

Indoor Soundscape of Historical Spaces: The Case of Çengelhan Caravanserai

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Summary

Aim of this paper is to conduct a qualitative research which explores and identifies the indoor soundscape of historic spaces. Research has taken place in the Cengelhan Caravanserai. Historic building is currently used by the Rahmi Koç Museum, an institution concerned with collecting, researching, preserving and exhibiting industrial and engineering object from all countries and periods up to present day. Building is located in front of the main gate of Ankara Castle. It is constructed at the first quarter of sixteenth century as caravanserai, and used for various different purposes until its comprehensive restoration and conversion into a museum at the beginning of twenty first century. Grounded theory is used for exploring both indoor and urban soundscapes previously. This paper also uses the grounded theory method to identify the context of indoor soundscape in this historic caravanserai. Semi-structured interviews are held with participants until the data reaches theoretical saturation. Constant comparison method is used for analysing the data and creating a conceptual framework. Results showed that core categories of the framework, such as the context of sound, are similar with previous work, while some categories are different, possibly due to the function of the indoor space. Findings indicated that sound can be used to create a living environment with a unique atmosphere that would enhance the visitors' experience to a maximum degree.

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1. Introduction

Soundscape approach was introduced in late 1960's, by R.M. Schafer and it reached peak popularity within the last decade [1]. Soundscape is concerned with the perception of sound rather than the transfer of sound energy. ISO 12913-1 defined soundscape as "the acoustic environment perceived or experienced and/or understood by a person or people, in context" [2]. Great majority of the soundscape research has focused on urban environment, with very little attention to the indoor environments. However, there are various types of indoor environments that serve different functions and completely different sound environments.

Main functions of the museums are collection, education, recreation and exhibition [3]. In modern times museum experience of the visitor does not necessarily have to be passive but it can also

encourage interaction which the sound can be potentially used as the mediator.

With this regard, aim of this paper is to investigate visitors' subjective perception of the museum soundscape and how it effects the visitor experience. Secondly, we seek to identify the associations between the soundscape, function and the historic characteristics of the museum. With this regard, qualitative approach of grounded theory is used to explore the phenomenon.

2. Method

2.1. Case Study Settings

Cengelhan is constructed between 1520 and 1521[4]. It is located at the historical commercial centre of Atpazarı square, right in front main gate of Ankara Castle. This area is also referred to as the



Figure 1: The inner courtyard (left) and the ground floor plan (right) of Cengelhan. Red spots indicate the sound source location used in the ODEON model

caravanserais district due to the large number of caravanserais. Until its restoration at 2005, building is used for various functions. Through the centuries, buildings' main function was an inn with a marketplace located at its inner courtyard and front facing façade [4]. During last few decades however, it was used as a tannery and until its adaptive reuse, the building was very far from its current identity of a cultural hub. With the restoration efforts of 2005, the building is converted into a museum which houses exhibitions that display industrial and engineering marvels of past decades.

The single storey building has an inner courtyard and a basement floor. The courtyard at the middle is surrounded with vaulted cloisters (Figure 1). The inner courtyard is covered with a glass roof during the restoration (Figure 1) and has the total height of 10.5 meters. Ceiling height of the ground floor is 3.5 meters, while ceiling height of the upper floor is 3.2 meters. Courtyard floor is covered with a thin layer of carpet over the original stone floor. The floor material of the cloisters and rooms are generally stone too, but wooden floor planks are also used in some rooms. Ceiling of the cloisters and rooms are brick vaults, while the walls made out of a combination of brick and local stone.

2.2. Data Collection and Analysis

Data collection is held by semi-structured interviews. A total of 15 interviews are held with 5 male and 10 female participants. Their age varied between 25 and 60. Interviews are held after the participants toured the museum at their own pace. Interviews lasted between 9 to 19 minutes. All interviews are recorded and transcribed verbatim

Data collection continued for 3 days and ended once the data reached theoretical saturation and no longer provided any new insight.

Grounded theory (GT) is used to analyse the data. This procedure used three phases of coding and relied on theoretical saturation and constant comparison. At the beginning, interview transcriptions undergone sentence by sentence *open coding* which separated the data into pieces by labelling each significant event. After the data are broken down into pieces, which held the essence of the significant events, the data are grouped back together based on their association with each other by using the *axial coding*. This procedure created the categories. Based the relation between the categories, such as causal relationship, a framework is created to visualize the emerging theory. In the last phase, the selective coding, a category which reflects the core of the phenomenon is chosen. Its relation to other categories are explored which creates the theory to explain the phenomenon.

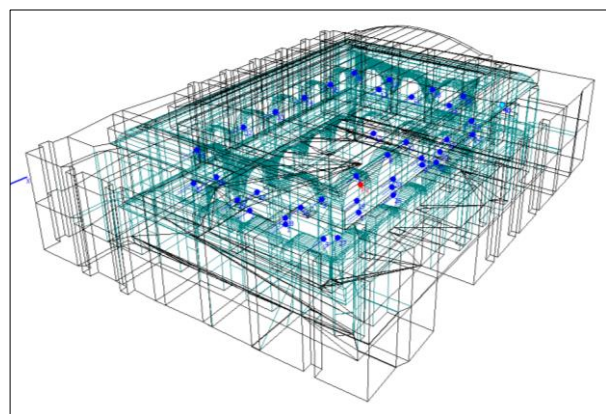


Figure 2: Sound source and receiver locations of the ODEON model.

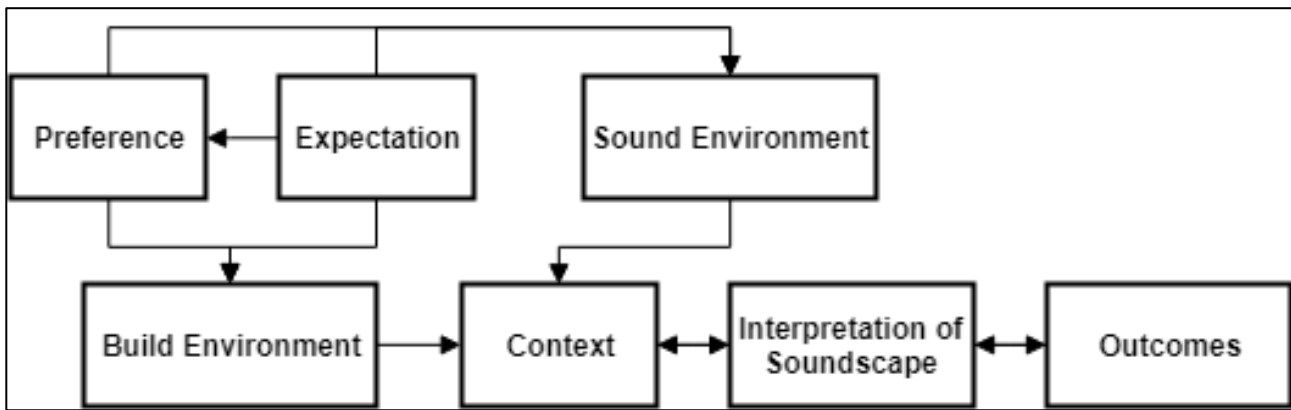


Figure 3: The conceptual framework that is created after the GT analysis.

ODEON Room Acoustics Software is also used in order to acquire a brief idea about the acoustical parameters of the building. Three dimensional model of the building is created with SketchUp 2017 software, based on the recent restoration drawings. Model is exported to the ODEON Room Acoustics Software version 12 basic edition (Figure 2). In order to find the Speech Intelligibility Index (STI) and Reverberation Time (T30), 40 receiver and 6 sound sources are placed in key locations.

3. Results and Discussion

According to the ODEON simulation the speech transmission index (STI) ratings ranged from 0.43 to 0.77 with average rating of 0.53. Reverberation Time (T30) also simulated with ODEON software which indicated that the average T30 ratings for the common frequencies of speech are, 2.25 for 500 Hz, 1.95 for 1000 Hz and 1.86 for 2000 Hz.

Grounded theory analysis of the interview data resulted in a conceptual framework with 7 categories (Figure 3). These categories are Sound Environment, Build Environment, Context, Preference, Expectation, Interpretation of Soundscape, and Outcomes. The key phenomenon in this framework is the Interpretation of the Soundscape. Conceptual framework represents how this process works.

3.1. Expectation and Preference

Expectation and *Preference* are the causal conditions of the framework. Visitors' expectations and preferences regarding the physical and auditory environment cause them to make a judgement call about whether the environment is on par with their predetermined expectations and preferences once they visit the space.

Expectations are formed by individuals past experiences [5]. Almost half of the participants were unfamiliar with the museum and unaware of the theme of the museum. When the participants' were told that they will be visiting a museum, majority of them thought that it will be a modern building, like a contemporary art museum based on their former experiences with museums. Similarly, there were architects among the sample group who had professional knowledge about the necessities of museum design and had very fixed expectations about subject. Majority of the participants' expectations were related with the build environment rather than sound environment.

Expectation also has an influence on individuals' preference. Both the expectations and preferences are predetermined and formed by prior knowledge. Majority of the individuals preferred to have a quiet environment in the museum as they expected that it would be hard to concentrate on the exhibit if the environment is loud. Similarly some of them preferred the museum to be a modern environment beforehand. Once they experienced the historic build environment and its relation with the exhibit, they were satisfied regardless of their preferences. Thus, it can be said that *Expectation* and *Preference* are the first step towards the interpretation of the soundscape, and *Expectation* also has an influence over *Preference* up to a certain degree.

3.2. Sound Environment and Build Environment

In the sense of qualitative research model, the categories of *Sound Environment* and *Build Environment* accounts for the context of the research (not as in context of the sound). These

Categories						
Expectation	Preference	Build Environment	Sound Environment	Context	Interpretation of Soundscape	Outcomes
		<ul style="list-style-type: none"> • Physical Aspects • Perceptual Aspects 	<ul style="list-style-type: none"> • Sound Sources 	<ul style="list-style-type: none"> • Consistency • Inconsistency 	<ul style="list-style-type: none"> • Positive Interpretation • Neutral • Negative Interpretation 	

Table I: Categories and the subcategories which are found at the end of data analysis.

categories are the context in which the actions are taking place in, a location.

Based on data analysis the category of Build Environment divides into two subcategories (Table I), *Physical Aspects of the Build Environment* and the *Perceptual Aspects of the Build Environment*. Physical aspects consists of items such as materials, layout, content of the exhibitions, and space definition (large-small, open-enclosed, historic-modern). On the other hand, perceptual aspects of the space are comprised of statements that describe the space regardless of the sound environment, such as, cozy, orderly-complicated, crowded, and boring/ordinary.

Sound Environment includes the subcategories of sound sources, background sound, and participants’ descriptions regarding sound environment (high-low sound levels, controlled-uncontrolled sound environment).

3.3. Context

Context is an intervening condition. *Context* shapes, facilitates and/or constrains the interpretation of the sound environment. *Context* is divided into two items as consistency and inconsistency. Similar to the previous research [2][6][7][8], we have found that context is the most important element towards the interpretation of the soundscape. In this sense, context of the sound is not independent from the physical environment [8]. Throughout the research, it was seen that even the most frustrating sound environments can at least become non-irritating, if not satisfactory, as long as it is consistent with the context. In the part of the museum, where the section is dedicated to doll houses and century old toys, a visit from an elementary school would not become so annoying it might be thought. Even though the school children make the environment feel loud and crowded, various accounts stated that they did not find the sound of the children annoying

or disturbing. When asked about this event, one participant (*P*) stated:

P: That part, at downstairs, was the toys section. Children were yelling at each other, some of them were calling for their teacher. It matched what was displayed. What I was looking at was kids’ stuff. Sound matched with the objects and created strong interaction (translated from Turkish).

Indoor environment of a museum can be comprised of different sections with various different themes. Physical and auditory elements within the environment create a context. If this context of sound is consistent with environment or suitable for its function it can greatly influence the interpretation of the soundscape.

3.4. Interpretation of the Soundscape

Central phenomenon of this research is the Interpretation of the Soundscape. It consists of subcategories of positive interpretation, neutral, and negative interpretation. These subcategories are also a response to the interpretation of the soundscape. When the interpretation is positive, it can lead to appreciable, interesting or intriguing environment. On the other hand, when it is negative it leads to irritating, unenjoyable environment.

Context of the sound is a major factor that influences the interpretation of the sound. As previously given examples demonstrated soundscape can be interpreted positively if it matches with individuals’ expectation and context. Soundscape can also be interpreted positively even if does not match individuals’ expectation, as expectations are not necessarily positive. An individuals’ can expect the museum to be an ordinary and boring environment.

Even though having a background sound is appreciated by majority of the participants. Almost all expressed dissatisfaction with the type of music

that is broadcasted. Participants' common choice of background sound is found to be classical music, as they think that it will not interfere with their concentration but merely create a soft background sound. Not having any background sound at all is not preferred, as the participants' were aware that it is impossible to rid the space of uncontrolled sounds, especially human generated ones, and these sounds will cause more distractions with the absence of a background sound that can mask them to a certain degree at least.

3.5. Outcomes

Previous section demonstrated individuals' interpretation, and their responses to the soundscape based on this interpretation. These responses to soundscape result in various positive and negative outcomes. A soundscape that is interpreted as interesting, intriguing or appreciable, can result in a positive contribution to the atmosphere of the space. For this specific environment, interaction with the displayed object is perhaps one of the most important factors to promote an appreciable museum experience. If we consider the fact that it is not usually allowed to touch the displayed objects, best way of forming an interaction with the exhibit is by hearing it. Sections of this museum is dedicated themes such as, craftsmanship, historic cars, vintage toys, and engineering marvels. To some extent sound is used as a design element to create the feeling of being present in that environment. Buildings historic characteristic greatly helped participants to imagine themselves being in the actual environment. This atmosphere is further enhanced with introduction of different sounds depending on the contents of the exhibitions. In the exhibitions, like blacksmithing or carpentry, hearing the sound of the hammer hitting the anvil or a saw cutting through a wood plank made visitors to imagine themselves travelling through a bazaar of old times. In a way it can be said that proper usage of sound gave life to the space.

P: It was like the museum was blended into real life. I felt like I toured through a bazaar rather than a museum.

The combination of the historic aspect, function and the sound of the building created a unique atmosphere. As a participant stated, mixture of the historic stone walls and the wooden floors, with the exhibitions that display the life of the past generations created a visual atmosphere that took

the participants decades back in time. Addition of proper sound elements further enhanced the atmosphere and created a unique sensation that feels like the building is speaking to them.

P: It felt like I went back in time and lived that moment. It was not just a space surrounded with four walls. It had a unique atmosphere.

Every participant appreciated the usage of sound based on the theme of the section. However, some of them complained that sounds levels were too high in some sections and too low in some others which caused sound interference. Participants especially enjoyed the sections where they can control the sound with buttons, but could not use this to its full extent as the sound within that room was too low and the sound outside the room was too high. This created a sense of frustration as the participants' tried to understand the message conveyed through the sound.

As it was expressed earlier, under right context even the most frustrating sound sources, like the sound of yelling children, can be appreciated. But, when these children moved from the toys section to a more serious section, their uncontrolled sound has become an issue. Participants expressed that when the space became so crowded and filled of irrelevant speech it caused a loss of concentration, disturbance and made them want to get away from that part of the exhibition as an outcome.

4. Conclusion

This research investigated individuals' subjective perception of the soundscape of a museum and the associations between the soundscape, function and historic aspect of the building. Findings indicate that individuals' desire the sound environment to be designed just like the physical environment. Under right conditions sound can be used to create a living environment with a unique atmosphere that would enhance the visitors' experience to maximum degree.

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