

# A Parametrical Shape Grammar Model for Generating Bedestens; a Classical Ottoman Period Commerce Building Type

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*A 3D generative parametrical shape grammar model of Bedestens; which are Classical Ottoman Period's typical commerce buildings will be presented in this paper. The model operates in a bottom-up approach and in three levels: vocabulary analyzing of Bedestens, formation of vocabulary and defining of the shape grammar rules. The future objective of the study is to implement it in a computer and use it in architectural design education.*

**Keywords:** Shape Grammar; Bedesten; analysing architectural language

## Introduction

Shape grammars are described by Tapia (1999) as a mechanism for performing recursive shape computations. Tapia (1999) states that in the system of computer implemented shape grammars having a very big theoretical appeal, computer is charged of the book keeping issues such as representation, computation of shapes, rules and grammars and the presentation of correct design alternatives. On the other hand the designer specifies, explores, develop design languages and select alternatives. A 3 D generative parametrical shape grammar model of Bedestens; which are Classical Ottoman Period's typical commerce buildings is developed. As described above, the design language is analyzed by the designer who explore the design system and the generation of the new design alternatives are shaped through a process in which he/she makes simple and basic choices.

The model which operates in a bottom-up approach can be described at three levels:

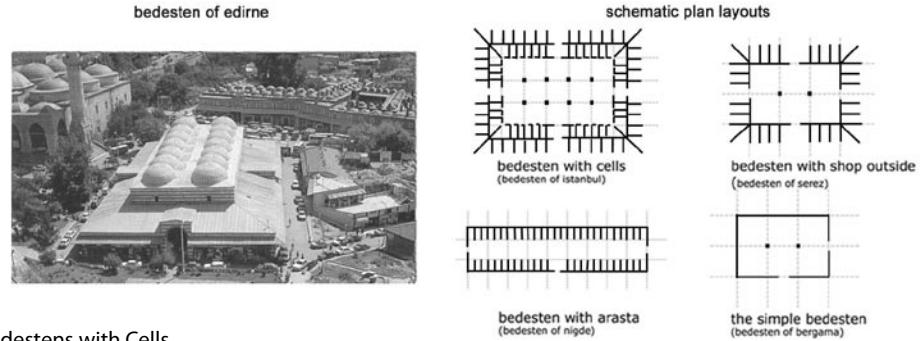
- At the first level a vocabulary is formed by analyzing Bedestens syntactically and formally;

- At the second level this vocabulary is transformed into a shape grammar.
- Finally the shape grammar rules are defined as a space of possible designs according to these analyses.

## Bedestens

Bedesten is defined by Cezar (1983) as a special section of the bazaar where only clothing commerce is available. There are two different types of Bedesten buildings classified regarding to the periods which they belong to; Seljuk Period's Bedestens and Ottoman Period's Bedestens. The classification made by Cezar (1983) is made according to the Bedesten's plan layout characters and their functional uses. This classification is considered as the framework of the analyses. Some very complex types which can be considered as hybrid types are excluded from the scope of this study. The classification of Cezar (1983) and the schematic plan layouts are shown below:

Figure 1  
Bedesten of Istanbul and schematic Bedesten Layouts



1. Bedestens with Cells
2. Bedestens with Shop Outside
3. The Arasta-Bedestens
4. Bedestens with Arastas
5. The Floor Bedestens
6. The Simple Bedestens

The 4th and 5th types are excluded as explained above. The analyses are constituted from 21 examples from different types; and there are at least one Bedesten from each type included in the analyses folder, represented with a schematic plan; Bedesten of Beyşehir Bedesten of Bursa, Bedesten of Edirne, Eski Bedesten, Bedesten of Tire, Bedesten of Serez, Bedesten of Niğde, Bedesten of Bergama.

### The Generation Process

The generation process is divided into 2 phases; a 2 dimensional phase and a 3 dimensional phase;

- 1st phase: On the plan layout dimension axes, square-shape dome bottoms, columns, main shape (square shaped or rectangular), cells and shops.
- 2nd phase: On the facade dimension; facade walls of the main shape, cells and shops, doors, windows, domes, dome bottoms and vaults.

After analyzing the design repertoire of the Bedestens, the design vocabulary is constituted; these are the repertoire elements forming raw design shapes as a vocabulary of a natural language ready to constitute meaningful sentences. The grammar rules are the conditions of forming meaningful designs. The rule sets that are determined according the following logic; "How the design process starts, how and in

which sequence the design principles are applied?"

The generation process is applied in the following sequence:

- Creating of the axe system according to the dimensional and numerical constraints;
- Generating the main shape with the help of the axe system;
- Locating the central columns;
- Locating the cells and their openings;
- Locating the shops and their openings.

Consequently the 2 dimensional phase of Bedesten generation process is determined and the following process is the 3 dimensional phase with a similar logic of rule sets depending on the facade principles of Bedestens.

While generating a Bedesten there are 3 possible roof cover system that are varied according to the Bedesten types:

- 1st possibility is about the Bedestens with Cells where the cells are covered under the main roof, where the cells and the shops are covered under the same roof and where they are separated;
- 2nd possibility is about the Bedestens with Shops where the shops are covered with a different roof structure than the main shape which is covered by a vault or by domes;
- 3rd possibility is for the Arasta-Bedestens where main shape is covered by a vault parallel to the longer edge and the cells are covered independently with a terrace or pitched roof system.

After defining all the possible roof covering

modes the generation process is applied in the following sequence;

- Elevating the main shape height;
- Elevating of the cells;
- Elevating of the shops;
- Locating the domes;
- Locating the main shape's windows;
- Locating the doors.

The 3 dimensional Bedesten is finally constructed from a set of rules constituted after a broad study and analyzing period. Below the rule set of the generation process is shown with the schematic plan and elevation layouts on Figure 2.

## Conclusion

The main objective of this work was to 'illuminate a design space' (Proctor, 2001), a particular one: Bedesten, a building type dating from the centuries and belonging to a certain culture. More important for us to dissolve the architectural method, this means the design intuition and the environmental and social factors which finally lead to the form of Bedesten. Architectural vocabulary is a second degree of importance in this study. The developed shape grammar examines the topology, dimension and proportion issues and this way all the architectural details belonging to the design process are deeply observed. In every step of the process the user is more and more merged in to the issue when the architectural language is slowly dissolving.

This understanding of the shape grammar studies belongs to an educational perspective. In architectural design projects where the context is historical or where there is an important historical reference building, we experience that the student's approach to this kind of architectural design problems is more like picking up the architectural elements and using it in their own designs which is just a copying and pasting attitude. This kind of approach leads to superficial design solutions which are not belonging to the contemporary design understanding and not creative at all. The implementation of such grammar is where the vocabulary of the architectural language is dissolving and the design

process is bringing to life. This way the student is more and more aware of the architectural characteristics of the Bedestens, questioning the process and this way internalize the architectural style and culture.

A computer implementation of this study is not made but the algorithm is rigorously constructed in order to easily implement it in a computer application which is the future plan about this study. A computer implementation aiming to be used in the architectural design studios especially in the beginners level and this way give the students a profound view to the historical or vernacular architectural styles and at the same time helping them to understand the architectural design problem; collection of the architectural data, the methodology, the environmental inputs, the functional inputs, the inputs originating from the context and this way to improve their architectural intuition.

Furthermore beside the educational objectives this shape grammar implementation can be used in comparison with the contemporary shopping mall design and contribute some new approaches. Today shopping malls are the mega buildings which are seriously affecting the urban qualities of the cities. The design approaches of them are seriously studied in very different contexts and in graduate levels. Design principles of the contemporary shopping malls and the Bedestens of the Classic Ottomans can be studied as a whole system; as a research on the shopping issue.

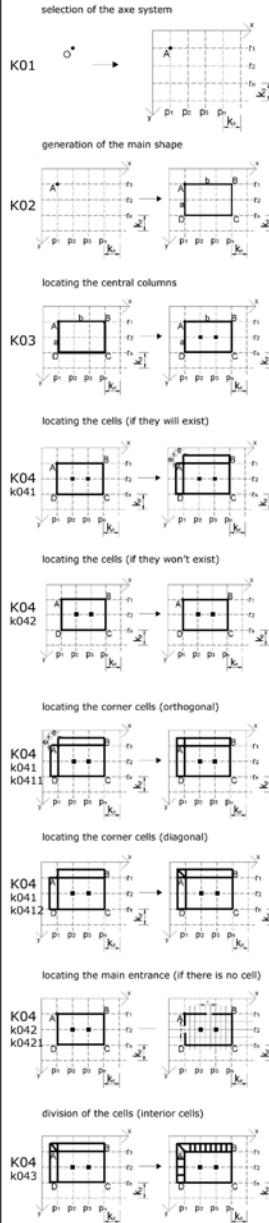
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Figure 2  
Rule Set for Bedesten Generation Process

rule set for Bedesten generation process

2 dimensional phase



3 dimensional phase

