many modernist architects.

The most prominent references of modern architecture to the architectural heritage are that of Jean Nouvel and architecture-Studio Team in the Institute of the Arabic world. "The Institute of the Arab world (IMA) is a Parisian Cultural Institute dedicated to the Arab world…”. How these architects took references from the architectural heritage in this Institute? Many studies have addressed the references to the Arab world in the Architecture of this Institute, among them the study of Miquel A. et Goulet P. (on line 2014) where the authors cite the reference to the Arabic patio in the Chamber hypostyle, the reference to the colonnades of Cordoba and the spirals that they reported to the minaret of the Mosque of Ibn Tulun… but the most eloquent and most spectacular reference is that of the Moucharabieh.

The Moucharabieh is the main element of composition of the facade of this Institute It is an essential traditional element in the former Eastern architecture. The definition of the Moucharabeh by a dictionary via the internet gives us this” The Moucharabieh is a forced ventilation device frequently used in the traditional architecture of the Arab countries. The reduction of the surface produced by the mesh of the moucharabieh accelerates the passage of wind. It is brought into contact with basins, dishes filled with water or wet surfaces which broadcast their freshness inside the House” (on line 2014). Jean Nouvel has not copied the Moucharabieh as a model element reproducible as what, but he modernized it and made it as a key and structural composition of the facade of this Institute. ”Designed by Jean Nouvel, South facade incorporates the historical themes of Arabic geometry since it is composed of 240 Moucharabieh. They are equipped with diaphragms that can open and close; This was originally to be based on sunlight, in order to fulfill the role of thermal regulator, but the photocells responsible for driving this device have shown failures, so that the opening and closing change now at each time.’’. (On line 2014). (Refer to figure 4)

CONCLUSION

Through this work and using a few definitions of the type and the model and by a few architectural examples, we have seen how the question of architectural heritage can be taken from the angle of architectural creation and how this creation can revive this heritage not by imitating and copying it but by pulling in it the meaning, ideas and principles; with adapting it to the context social, cultural, economic, climate... instead of its application; as such the question of heritage goes beyond the boundaries of space and time. This can be done by a real scientific knowledge of this heritage and its history. And if as said Quatremaire d. Q. (1832) :” In any country, the art of building regular was born of pre-existent germs. It Must be an antecedent to all; nothing, no kind comes from nothing and this can’t point apply to all inventions of men” (« En tout pays, l’art de bâtir régulier est né d’un germe préexistant. Il faut un antécédent à tout ; rien, en aucun genre ne vient de rien ; et cela ne peut pas ne point s'appliquer à toutes les inventions des hommes »). It is only through a considerable intellectual work of creativity that the architectural design remains in contemporary with using in the past.

A few Figures

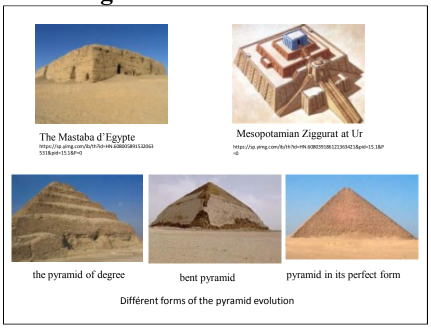


Figure 1: The evolution of the pyramid

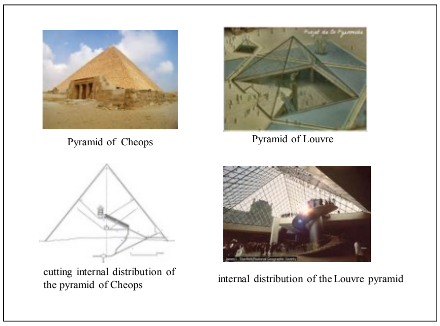
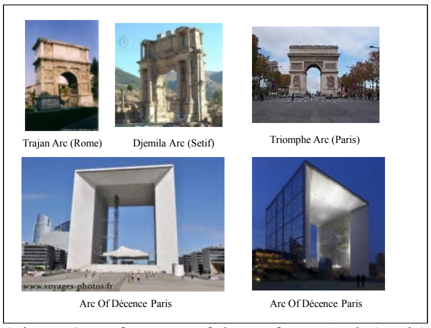


Figure 2: references of the Louvre pyramid



(Figure 3: References of the Defense Arch (Paris)

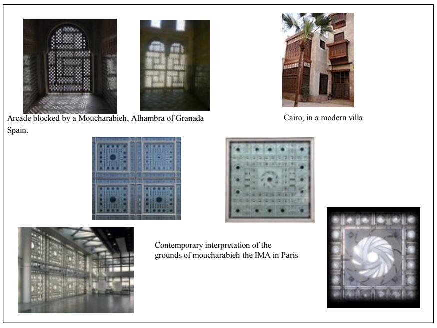


Figure 4: showing the old model of the Moucharabieh in Alhambra and Cairo and its modernization in the IMA

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TYPOMORPHOLOGICAL ELEMENTS OF URBAN SPACE AND NON-MOTORIZED TRANSPORT IN NAIROBI CITY

MBIDHI MARTIN, KIBUE SUSAN

ABSTRACT
At the rate the world is urbanizing, it is predicted that by 2030 all developing regions will have more people living in urban than rural areas. The rapid urbanization has led to change in urban structures leading to sprawling cities. The urban sprawl has resulted in challenges of mobility thereby making access to work opportunities and services more difficult for urban residents. The challenge for urban planners is how the urban space can be transformed innovatively to solve the mobility problem in the midst of incalculable complexity of the cities, composed as they are of so many different actors groups and institutions. This paper is based on a study conducted in Nairobi city, Kenya on Non-Motorised Transport (NMT) users. Most NMT users in Nairobi are captive to this mode of transport but are faced with long travel distance and difficult and dangerous travel environment. The study hypothesizes that the unfavourable travel environment is as a result of the poor planning and design of the urban space. It seeks to establish the effect of typo-morphological elements of the urban space on NMT travel environment by focusing on the journey to work. The study covered selected neighbourhoods in Nairobi as trip origins and the work places in the industrial area as the trip destination. A multi-stage technique was used in obtaining the primary data: interview schedule applied at trip destinations, a walk-through interview schedule applied along travel route and an observation checklist applied on four major routes selected on the basis of frequency. Preliminary results show that the spaces NMT users select to walk or cycle through are at variance with those areas designated for their use through urban planning. The study is expected to contribute towards the development and refinement of guidelines for designing new neighbourhoods and for retrofitting existing ones to better reflect current NMT planning goals. Ultimately, the predictions will be used to help determine how public resources can be best prioritized and allocated to achieve the planning goals of the city and create a safe and attractive travel environment for NMT users.
Key words: Typo-Morphology, Urban space, Innovative, Complexity, Computations

1. INTRODUCTION

Many transportation planners have noted that cities in all parts of the world are struggling to achieve some acceptable standard of mobility due to its significance to all social and economic activities of any city. Pacione(2009) has shown that demand for transport in the cities whether for people or goods, is determined largely by the spatial arrangement of different land uses. In most countries, passenger cars and trucks have become the most important transport modes (Joewono, 2005). This scenario is encouraged by the post-war "modernist" planning practices that focused on the large scale and efficiency of the motorised transport (Salingaros, 2012).

In many developing cities high growth of the vehicle fleet has taken place in recent years (Pacione, 2009) and planners have tended to plan at large scale to accommodate growing vehicle numbers. Non-motorized transport (NMT), which in earlier times was the common way of linking together places of activities, has to a large extent been substituted by the car in daily mobility, and by trucks, for freight movement (Fjellstrom, 2002). Nevertheless, NMT still has a significant beneficial impact to users and their environment. In many cities, it is the main mode of transportation for the majority of urban dwellers, and in some a significant source of income. It therefore has a very significant poverty reduction impact. Where NMT is the main transport mode for the work journeys of the residents, it is also critical for the economic functioning of the city (Joewono 2009). Despite this obvious merit, NMT has tended to be ignored by policymakers in the formulation of infrastructure policy and sometimes discouraged as a transport mode. Further, it is sometimes viewed as an unpleasant and dangerous, mode of transport in some of the very poor countries (Witink, 1998).

In the recent years, the problems associated with motorised transportation systems have led urban planners and designers of cities in highly industrialized countries to re-evaluate the approach to planning of cities are in respect to mobility and the general quality of the urban life. As Joh et al. (2012) point out, planning for sustainable communities has arguably become the dominant paradigm for urban and community planners in the twenty-first century with the promotion of walkable communities and walking behaviour as its primary thrust. In this endeavour, the over-arching view has been that the city is a very complex entity and that its problems, be they mobility related or other cannot be solved by focusing on one aspect in isolation. In other words, the city needs not only to be efficient but also liveable (Marshal, 2012). Thus, the problems of mobility must be studied in the context of the entire urban space.

The emerging urban space planning and design concept promotes an approach which seeks to limit car use in cities by focusing on small-scale mixed use neighbourhoods. This concept, promoted by the New Urbanism movement recognizes the significant role played by NMT in urban environments and aims at developing neighbourhoods and other urban spaces that are not only NMT friendly but also contribute to the liveability of the city in the overall.

2. THE NAIROBI SITUATION

The world is rapidly becoming urban. By the year 2030 all developing regions, including Asia and Africa will have more people living in urban than rural areas. Today, half the world's population lives in urban areas and by the middle of the twenty first century all regions will be dominantly urban, with the tipping point in Eastern Africa anticipated slightly after 2050 (UN-Habitat, 2008).
In most third world cities, rapid urban expansion driven by in-migration has led to many new arrivals being forced to live at increasing distances from the job opportunities found in the central city (Pacione, 2009). With the growing population and the expansion of the city, the greatest challenge, among others competing for the urban space is mobility. The challenge is compounded by the fact that in most of these cities, public transport systems are not well established leading to rise in the number of private cars. Most urban areas are faced with urban transportation problems mostly resulting from over reliance on motorized transport. Some of the problems are; traffic congestion (figure 1-3)and limited parking space, environmental pollution due to vehicle emissions and noise, and high cost of fuel resulting in high cost of travel for public transport (Makajuma, 2009)

Figure 1: Congestion on Eastleigh First Avenue; one of the streets in the study area
Source: Author

Figure 2:Traffic congestion on Jogoo road during

Source: Author

Nairobi City in Kenya faces similar mobility challenges as do other cities in the developing countries. Rapid increase in population due to rural urban-migration has multiplied these challenges significantly. There has been a rapid increase in the number of informal settlements within and at the fringes of the city. As a result of the sprawl, workers are increasingly living farther from the places where they work.

To make matters worse, available public transport is unreliable, expensive and sometimes inconvenient to workers since it does not link their residences directly to the places where they work (Mitullah and Makajuma, 2009). The problem is further compounded by the fact that even where public means of transport is available and reliable, most of these workers would not afford the chargeable fares. As a result, most of the workers have become captive to either walking or cycling to work. This study is built on the premise that this unfavourable NMT travel environment has resulted from poor urban planning and design (Siringi, 2013). A design that is not cognisant of the local circumstances and attitudes (Sangira, 2013). Although this study examines the transformation of the urban space as a whole, NMT offers a framework in which the wider urban space development issues can be examined and provides an opportunity to interrogate the space users on their experience on a one on one basis as a prerequisite for an empirical study.

Two major assumptions are made in the study of this problem: Firstly, that NMT offers one of the best and sustainable solutions to the urban transport problems (UN Habitat, 2008). It is convenient, environmentally friendly, and faster in areas where there is vehicular congestion, and is affordable (I-CE, 2000). Therefore, the study does not seek to make any case whether the use of NMT as a mode of transport in Nairobi is desirable or not. Secondly, that through design, urban spaces that nurture human life and imbue people with sense of community can be developed. According to Alexander (2006), this degree of life is an objective quality that may be measured by reliable empirical methods.

The focus of this study is to determine how the existing urban structure has influenced the cyclists' and pedestrians' behaviour and route choice in a complex urban environment. As Marshal (2012) has shown, the urban space is very complex and that no urban problem can be solved without considering the wider urban context. The study seeks to examine not only the travel route but also its relationship to the typo-morphological elements found in the urban space.

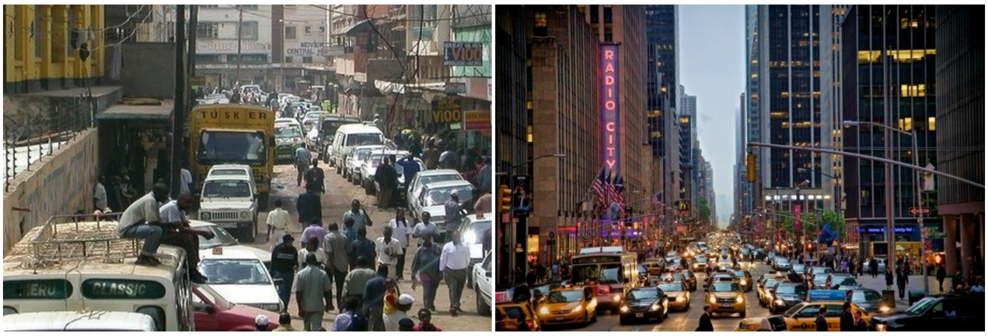

Figure 20: Nairobi (left) and (New York) city centres showing congestion caused by MT
Source:megatraveloffers.com

The study further seeks to link NMT design parameters of comfort, attractiveness, safety, directness and coherence recommended by (I-CE, 2000) to the

typology and morphology of the NMT routes in the light of new-urbanism theories and evaluate the applicability of algorithmic design promoted by Salingaros and Leitner (2010), Smart Codes promoted Duanny and Elizabeth Plater-Zyberk (1992,1994,1997) and genetic coding by Hillier (Hillier, 2012)as approaches to design of sustainable, adaptive and humanistic urban spaces.
(Figure4&5) show challenges faced by NMT users in the study area.

Figure 4: Vehicular and Pedestrian conflict on
Source: Author

Figure 5: Pedestrian access blocked by residents
Source: Author

3. RESULTS AND DISCUSSION

3.1 Introduction

This study was set on the premise that the unfavourable travel environment for NMT users in Nairobi is as a result of poor urban space planning and design. The independent variables of typological and morphological elements of urban space are looked at in terms of density, diversity, design and destination against the dependent variables for NMT defined in terms of coherence, directness, attractiveness, safety and comfort. This section identifies the typological and morphological elements and seeks to establish which of these elements and the extent to which they influence the NMT users' behaviour and route choice on a home-to-work trip. The data is presented following the objectives set out for this study. Firstly, the typological and morphological characteristics of the NMT routes in selected Eastland's estates are established according to route choices by NMT users; and secondly the NMT users' behaviour in their travel environment and their response to it are established

3.2 Typological and morphological characteristics of the routes

The NMT user interview carried out at the travel destinations identified four major routes used by respondents on the home to work trips. The respondents were shown the area map of the travel routes on which landmarks had been identified. The respondents were then asked to identify the routes which they frequently used shows the main routes used by NMT users as identified from the interview at travel destinations. The table shows the numbers that use the routes after cleaning out the data by eliminating routes that do not fall directly within the study area.

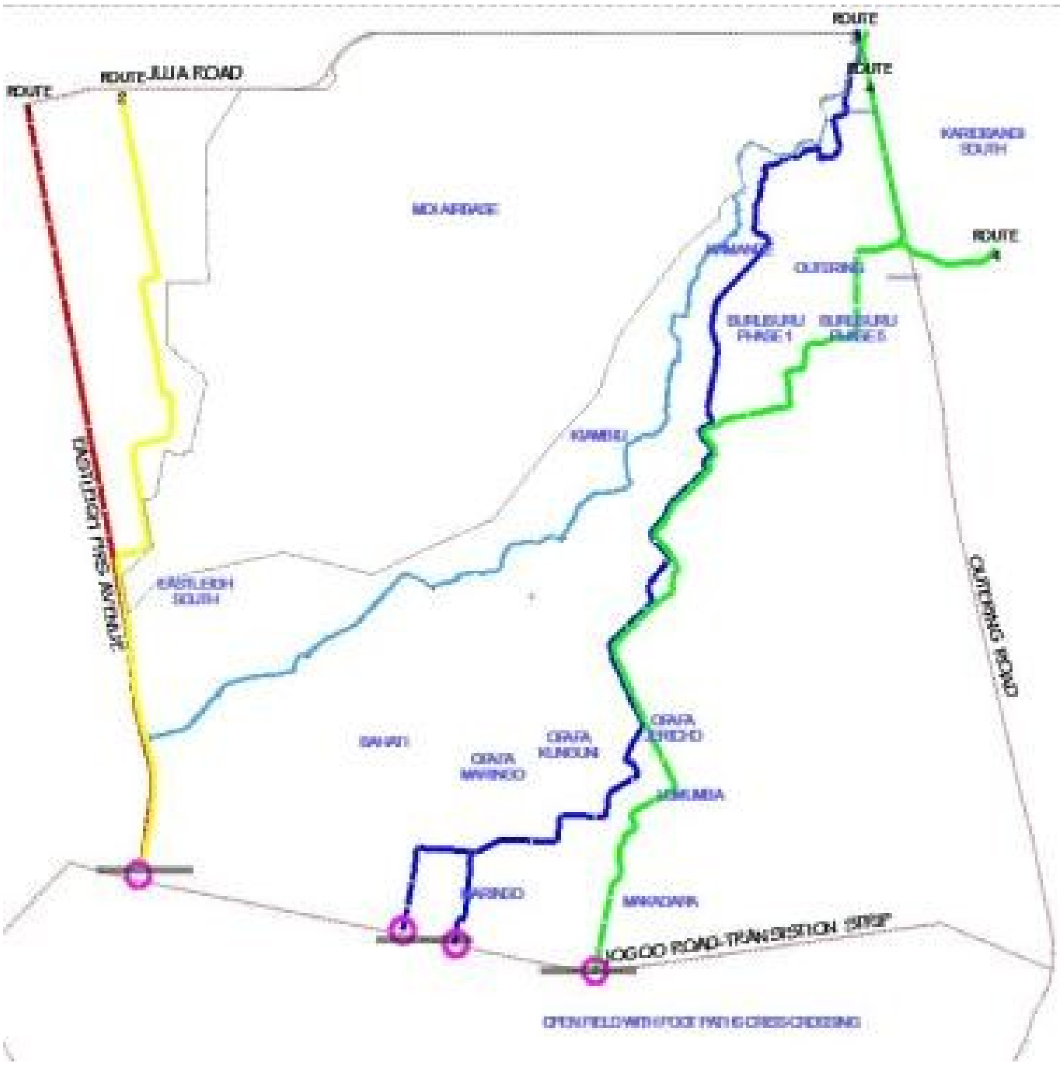

Figure 6: The four routes in the study area

Source: Author shows the routes on a map of the study area. Route one runs through the outer edge along Eastleigh First Avenue and connects Jogoo road directly to Juja road. Route three and four cut through the study area in the north-easterly direction. At one point, the two routes merge within Jericho estate. It is notable that due to the large area covered by the Moi Airbase, there is a large distance, almost four kilometres between route 2 and 3. NMT users that live beyond the airbase have therefore to cover much longer distances to reach their destinations. It is also clear that the NMT users using route three and four follow a more convoluted route to reach their destination at the junction of Outer Ring road and Juja road. From the study, it was noted that most NMT users avoid routes which have high vehicular traffic and would rather travel longer distances than use more direct routes that have higher vehicular traffic. This is evident in the fact that route three and four users converge at an area which has almost no vehicular traffic.

3.3 Typological characteristics of the four routes

The study sought to identify the typological characteristics of the NMT routes in the study area. Four main routes were identified. Shows the typology of buildings found in selected sections along the four routes. Route one has predominantly high rise (more than two storey) buildings with either commercial function or mixed use. In the mixed use buildings, most commercial activities take place at ground floor level while the upper floors are used as residential premises. Route two is predominantly high rise residential blocks. There are also a significant number of single storey informal structures along this route. Route three has predominantly single storey and double storey residential blocks. However, there are other typologies such as schools, commercial blocks, churches and community centres. The route also passes through an area of informal settlements (Kamande) along the Airbase boundary. Route four has almost similar typology to route three except that some sections of the route have high rise residential blocks while others have mixed use functions especially in the Hamza area.

Shows a figure ground image of the four routes. Route one and two show high densities with most areas covered by building blocks. Route three has sections which show varying densities. The area between Jogoo road and Eldebi road has a variety of built and open spaces along the route. The section passing through Kamande informal settlement is heavily built with very few open spaces left. Route four has the largest areas that are open. The routes passes through a number of neighbourhoods with low rise residential blocks planned around courtyards.

Figures 9-12 show different typologies found along the four routes.

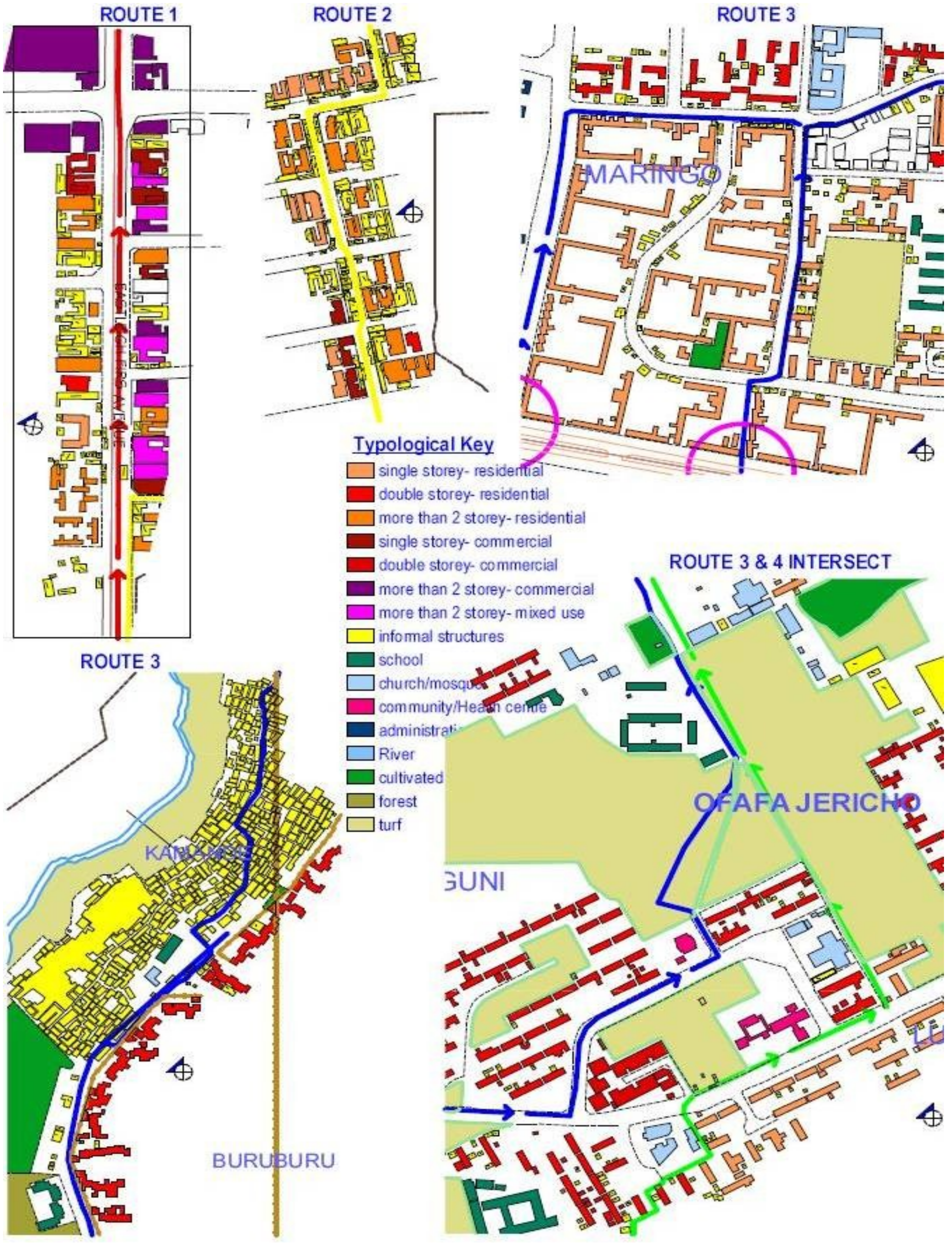

Figure 7: Typologies at Selected Sections Along the Four Routes
Source: Author

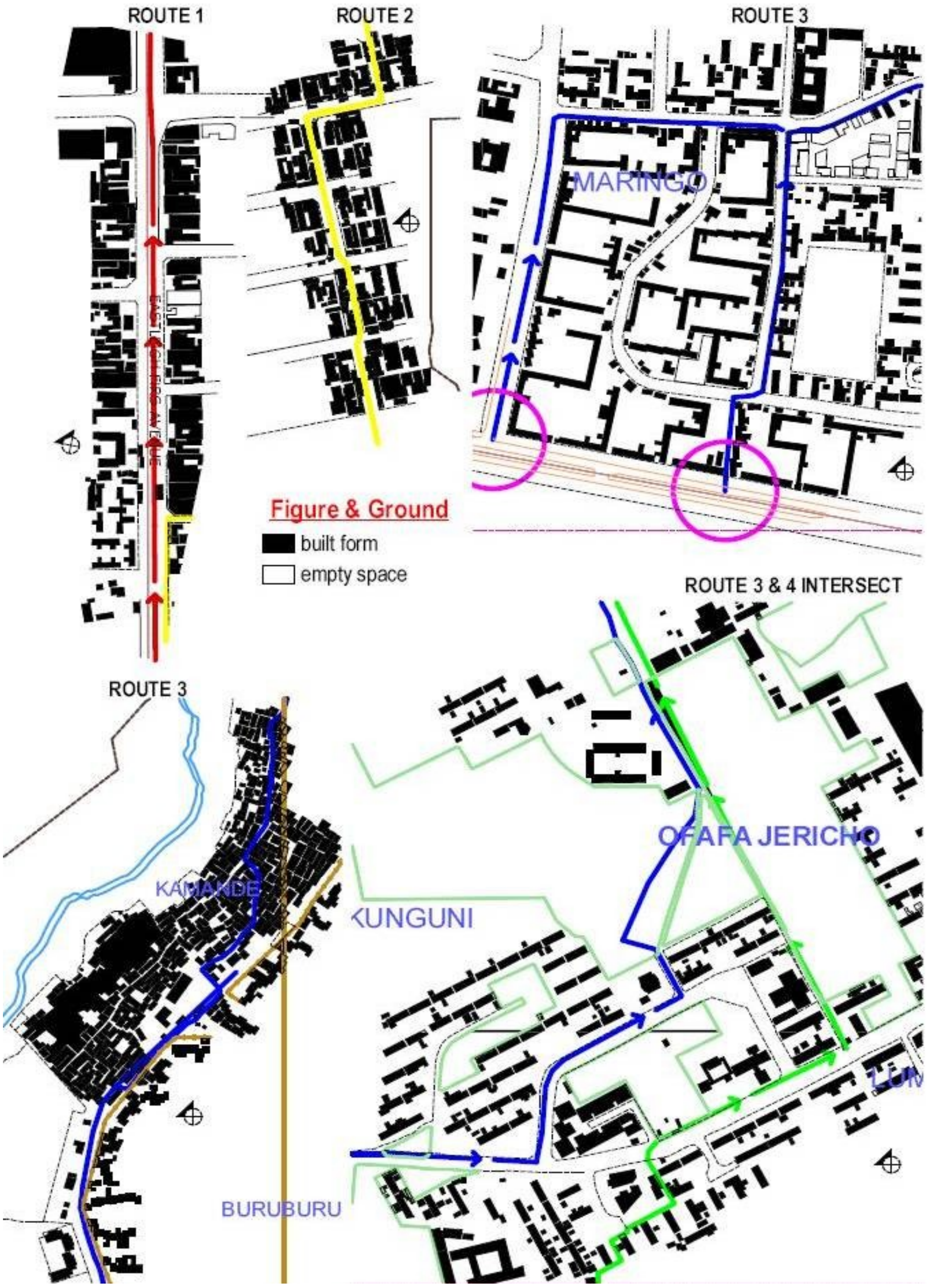

Figure 8: The figure ground image of the routes showing the building densities.
Source: Author

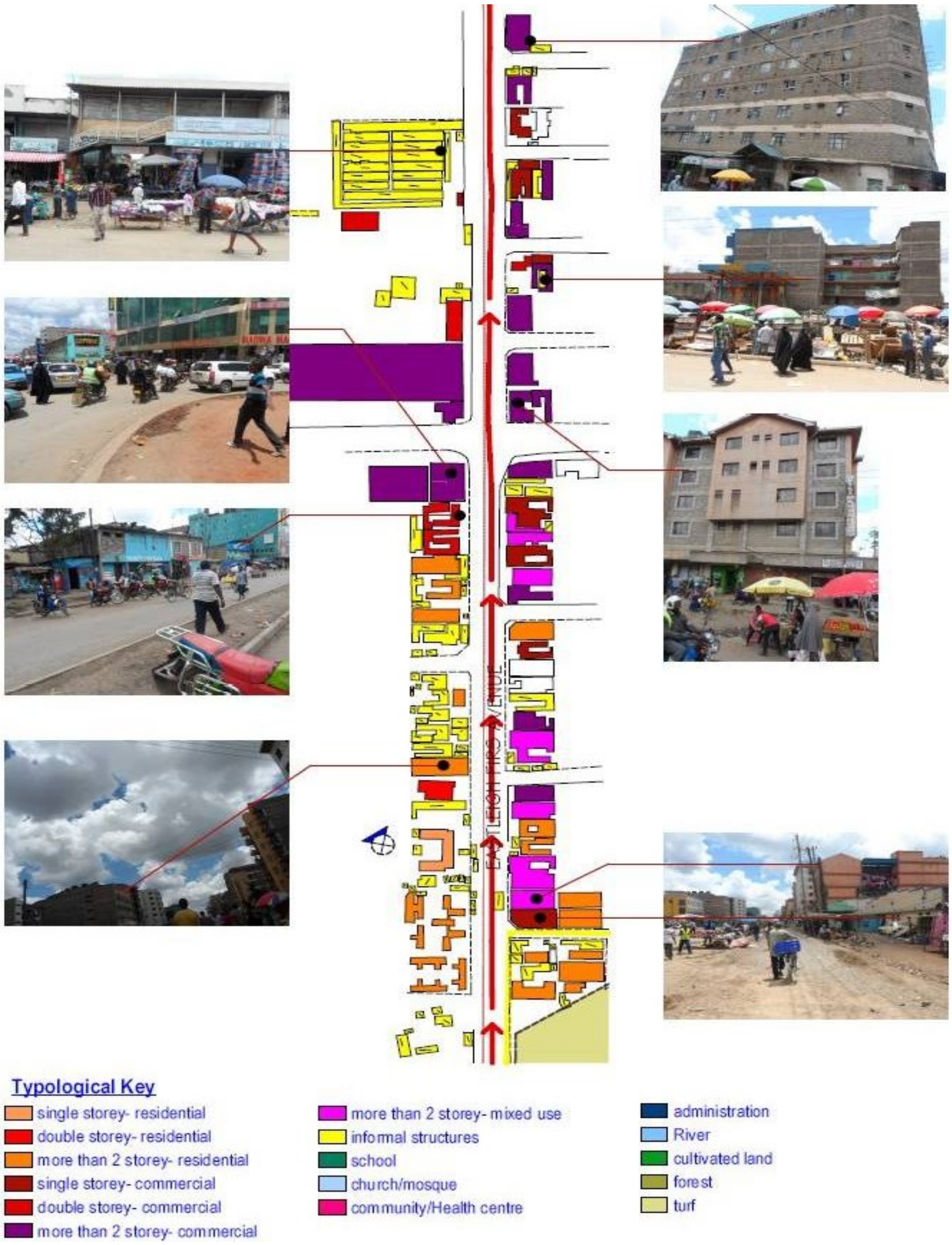

Figure 9: Building typologies on route 1
Source: Author

Figure 10 : Route 2 Building Typologies
Source: Author

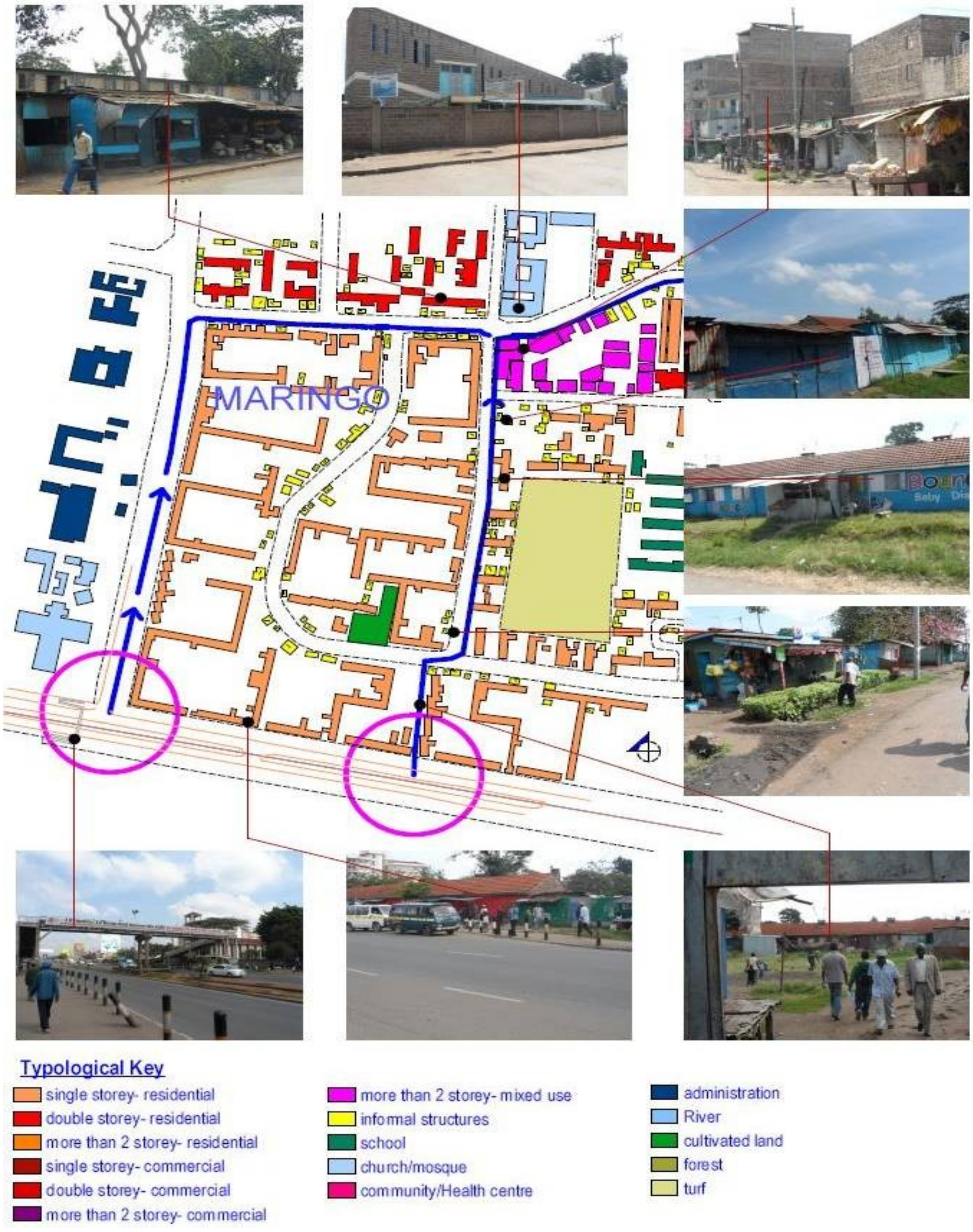

Figure 11: Route3 Building Typologies
Source: Author

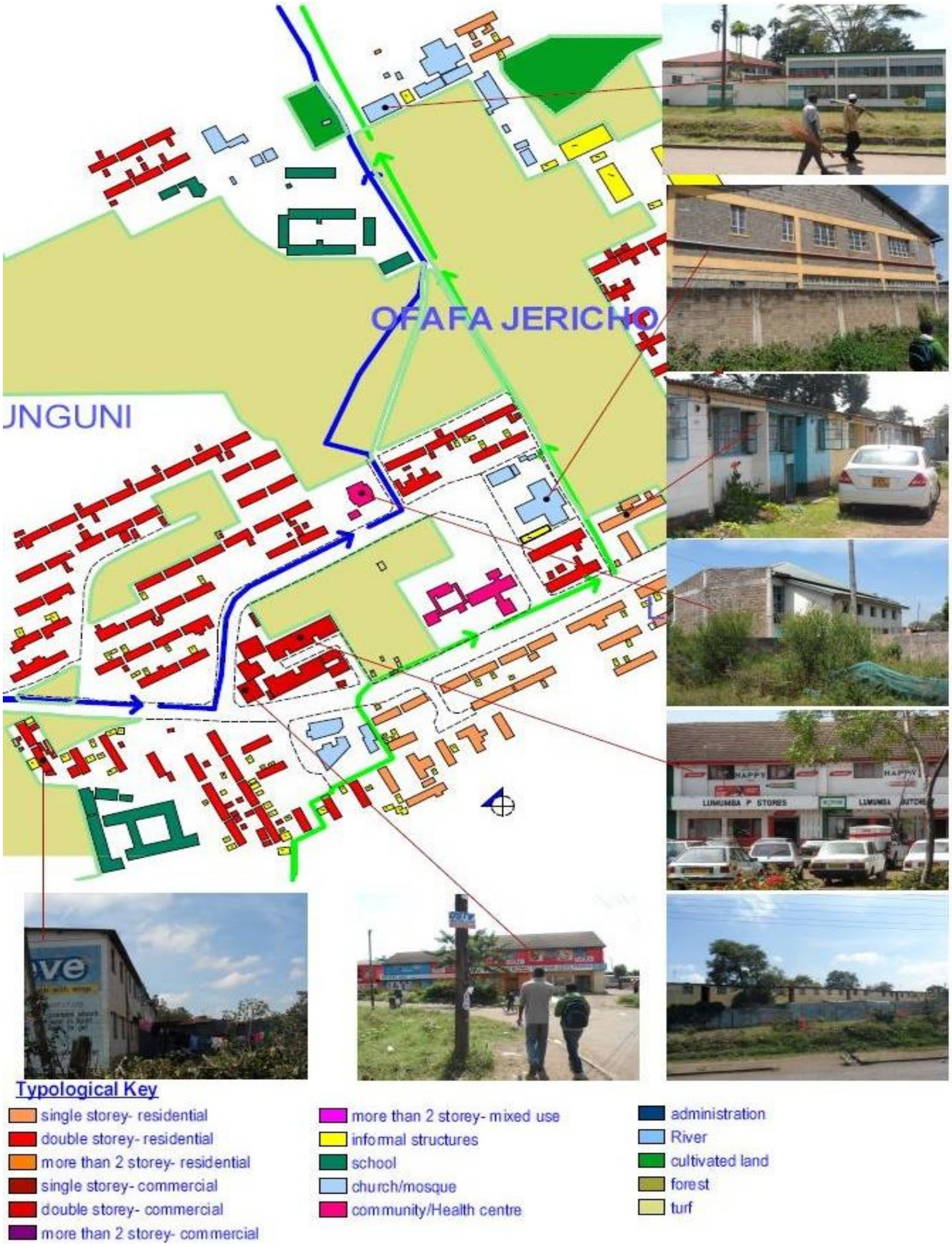

Figure 12: Route4 Building Typologies
Source: Author

3.4 Route analysis by variable

There were five factors under the dependent variable that were evaluated to determine the effect of the route characteristics on NMT users from the users' view point. The factors were: coherence, directness, attractiveness, safety and comfort. The factors were broken down into a set of questions. The respondents were asked to rate the quality of their route on a scale of one to five.

In, the box plot shows the coherence scores for all the four routes. Route three is judged to be the most coherent while route two is the least coherent. The test for coherence was to determine the route that was easiest to read, that is, the route in which one was most likely to find his way easily after a single use. The respondents were asked questions concerning; access to main network at points of origin and destination; integration of their route with the public transport; hierarchical approach to the route from urban, district to the neighbourhood network; constancy of the route quality; and ease of recognition of the route. It can be seen in the box plot the mean score for coherence in the four routes does not vary significantly. The most

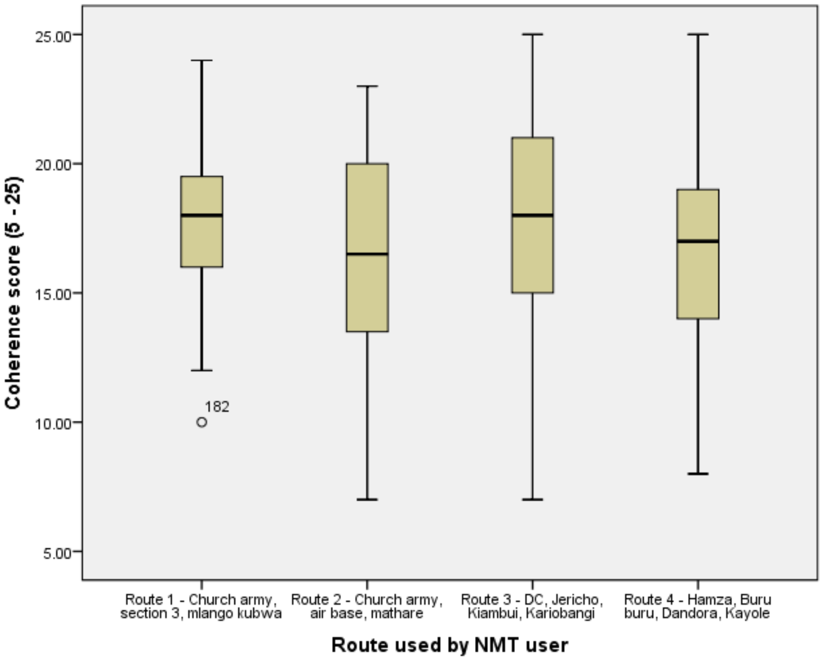

Figure 13: Box plot for Coherence Score of the Four Routes
Source: Author

coherent route has a score of 71% while the least coherent route has a score of 64%.

In, the box plot shows the directness scores for all the four routes. Route one is the most direct while route two is the least direct. Route two was also seen by the respondents to be the least coherent, indicating that there could be a relationship between directness and coherence. The standard deviation from the mean for all the routes does not vary significantly and that the median is very close to the mean. The most direct route has a score of 59% while the least coherent route has a score of 54% and a mean of 56%. This could mean that the respondents view their routes to be more coherent than direct.

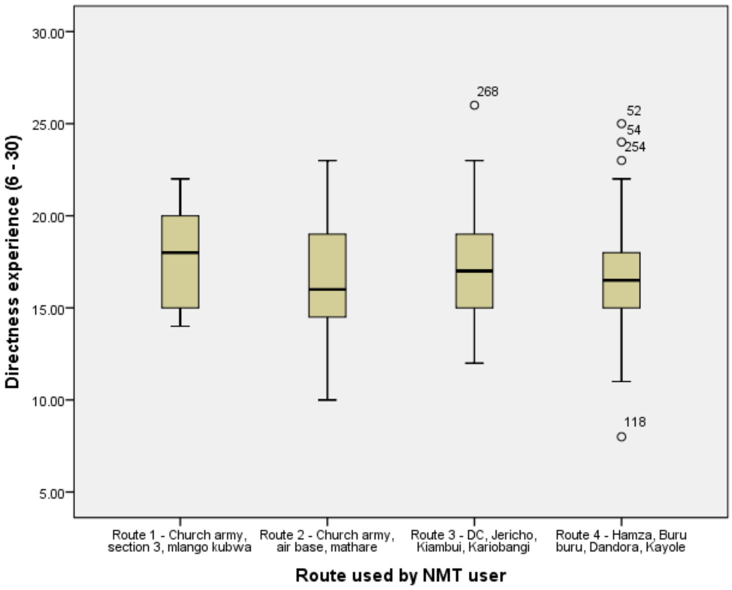

Figure 14: Box plot for Directness Score of the Four Routes

, the box plot shows the attractiveness scores for all the four routes. Route one is the most attractive while route three is the least attractive. The standard deviation for all the routes does not vary significantly and the median is very close to the mean. The most attractive route has a score of 54% while the least attractive route has a score of 49.6% and a mean of 51.3%. The mean score for attractiveness at 51% is lower than that for directness at 56% and coherence at 64%. This means that of all the three factors, the respondents felt that attractiveness of the routes is a more serious problem than coherence and directness.

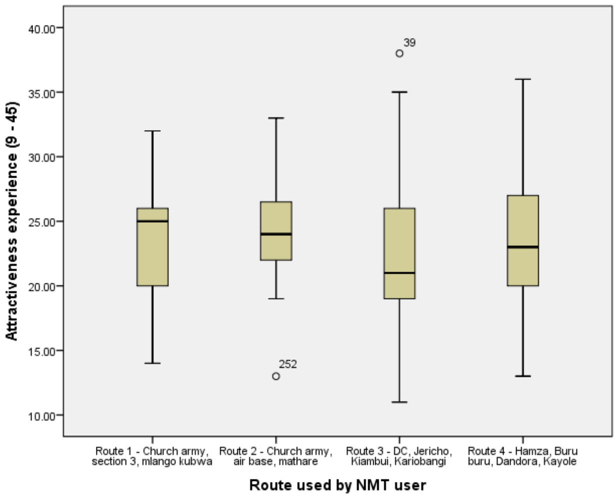

Figure 15: Box plot for Attractiveness Score of the Four Routes

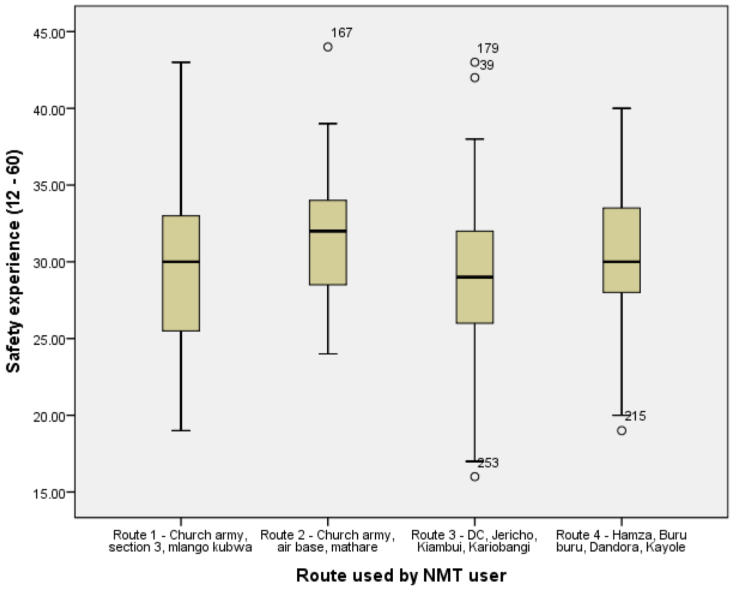

Figure 16: Box plot for Safety Score of the Four Routes

The box plot shows the safety scores for all the four routes. Route two is the safest while route three is the least safe. The standard deviation for all the routes does not vary significantly and the median is very close to the mean. The safest route has a score of 52.6% while the least safe route has a score of 48.6% and a mean of 50%. Safety has the lowest mean score at 50%, attractiveness at 51% is lower than that for directness at 56% and coherence at 64%. This means that of all the four factors, the respondents felt that safety is a more serious problem than coherence, attractiveness and directness.

The test for comfort was to determine the route that offered the most ease of use in relation to the built and the natural environments. This had to do with; capacity to prevent congestion; possibility of walking or cycling at a steady speed without hindrance; availability of shelter from rain or sun; bicycle parking and repair facilities; and availability of facilities such as shops or kiosks along the route.

The box plot shows the comfort scores for all the four routes. Route two is the most comfortable while route three is the least comfortable. The standard deviation for all the routes does not vary significantly and the median is very close to the mean. The most comfortable route has a score of 57% while the least comfortable has a score of 51% and a mean of 53%. The mean score for comfort at 53% falls between that of attractiveness at 51% and directness at 56% but much lower than coherence at 64%. Safety at 50% is the lowest score. This means that of all the five factors considered, the respondents felt that safety of the routes is the most critical factor that would require much intervention.

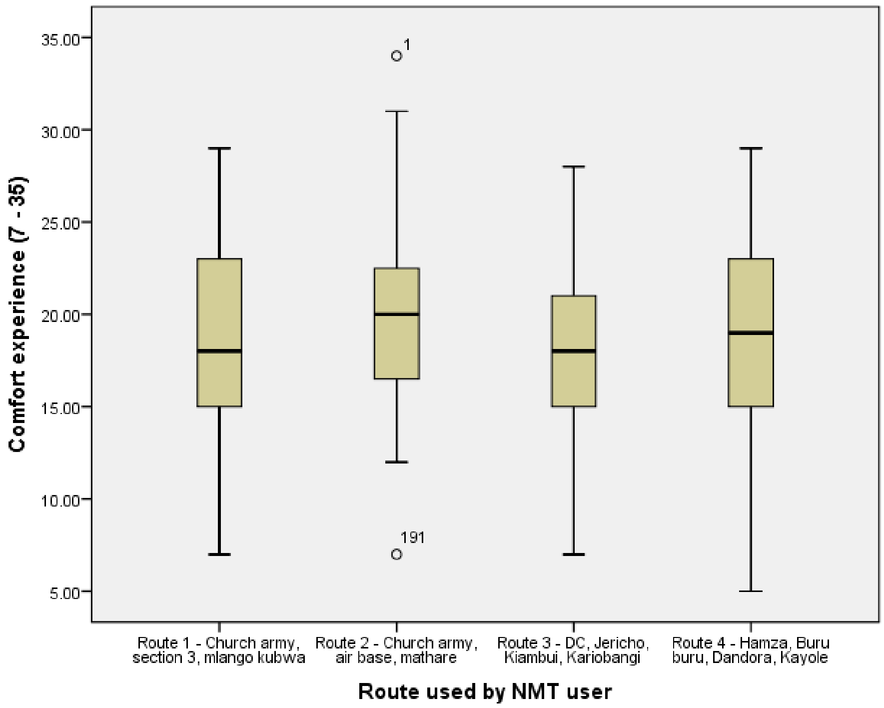

Figure 17: Box plot for Comfort Score of the Four Routes

The box plot shows the overall scores for the four routes. Although there is no significant difference in the quality of the travel environment according to the users' perceptions based on the five factors of the dependent variables, route two turns out to be the most favourable while route 3 is the least favourable.

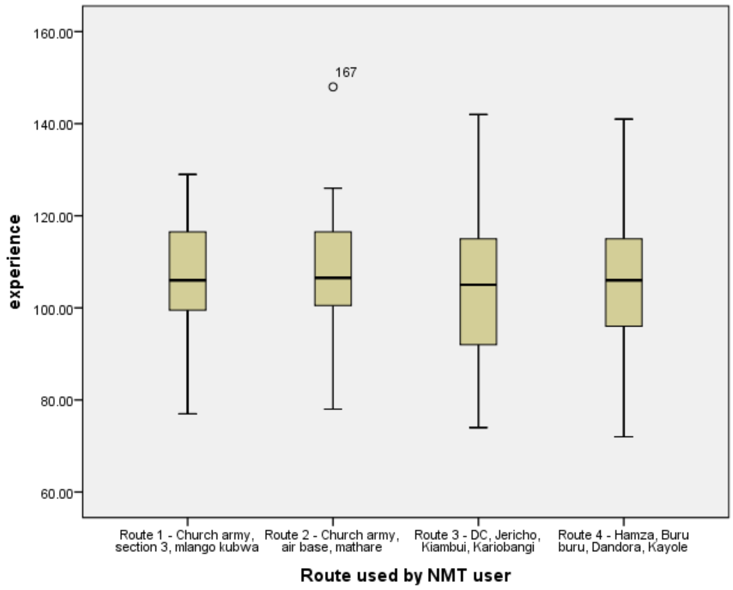

Figure 18: Box plot for Overall Score of the Four Routes

4. CONCLUSION

This study has established that typological and morphological elements of urban space do not have significant influence on NMT users' behaviour and route choice on journey to work. However, the study has identified safety of the NMT users as the critical factor to be considered hen designing urban space for these users. Here safety means that the NMT users are segregated from motorized traffic, and that situations or environments that may expose the user to acts of thugery or mugging should be eliminated.

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A STUDY ON LALEHZAR STREET TO BE CHANGED TO A PROPER WALKING STREET WHILE FOCUSING ON LOOSE SPACES

SEPIDEH SAFARI[1]

ABSTRACT

Nowadays, the quality and attraction of public urban spaces has been one of the most crucial features for a city to be called developed and manageable. Pedestrian walkways have a key role in social interactions in todays' virtual technology age,economical impacts on the areas around and multi-functional dimensions encompassing a wide range of activities. Historical texture and pedestrian walkways have an important role in peoples' quality of living, therefore, different factors affecting pedestrian walkways should be recognized and the loose spaces should be used as a parameter to develop the pedestrian walkways qualitatively. Having studied the related theories and concepts, and also Lalehzar street which has lost its livelihood, the mentioned theories have been tried to be proven right. This research tries to find strategies to make Lalehzar a successful urban pedestrian walkway. Since the concept of Loose space has not been utilized for similar places in Iran, and it is an effective factor in lively spaces, utilizing it along with historical Lalehzar pedestrian walkway can be considered an innovative approach.Therefore, the research model is prepared which covers the general model affecting factors on practical pavements and proper urban spaces. Furtheremore, the loose spaces are used for comparison and, finally, the loose spaces are mentioned as a progressive development factor along with the pedestrian walkways.

Key words : Loose Space, Lalehzar Street, Pedestrian Walkway, Urban Space

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1. INTRODUCTION

Pedestrian walkways are the free spaces, with multi-purpose functions, encompassing a wide range of activities like recreation, resting, pastime, games, hobbies, artistic and cultural occasions, and business center unique to the cities in the new millenium which are studied in this paper. The results show that people can make the pedestrian walkways filled with joy, if the streets have a safe and proper space and if the activities and hobbies are organized in a well-developed way, peoples' attendance and also its viability and livelihood increase.
The urban loose spaces have complex symbols of functions and possess a variety of principles and concepts whose understanding can affect the process of designing the civil pedestrian walkways. Safety, livelihood and flexibility are the parameters considered, while focusing on the designing of pedestrian walkways to be changed to a successful urban area on Lalehzar Street and the loose spaces are introduced as a symbol having all the factors of successful urban areas, proper pedestrian walkways and a useful area to do a variety of functions. According to the above ideas and in order to determine the research domain, the following questions are given: 1-what strategies and guidelines should be used to change Lalehzar Street to a proper urban pedestrian walkways? 2-what are the parameters for a successful pedestrian walkway and what are their common qualities with the loose spaces?
This paper focuses on the mentioned goal in four parts. In part one, the crucial viewpoints about a successful pedestrian walkway will be studied as one of the most important urban spaces. Part two deals with qualities and practicalities of the loose spaces. In part three, Lalehzar is named as a pedestrian walkway with the potential to be changed to a successful urban place based on the qualities of loose spaces. In concluding part, the results are given.

2. SUCCESSFUL URBAN SPACES

Urban spaces or public ones are the main living places for citizens; therefore, they have a key role in the environmental livelihood and social life. The urban spaces quality depends on many factors dealing with different individual understanding and cultural values (Kashanijoo 2006). Car et.al, have made a list of people's needs to have the optimum joy of a public space, including: "comfort, resting, non-active presence in the place, active presence in the place while exploring, and proper places." in figure 7 these factors were compared with the characteristics of Loose spaces.

3. VARIOUS FUNCTIONS OF PEDESTRIAN WALKWAYS

People walk for different reasons and studies show that passersby walk to go shopping, run errands, or have fun. Walking affects us both on body and mind. In figure1, some of crucial functions of the pedestrian walkways are given (Shahidi 2002). Pedestrian walkways are multi-purpose which differentiates them from other open and public urban areas. Dr. Pakzad in his book entitled 'Designing the urban spaces in Iran' summarizes the most crucial goals and qualities of a walkway named livelihood, flexibility, and security (Pakzad 2005) (figure2).

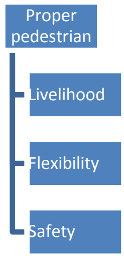


Figure1. Various functions of pedestrian walkways
Figure2. Three characteristics of a proper pedestrain

4. FEATURES OF LOOSE SPACE

In urban public spaces around the world people pursue a very rich variety of activities not originally intended for those locations. Accessibility, freedom of choice and physical elements that occupants can appropriate all contribute to the emergence of a loose space, but they are not sufficient. For a site to become loose, people themselves must recognize the possibilities inherent in it and make use of those possibilities for their own ends, facing the potential risks of doing so.
1-Flexibility: Many of the activities that generate looseness are neither productive (like traveling to work) nor reproductive (like buying necessities), being instead a matter of leisure, entertainment, self-expression or political expression, reflection and social interaction- all outside the daily routine and the world of fixed functions and fixed schedules. As importantly, loose space is a space apart from the aesthetically and behaviorally controlled and homogeneous “themed” environments of leisure and consumption where nothing unpredictable must occur (A.Frank 2006).
2-Livelihood and social interaction: The sense of freedom and the inclination to engage in actions one might not elsewhere arise partly from the anonymity of urban public space. For many people, the sense of being free from judgment is one of the main pleasures of being out in public (Lofland 1998). Others may also approach us and force us into engagements: foreigners who are lost, drunks, charity collectors, as well as those who merely bump into us in crowds.
3-Safety: People’s frequent presence in loose spaces helps them have peace of mind. Homeless people find shelter in loose spaces. If limiting the comings and goings is necessary, then using obstacles is required. Then these obstacles can be used for relaxing, leaning against, and other leisure activities. And by this the obstacles make the space loose (A. Frank 2006).

5. VARIOUS FUNCTIONS OF LOOSE SPACES

Some of the activities that make a space loose are, in Gehl's (1987) terms, necessary while others are optional. People address their economic need to make a living when, for instance, street vendors sell fresh produce and prepared foods in public urban spaces on sidewalks and in squares. Or they may be selling art works, handicrafts, "designer" watches, jewelry and sunglasses, souvenirs or handbags. Musicians and mimes give street performances.
Physical recreation is one broad category of voluntary action that characterizes loose space like climbing up lampposts, dirt biking in empty lots. Games may also be more sedentary, such as chess. People find places for reading, drawing, sun bathing, dancing, gardening, chatting, having a meal or a snack or just relaxing, lost in their own thoughts or studying the passing scene (Lefebvre 1991). Art installations and art festivals may gather many people, stimulating spin-off events and vending. Expressive and political activities are also common in loose space (figure3).

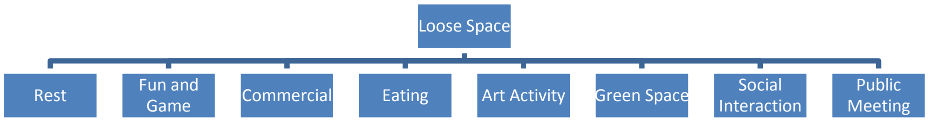


Figure3. Various functions of loose spaces

6. CASE STUDY: LALEHZAR STREET

Lalehzar Street is one of the most brilliant streets of old Tehran built in Nasereddin Shah's age and with undeniable visual values. Lalehzar street was chosen due to the following criteria: 1-The area should have the least attraction for people. 2-There should be a public place in the area.3-It should have the needed capacity. 4-The livelihood of the area should be on the decline. 5- It should have the potential to be improved.
If Lalehzar Street is changed to a pedestrian walkway, we can stop its being destroyed and correct the wrong activities happening in the area through social and cultural actions. It has been tried hard to achieve wider and more detailed information by collecting data and also based on peoples' viewpoints. In fact, the neighborhood quality control is done dealing with safety, livelihood, social acceptance and flexibility through proper techniques and methods. Survey and investigation methods are used to analyze what the inhabitants believe and also their needs. To do so, different techniques are used as the following.

6.1. Questionnaire

One of the methods used is to fill in questionnaires. This questionnaire is prepared based on pedestrian walkways criteria and through Placemaking method. The questionnaire is prepared in three parts. In part one, there are some general questions about the neighborhood for which one can answer freely about his neighborhood, living place and commuting to work. In part two. There are 10 questions focusing on a number of factors like safety, pastime, livelihood, and flexibility and in part three people recommend what activities they like to do in Lalehzar pedestrian walkway in future. This questionnaire is prepared for two groups. The first group are people like passersby who are not always available in this space, but witness whatever happens in the area. The second group are the ones like shopkeepers always spending time in the area being affected by the events in the area. 120 people were chosen as the case society of which 70 were men and 50 were women (Figure 4-6).

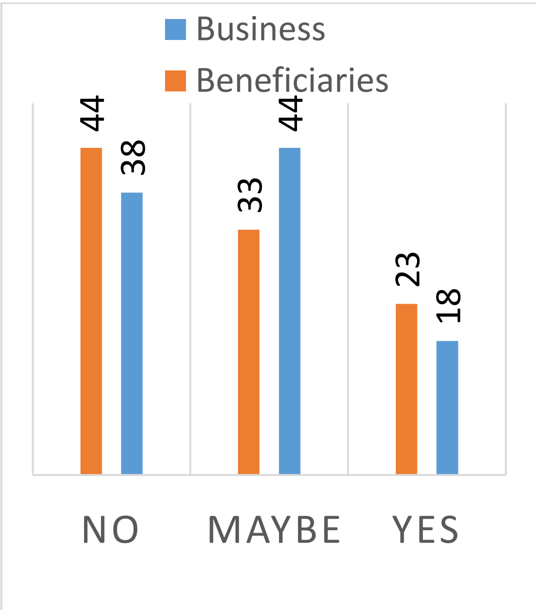


Figure4

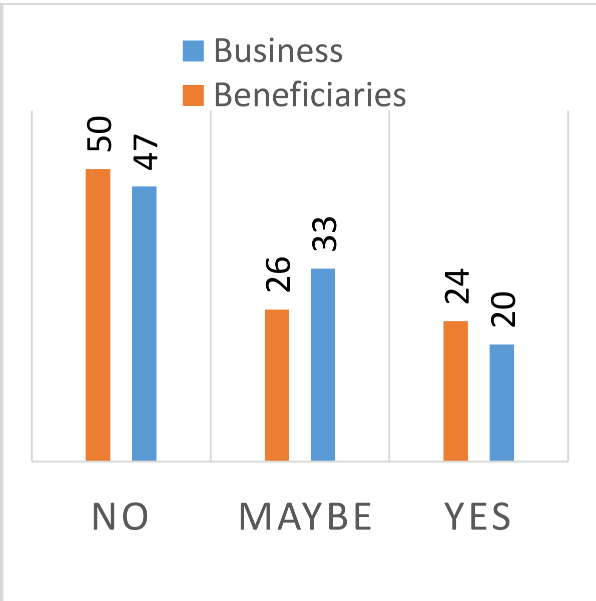
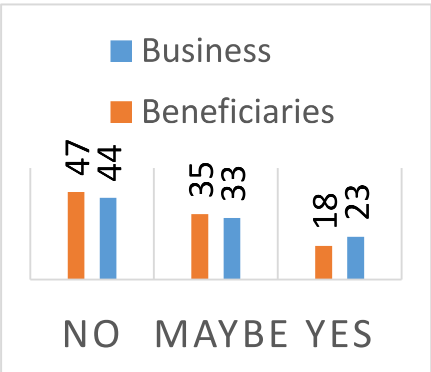


Figure5



Do you find opportunities in Lalehzar Street to do your favorite activities?
Figure5. Do you find Lalehzar Street a lively place?
Figure6. Do you find Lalehzar Street a safe place?

In part three, the interview were to answer what makes them go to Lalehzar street the most whose results and given in continue: 1. coffee shops and restaurant 2. Specific cultural construction 3. Street ceremonies and parades 4. Seating spaces 5. Social security for pedestrians 6. Vendors 7. Social interaction 8. Presenting artworks 9. Meeting friends 10. Different individual and group activities.

6.2. Interviewing Some Trustable Citizens

Some trustable residents were interviewed to have more detailed and correct information. This method is not that much scientific, but it renders proper qualitative information to better know the area. The interviews focused on problems and priorities of the neighborhood, the taken actions to improve the area, and the interviewees' opinions and suggestions to renovate the whole neighborhood.

6.3. Data Analysis

The results for the last part of the questionnaire show that when the majority of people in the area attend Lalehzar Street, they are interested in different functions of pedestrian walkway, like artistic jobs, rest, fun and individual and group activities. Based on the achieved results, the following suggestions are made to improve the overall conditions in Lalehzar area. 1-Constructing business centers along with some locations for vendors. 2-Making enough green areas. 3- Providing some places to hold ceremonies and street parades. 4-Considering pedestrians' need. 5-Having the feeling of freedom, comfort and safety. 6-Proper environmental condition to have people participation along with people supervision. 7-The importance of edges in designing and their being joined to walking spaces. 8-Specific areas for games and fun. Having compared the results with the parameters related to free and loose space, we can conclude that more than 75% of needed features are available to change Lalehzar to a proper pedestrian walkway (Figure.7).

Figure 7. Comparison of successful places features with those of loose space.

7. CONCLUSION

According to the studies done about the loose spaces, these spaces have all these three qualities of pedestrian walkways called safety, livelihood, and flexibility. The results achieved based on the comparison of different functions of pedestrian walkways with the loose spaces show that the loose spaces have all the needed features to provide us with a multi- functioned community in which people at different ages can meet their own needs related to walking activities and finally possess more than 75% qualities of a proper urban area. Therefore, these areas can be considered as a qualitative development factor which leads to the progressive development of pedestrian walkways which increases the safety and flexibility of pedestrian walkways. It further promotes the livelihood factor in pedestrian walkways by making spaces like walls for graffiti, skating area, street music and theater, children's games, multi-purpose spaces and the like.

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ICONARCH II
CONGRESS CITY TOUR PROGRAMME

On The 3rd Day of the Conference
(November 22, 2014 Saturday)

09:30	*Departure from outside our Congress Building (Süleyman Demirel Culture Center)*
10:00-12:00	*Çatalhöyük Visit-Sille Village Visit*
12:00-13:00	*Traditional Lunch in Sille Village*
13:00	*Departure from Sille Village*
13:30	*Arrival to Meram*
14:00-15:30	*Mevlana Museum Visit*
15:30-16:15	*Karatay Madrasa Museum Visit*
16:30-17:30	*İnce Minare Museum Visit*
17:45 18:30	*Alaaddin Hill and Mosque Visit*
18:30-19:30	*Panoramic City Tour and Arrival to Hotels*