



# Employing architectural programming to discover the formal potentialities of the Site issue for the reconstruction of old Mosul

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## Abstract

Architectural Programming is one of the most important scientific methodologies used for pre-design planning, and because the process of rebuilding Mosul is a complex process, so it needs that stage, and in order to identify its stages and the most important analytical methods that it used. The research reviewed the most important literature, as it became clear that the client's goals were not clearly and precisely defined, an analytical study of real examples from the architectural programming literature examined in order to determine the locations of the client's embodiment of the "Site issue" of the old Mosul. Where the research assumed the variation in the embodiment position of the user and expert goals, and the "Delphi method" used in order to determine the physical locations that represent the formal possibilities of the client, which requires the use of a resolution. The questionnaire data analyzed using descriptive and inferential methods of analysis, the study discover the formal potentials of the user and the experts, and it found that the user and the expert agree with the goals regarding the issue of the site, but they differ in terms of the degree of importance.

**Keywords:** Architectural Programming, Client's goals, Delphi method, Old Mosul.

## 1. Introduction

The reconstruction of the old Mosul is a complex process related to several participators, including the user, the state and experts. Because of the historical specificity of the old Mosul, the reconstruction must be preceded by a systematic programming process, which led to discover the Goals of the participators. Moreover, by using scientific methods quantitative and qualitative to analysis physical, social and valuable information, that allows to discover the formal potentialities of the client for the issue of the site, and involving him in the reconstruction of the city.

Therefore, the definition of Architectural programming and analyzing previous studies will help determining the formal potentialities related with the Site issue.

## 2. The Architectural programming definition

Architectural programming is a systematic research and management of information, aiming to identifying requirements to solve the important problem, and has general stages of application (Peña, 1969), (Sherzad, 1985, p.291). According to Cherry, programming is a searching and decision-making method that defines the important problem and the requirements needed to solve by the designer (Cherry, 2006, p.3). The term Briefing (common in Britain) reflects the methods of analysing and synthesises the information needed for decision-making (Kelly and Duerk 2006, p.3), Duerk defines architectural programming as a systematic method of searching for sufficient information to clarify, understand and identify the problem (Al-Dabbagh, 2014).

Therefore, architectural programming can be defined as a process that uses scientific research methodologies in the management and analysis of information aiming to increasing the efficiency of designing, implementing and operating the building, and reducing the risks, that result from decision-making by designer and executor.

Architectural Programming start from the beginning of architectural practice innately, and was practically applied after World War II, adopted by American institutions such as CRS and AIA, also applied in Germany and Britain. The first literature that officially identified it appeared in America in the 1960s (Seeking Problem), aimed to reducing the economic cost and time of the building's life cycle and reducing the subjectivity of design process. Then the British methodologies in the early 1990s developed architectural programming, enabling it to format performance standards (American and German) (Peña, 2012, p.12).

### **3. Previous studies**

#### **3.1. (Peña W., 1969; Peña and Steven, 2012) "Seeking Problem"**

Explained the Participatory-based approach adopted by CRS, facilitating the design process by integrating together the client, designer and work-team, reducing the cost and time needed to implement and design the project, and using linear thinking methods, within a five-stage stages, starting with the goals delineation (the client's requirements), collecting facts (using quantitative analysis). Identifying ideas (determining the goals), and determining requirements (spaces, cost and quality). The study indicates that the client (user, expert) is interested in the site formally, so the programmer has to analyses the formal issue quantitatively.

#### **3.2. (Cherry, 2006) "Programming for design from theory to practice"**

An applied and analytical study, developing Peña's approach, by addressing feasibility of the methodology of Participatory-based approach, it turns out that the client (user, expert) determines the important criteria, within the same conditions of the Participatory-based approach, which require social analyses, and require an understanding for the thinking methods (inductive and deductive) of the client in order to determine the appropriate strategy. Cherry stated six stages for programming, beginning with physical analysis, data gathering, goals delineation (issues), determining the optimal strategy, identifying ideas, and then preparing the briefing, where the decision-making is based on the sequence of criteria (organizational, function, form, economy and time). Finally, the study indicates that the client's goals related to the Site issue are formal one, related to the client's requirements, and therefore the programmer must analyses client's requirements socially and quantitatively (Cherry, 2006, p. 13).

#### **3.3. (Cherry, E., AIA and P., 2016) "Design disciplines"**

By adopting a participatory-based approach, Cherry's study considers architectural programming as a service which helps the designer, by investigating the reasons for neglecting architectural programming in the 1980s and early 1990s, clarifying the importance of programming as a facilitator for participation between user and expert within the design process, and explaining that this approach do not requires a sequence of fixed criteria (including social facts), which is needed in architectural practices within many contemporary architectural movements, because it's using linear thinking methods to apply the six stages mentioned above. Also indicating that the client's goals related to the issue of Site are formal one related to the client's requirements.

#### **3.4. (Faatz, 2009) "Architectural programming: Providing essential knowledge of project participants needs in the pre-design phase"**

By developing the participatory-based approach, applying it in integrating different departments at Vienna University of Technology, and using the quantitative methodology in a linear thinking to apply the six stages, with qualitative analyses in the third phase to determine the evaluation criteria (organizational, function, form, economy, time), and evaluation criteria for each project derived from the client's goals, which are converted into issues such as (economic, environmental sustainability, social sustainability, client's requirements or psychological environment). Therefore, the programmer must use qualitative and quantitative analyses to detect client's requirements concerning the Site issue.

#### **3.5. (Kelly and Duerk, 2006) "Best Value in Construction: (Construction project briefing) Architectural Programming"**

This is a theoretical study adopting the value-based approach, using a qualitative methodology dealing with methods of extracting the client's goals (user, expert), and translating them into performance criteria (issues), which is used to evaluate the programming stages (design, implementation and pre-occupation). So the programmer is a facilitator and an investigator by using spiral thinking methods, thus the work plan is progresses from the general to the specific by tree- like analysis method, collecting information (including physical, social and value facts), determining the client's values, translating values into goals, translating goals into issues (performance criteria), so the programmer must use qualitative analyses in order to manage client's values and discovering the important values concerning Site issue.

### 3.6. ((Hershberger, 2015) “Architectural programming and predesign manager”

By following the value-based approach, and developing Duerk’s work (1993) (Hershberger, 2015, p. 4), programming is considered a process that facilitates the stages of design, implementation and operation, and extends along these stages (Hershberger, 2015, p. 13), also aims to involve the client (user, expert) in those stages, and it is a way to manage the values derived from it, in order to reduce time and cost required for programming, and by using methods of spiral thinking the programmer follows several stages above mentioned, and adopting the value-based approach, recently known as HEACTAS, the programmer briefing client’s eight values, concerning Site issue, such as topography, infrastructure, relative density and client’s requirements.

### 3.7. (Kelly and Mal, 2006) "BEST value in contraction Male, Steven Building the business value case"

By developing the work of Duerk and Hershberger, in order to determine the issues of values at all stages, through the adoption of values-engineering strategy, so the programmer as a facilitator is determining executive values derived from the client (user, expert), and by using spiral thinking methods, the programmer can draw the important values of the client concerning the Site issue.

After all, the variation of architectural programming methodologies (stages, methods of analysis) affects dealing with the types of client’s goals (user, expert). As mentioned above shortage in programming literature include determining the delineation position (formal potentialities) of the client's goals clearly and accurately, so (in the next paragraph) real examples from architectural programming literature will be analyzed (Peña’s approach, Hershberger’s Approach) in order to conclude the delineation positions (formal potentialities) that concerning the Site issue, table (1) and table (2).

## 4. Analysis of case studies according to Peña’s approach (Peña and Steven, 2012, pp. 125–150)

**Table 1:** The formal potentialities (according to goals) derived from public building concerning the Site issue

Projects	Goals	Goals types	Delineation positions (formal potentialities)		Data Source	Reference
University Research Center Park 1983	Maintaining the cohesion of the building's location when a public street passes through it	Efficiency of land-use	Physical construction	Coverage ratio	Client	Abu Sa'a, A.S.A. (2014)
	Site condition	client's requirements				
	When the site doesn't have a clear shape, the park must provide the client's requirements	client's requirements	Masses/ Construction	High technologies/ Structural elements		
Technical College Department of Science 2007	To preserve energy and water	Environmental Sustainability	Masses/ Opening, Spaces	Size Lighting	Designer	Al-Dabbagh, A., al-Hayali, M. (2014)
	Expression of creativity and innovation	Unique	Masses/ Construction	High technologies		
	Expression of the coastal environment of other pure wild coral reefs	Harmonizing site features	Masses/ Construction	Structural elements		

## 5. Analysis of case studies according to Hershberger's Approach (Hershberger, 2015, pp. 117-300)

**Table 2:** The formal potentialities (according to goals) derived from residential buildings concerning the Site issue

Projects	Goals	Goals types	Delineation positions (formal potentialities)		Data Source	Reference
Thompson's House of Architect Kelvin Serang, House of architect Charles Moore.	Adapt to the climate and achieve landscapes with natural lighting, ventilation, extension of living spaces outwards and extension of balconies for obtaining and shading	Topography	Adjacent features	Physical/ Staggering	Expert	(Aldewachi, M., Bayaty, N., (2018)
			Spaces	Continuity		
Arizona Desert Houses	Get proper lighting, avoid wind, tilted ceilings to the east, make wind bumpers from the west, and create living spaces on the west side.	Topography	Plan	Order units pivotally taking into account non-contact	Expert	
			Masses/ Orientation			
West- Pakistan Houses	Reducing the impact of wind and flooding, protecting against storms and resisting extremism in the climate	Topography	Site	Physical/ Rising on ground	Expert	
			Masses	Orientation to avoid wind		
Oreo House in Arizona	Respect the site, landscape or buildings	Topography	Masses	Orientation/ Traditional type	Expert	(Aldewachi, M., Bayaty, N., (2018)

## 6. Practical application

After determining the Delineation positions (formal potentialities for the site issue specifically) by analyzing specialized studies in architectural programming methodologies, and analyzing the programming texts of real examples as well, these are considered variables that the research sought to measure by questionnaire, and can be identified as follows (masses staggering, spaces continuity, axial order of blocks, blocks orientation within topography, height of blocks, orientation of blocks to avoid wind, directing blocks toward view, coverage ratio, structural techniques of blocks, size of each mass, spaces and openings, the use of construction elements, juxtaposition between spaces, separation). This research was based on a hypothesis (the user and the expert differed in their preference for certain values within the variables specified within the Site issue) and thus the search objective was (determining the preferences of both the user and the expert for the variables associated with the Site issue)

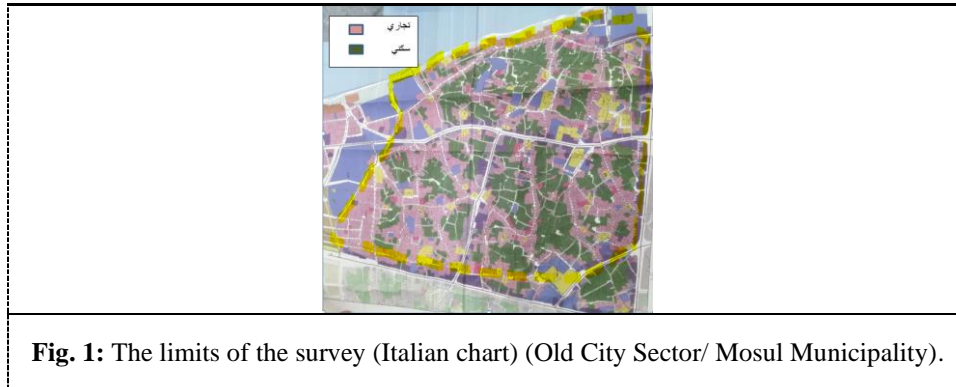
The architectural programming methods confirm that the client's goals (people's preferences) are delineated in qualitative data that requires the use of qualitative measuring methods (Hershberger, 2015, p. 273), that needs to use the questionnaire to measure variables, then followed (Delphi Technic) to find the important issues, by engaging the client in "participatory policy-making approach" relying on collective intelligence, and using (Likert scale), which enables preferences (user and expert) to be translated into measurable intervals, finally the results are discussed.

The reconstruction of the old Mosul must be preceded by the process of planning and collecting data (architectural programming), the size and types of the facts related to it are large and varied. Therefore, the old city residents (users), and the institutions responsible for it (experts) can be considered perseveres of its identity, which recall using methods of architectural programming in order to identify the important issues for this process.

The formal potentialities are due to client's requirements about the psychological and physical environment of the building and its surroundings, which considered client's preferences. The sources of information vary between (user, expert and designer), since the designer of the old city is not yet specified, as well as the programming results of this paper will help the designer later, so two types of questionnaires were prepared, (type 1) for the user, table (3), and (type 2) for the expert, table (4). Collection of data for (type 1) has taken into account the distribution in vast areas of the Old City, the questions

deal with the delineation of the client's goals (formal potentialities), according to types of buildings and to the conclusions of the analytical study (mentioned above; paragraphs 4 and 5), (laws of the municipality of Mosul) for the Old City, and the use of architectural programming studies to determine the topics of the questions (Peña, Steven, 2012, p. 259), a pilot study has been conducted for a sample of 6 persons, then the questionnaire were justified.

The Old City of Mosul has the population of approximately 120,000 (Dearuna, 2018), and because of the difficulty of conducting the questionnaire for all members of the city (type 1), random fixed samples were selected (academy, 2018), taking into account the spread of the sample for all 24 areas of the Old City according to UNICEF statistics, figure (1), thus collecting 104 samples, and to ensure the stability of the questionnaire (i.e. the probability that the same answer will be repeated when asked again after a period of time) "Alpha Cronbach test" was used. As for (type 2) the simple random sample was selected for employees (expert), who have experience with the old city's buildings laws, such as the Consultant Office of Mosul University, Governorate, Municipality, Municipalities, and Electricity offices, to represent the expert's opinion, by using the Google-form manually and electronically.



**Fig. 1:** The limits of the survey (Italian chart) (Old City Sector/ Mosul Municipality).

**Table 3:** User Survey- Type (1)

Statement topic	Code	Statement
Residential/ site influence/ client's requirements	X1	The house could be graded because of the lack of space
	X2	It is difficult to determine the ownership of the house and because of the irregular form of houses
	X3	directing the windows to the courtyard, as a result of adjacency between the houses
	X4	The inability to increase the number of floors (due to municipal laws) affects the size of the house
	X5	I'd prefer the heights of the houses be equal
	X6	I don't prefer high-rise buildings near residential homes
	X7	Windows size and direction
	X8	The courtyard is consistent with the nature of the buildings in the area
	X9	The rising of the building above the ground avoids the leakage of drainage water into the house

**Table 4:** Expert Survey- Type (2)

Statement topic	Code	Statement
The following aspects in site are depended on (the old city planning municipal law) 2 surrounding the official building with landscapes affects 1, 2	X1	In terms of the relative density of construction (land-built area)
	X2	In terms of separation
	X3	In terms of set-back
	X4	In terms of building height
	X5	Windows size and direction
	X6	Masses staggering
	X7	Windows size and direction
	X8	Traditional type

The data processing was converted to "EXCEL software", and then to "SPSS software", then using "Alpha Cronbach" test to ensure the reliability of internal consistency of the questionnaire, which showed 86% for 50 surveyors (acceptable value: greater than 70%), the results of the questionnaire were adopted to achieve the results.

Measuring variables according to the Likert scale, to translate preferences into analytical intervals, and the statements grouped according to the Site issue, then calculating the "Average value" for the replies, adding an aspect representing the average of preferences, according to intervals in Likert scale.

## 7. Statistical analyses

Type 1: Descriptive Analyses: Percentages and Frequencies

Type 2: Deductive Analyses:

- (One sample-T-test) for Comparison Analysis, to compare the average of two independent samples, devoted to show the difference of opinion between the user and the expert.

- (One-sample-T-test), (Independent-Samples-T-test) for preferred potentialities, to determine where the client’s goals embodied, which represents the formal potentialities.

### 8. Analysis of practical study

#### 8.1. Analysis of results on formal potentialities/ representation of results for the user and expert

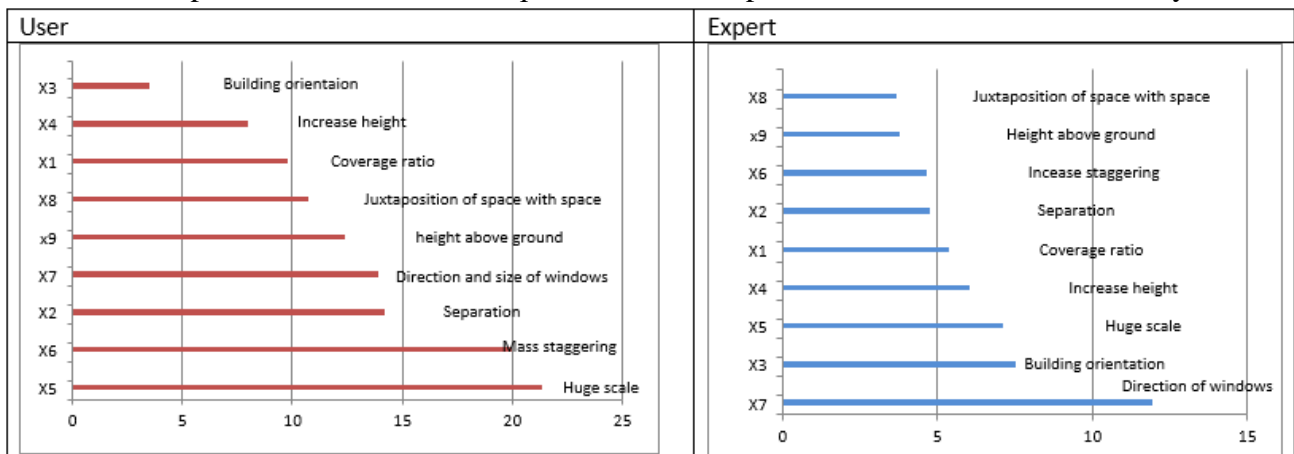
Results of “Delineation positions/ formal potentialities” according to the expert's preferences for the Site issue, (level of significance is smaller than [0.05]), which means that all paragraphs averages are consistent with the average mean, therefore rejects zero hypothesis and accepts alternative hypothesis, so the variables (direction and size of openings, building orientation, the huge scale, increase height, coverage ratio, separation, increase mass staggering, height above ground, juxtaposition of space with space) is a related formal potentialities, and the preferences priorities was represented by the value of T, as shown in table (5).

#### 8.2. Analysis of results on Delineation positions/formal potentialities according to the user's preferences for the Site issue

Which is represented by the averages of paragraphs, that are consistent with the average mean, and therefore rejects the zero hypothesis and accepts the alternative hypothesis, so the variables (the huge scale, mass staggering, separation, direction of windows, height above ground, juxtaposition of space with space, coverage ratio, height above ground, building orientation) is a related formal potentialities, and the preferences priorities was represented by the value of T, as shown in table (5).

That means the user prefers the variables related to mass scale and staggering, while the expert prefers the variables related to directions of windows and building orientation, so there is a deference between their preferences for the Site issue.

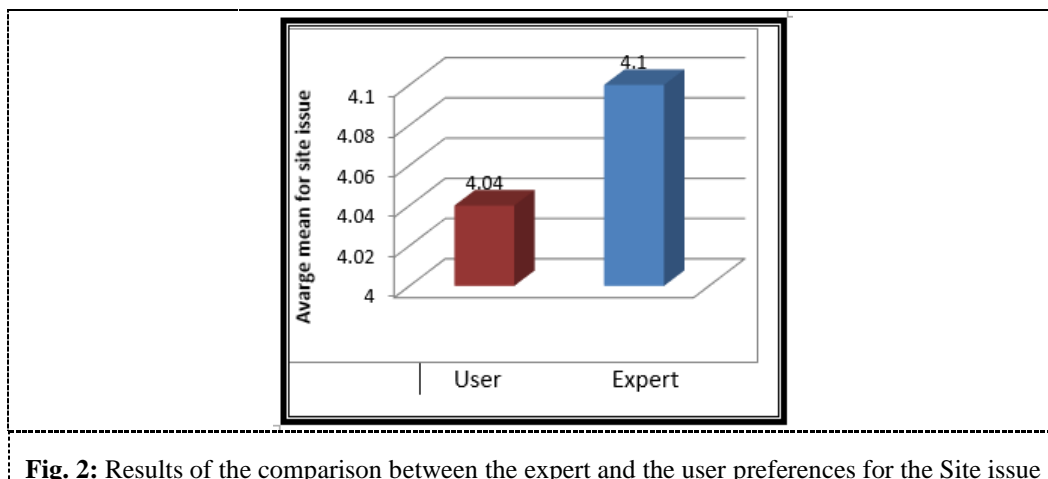
**Table 5:** The priorities of “Delineation positions/ formal potentialities” for the Site issue by T value



#### 8.3. Analysis of (independent-Samples-T-test) results related to the comparison between the (expert and user) opinions

Concerning the delineation positions/ formal potentialities for the Site issue: the results show the agreement of the expert and the user preferences on the Site issue, as the average mean for agreement (expert) is higher than the average mean for agreement (user), with a standard deviation (130), as shown in figure (2).

That shows the importance of Site issue for the programming process and its role in reconstruction of old Mosul.



**Fig. 2:** Results of the comparison between the expert and the user preferences for the Site issue

## 9. Discussion of results

There is a difference between the priorities and the importance of the formal potentialities between the user and the expert. The expert's goals are embodied in the masses (direction and size of the openings, the orientation of the building to the river related to the external urban level of the city and related to topography), followed by the importance of the masses relationships (increase large scale, increase height, coverage ratio, separation, increase mass staggering), which are related to the client's preferences, followed by adjacencies (coverage ratio, separation, rising above ground level, adjacency between spaces), because it affects relative density.

While the user's goals are embodied in masses relationships (large scale, mass staggering), which are related to the client's preferences, followed by the masses included (the outer direction of the windows, rising above ground level), which are related to topography, followed by the adjacencies (separation, increasing coverage ratio), which are related to relative density.

## 10. Conclusion

Architectural programming is acknowledged as an important scientific methodology for information management, it leads to the involvement of the client in the design process, which ensures the embodiment of his goals in architectural design, also it reduces the risks resulting from the subjective decisions of the designer, reduces the cost and time required for design and implementation.

The results of practical application highlighted the delineation positions that represent the goals of both the user and the expert (formal potentialities) scientifically, focusing on specific potentialities among others.

This research's role was "Facilitator" for the programmer, because it identify the formal potentialities associated with each of the client's goals, and was able to reduce the quantitative analysis by limiting within the formal potentialities associated with the Site issue.

The programmer of the reconstruction of old Mosul should focus on quantitative analyses for Site issue concerning residential and public buildings, which are related to the topography at the urban level of the city, also related to formal potentialities of masses (direction and size of openings, orientation of the building to the river), in accordance with the aspects of the Participatory- approach. As well as analyses related to the client's preferences related to the masses relationships (increase the large scale, increase the building height, increase the coverage ratio, separation, increasing staggering) in accordance with the aspects of the Participatory-approach. While in public buildings the programmer should focus on quantitative analyses related to the topography at the urban level of the city, also related with masses (direction and size of openings, orienting the building to the river) to achieve the expert's goals, because the user is not interested in the formal potentialities related with administrative buildings in Site issue.

So the expert is more interested in the aspects of form (related to the Site issue), this is consistent with aspects of the Agreement-approach, and the user is more interested in the aspects (client's requirements), and this is consistent with aspects of the Participatory-approach, which is partly consistent with the analytical study of the variables correlation with their data source and its aspects. That is to say, the British-methodology is appropriate to analyse the formal potentialities associated with the Site issue, because it uses qualitative analyses that enable the analysis of the formal potentialities of the client.

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