

# Spatial Typology in Tabriz Bazaar based on the Soundscape\*

**Bitā Shafāee<sup>a</sup>- Abbas Ghaffari<sup>b\*\*</sup>- Morteza Mirgholami<sup>c</sup>**

<sup>a</sup> Ph.D. in Islamic Urban Planning, Faculty of Architecture and Urban Planning, Tabriz Islamic Art University, Tabriz, Iran.

<sup>b</sup> Associate Professor of Architecture, Faculty of Architecture and Urban Planning, Tabriz Islamic Art University, Tabriz, Iran (Corresponding Author).

<sup>c</sup> Professor of Urban Planning, Faculty of Architecture and Urban Planning, Tabriz Islamic Art University, Tabriz, Iran.

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## ABSTRACT

Soundscape is the perceptual quality of heard sounds. This study examines soundscapes of nine spaces of three special types in Tabriz Bazaar, Bazaars' aisle (Rasteh), Malls (Timcheh), and stores (Sarai). The extant study aims to find how the soundscape of the three spatial types is perceived and how special features affect the quality of soundscapes of studied spaces. For this purpose, perceptual components of soundscape were surveyed by individuals who were present in the studied spaces of Tabriz Bazaar. This assessment was conducted based on scores given to perceived loudness of sound, acoustic comfort, noise source acceptability, and soundscape descriptors through the questionnaires filled out by 384 members. The research results indicated that the soundscapes quality of different spatial types of Tabriz Bazaar was affected by the environmental qualities, specifications, and sound sources. In static and unpopulated spaces that provide the possibility for pause and watch, the soundscape is more pleasant. Overpopulation usually reduces the perceptual quality of soundscape. The sounds with the sudden incidence in quiet spaces have a bad effect on the acoustic comfort and quality of soundscape due to the sound pressure level (SPL) difference. Therefore, a component called urban soundscape clarity must be considered in the studies conducted on the soundscape of quiet urban spaces. Moreover, sound source acceptability and quality of soundscape will be higher if the noise sources are matched with the acoustic expectations of users, in other words, the sounds heard in the space are consistent with its nature.

**Keywords:** Soundscape, Special Features, Urban Soundscape Clarity, Acoustic Expectations, Tabriz Bazaar.

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\*\* E\_mail: ghaffari@tabriziau.ac.ir

## 1. INTRODUCTION

The quality of sound heard in the city, and its spaces are addressed in urban soundscape studies, which have received great attention in recent decades. The International Standardization Organization defines this concept as an “acoustic environment as perceived, experienced, and understood by people, in context” (Standardization 2014).

Soundscape study addresses sound experience (Wagstaff 1998). Soundscapes of urban spaces become meaningful through human perception of the acoustic environment, which meaning is always concerning the specifications of time, place, and current activities in the space (Maculewicz, Erkut, and Serafin 2016). Moreover, the perception of the acoustic environment concerns the effect of ongoing activities in it. According to studies conducted by Meng, Sun, and Kang (2017), and Meng and Kang (2015), the activities done in urban spaces and the population density rate in the space considerably affect the quality and desirability of the soundscape. The adoption of abstract and subjective views on the perception of sounds heard in the environment redirects studies from acoustic research to the soundscape field (Lionello, Aletta, and Kang 2020).

Many studies (Kang et al. 2016; Lavia et al. 2012; Margaritis et al. 2015; Hong and Jeon 2015; Steele, Steffens, and Guastavino 2015) have indicated that soundscapes in public urban spaces highly depend on the place function because this index of sound sources determines the environmental and physical specifications and ongoing activities in the place. Therefore, one can examine sound sources, environmental qualities, population, and activities as factors affecting the quality of urban spaces' soundscape, and distinctive indicators in selecting case studies for comparisons.

The nature of heard sounds and the type of acoustic sources are other important points. Farina divides sounds into three categories based on their sources: geophony (sounds produced by natural factors), biophony (sounds produced by organisms), and anthrophony (sounds produced by human activities) (Farina 2013). Moreover, the sounds heard in the space can be divided into three point, linear, and zone categories based on the nature of noise sources (Ghiabaklou 2018). Moreover, various categories of heard sounds have been proposed in terms of perception: Keystones, Sound signals, and Sound marks (Payne, Davies, and Adams 2009).

Studies on the soundscape must be done based on the local and contextual features, as well as the effect of social properties and cultural background of that society on the perception of the soundscape. This study examines the acoustic experience of individuals in terms of the soundscapes of different urban spaces by selecting three special types of Tabriz Bazaar. This study aims to answer the following questions:

1. What is the perceptual quality of soundscapes in

spatial types in Tabriz Bazaar?

2. What factors affect soundscapes in different spatial types in Tabriz Bazaar?

Distance from adjacent streets (Herranz-Pascual et al. 2017), overcrowding (Meng, Sun, and Kang 2017), and dynamism or static status of space and sound sources (Hong and Jeon 2015) are the factors that affect the quality of soundscapes of studied spaces are examined as the hypothesis.

## 2. MATERIALS AND METHODS

Many studies tend to identify the relations between indicators, including contextual and environmental factors, and soundscape descriptors to determine how soundscape is perceived (Jo and Jeon 2020). In a systematic review conducted by Lionello et al. (Lionello, Aletta, and Kang 2020) 2020 that scrutinized the soundscape studies, the questionnaire was identified as the most common method has been used to examine the perceptual status of soundscape and soundscape evaluation through sound descriptors based on 5-point Likert scale has been the most practical technique. The present paper is a qualitative study that surveys people's perception of the soundscape of spaces in Tabriz Bazaar using a questionnaire. This questionnaire asks about the perceptual loudness of heard sound, perceived acoustic comfort, and acceptability of sound sources. Soundscape descriptors were used to reveal the quality of soundscapes in studied spaces. Soundscape descriptors serve as measures to explore how people perceive the soundscape (Lionello, Aletta, and Kang 2020). The soundscape descriptors are scored based on the semantic Likert scales (Hong and Jeon 2020; Jo and Jeon 2020; Liu et al. 2019; Lionello, Aletta, and Kang 2020; Ma, Mak, and Wong 2021; Cao and Kang 2021; Kang and Zhang 2010). Questionnaires are also used to derive the acceptability of sound sources in urban spaces. The reason is that sound preference is the key component that reveals the quality of soundscape, which associates with the sound sources existing in the environment (Morillas, Escobar, and Gozalo 2013).

### 2.1. Studied Area

This study selected nine spaces of Tabriz Bazaar, which comprise three stores (sarai), three malls (timcheh), and three aisles (rasteh). The distinctive point that led to the selection of these nine spaces was the distance from the street to examine the possible effect of the street on the soundscape and population and overcrowding rate in the street. The reason is that overcrowded streets can affect the perception of the acoustic environment and subsequently the quality of the soundscape (Meng and Kang 2015).

Moreover, three spaces with high, medium, and low sizes and dimensions were selected in three cases of each spatial type. Figure 1 depicts the location of studied spaces in Tabriz Bazaar.

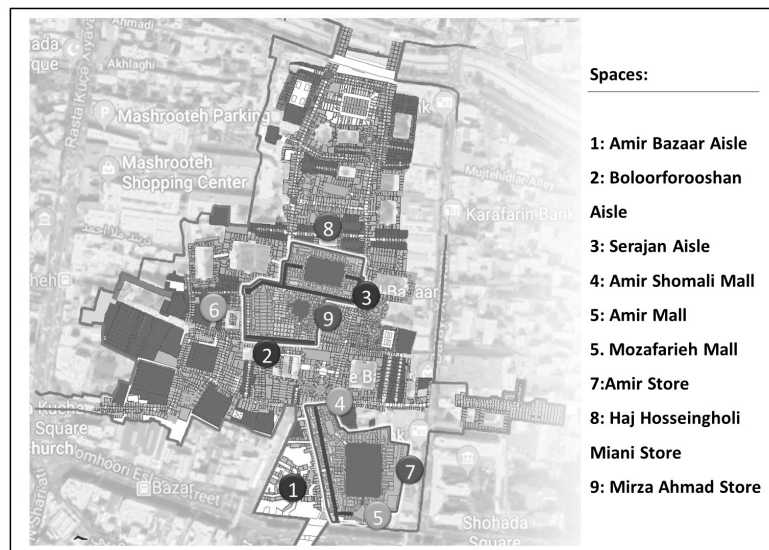
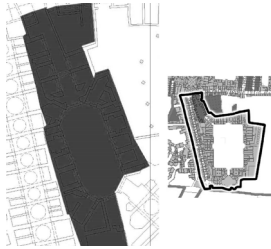
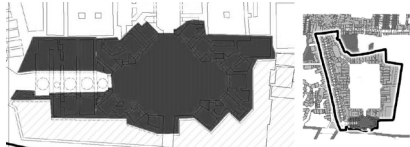
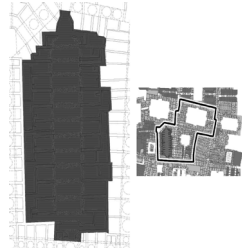
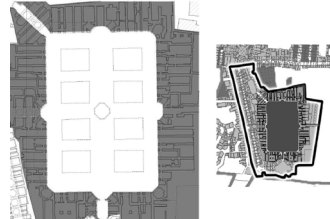

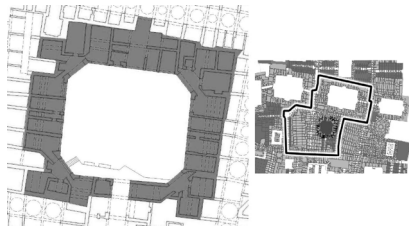


Fig. 1. Location of Studied Spaces in Tabriz Bazaar

Table 1 reports the name of studied spaces and their difference in terms of crowding, distance from adjacent streets, and the number of people tested in each space.

Table 1. Introduction to Studied Spaces and Tested Individuals

Spatial Type	Row	Name of Space	Distance from Street	Crowing	Plan	Number of Tested People
Bazaars 'Aisle	1	Amir Bazaar Aisle	The Immediate Area of Street	Medium		64
	2	Serajan Aisle	Heart of Bazaar	Relatively low		53
	3	Boloorforooshan Aisle	Middle Part	High		75

Spatial Type	Row	Name of Space	Distance from Street	Crowding	Plan	Number of Tested People
Malls	4	Amir Shomali Mall	Middle Part	Low		15
	5	Amir Mall	The Immediate Area of Street	Medium		21
	6	Mozafarieh Mall	Heart of Bazaar	High		32
Stores	7	Amire Store	The Immediate Area of Street	High		74
	8	Haj Hosseingholi Store	Heart of Bazaar	Medium		35
		Mirza Mohammad Store	Heart of Bazaar	Low		15

## 2.2. Statistical Society, Sample Size, and Sampling Method

To examine the reliability of the questionnaire, 40 questionnaires were tested in four samples of selected spaces. Cronbach alpha was calculated through IBM SPSS Statistics 25 and equaled 0.916. The statistical

population of the study comprises the people who were present in the Grand Tabriz Bazaar. This number was assumed 100000 people (the maximum rate of statistical society in Morgan Table) due to inaccurate statistics given by daily reference to the bazaar, so the sample size equaled 384 people based on this assumption (Barati, Davoudpour, and Montazeri

2013).

The approximate population density and people attending have been considered to assign the selected people (n=384) to 9 studied spaces. The selected sample must represent the nature and profile of the whole society (Ibid). The soundscape studied must pay attention to the point that various groups have different feelings and perceptions of the soundscape. Therefore, in addition to demographic factors, some other points must be considered when selecting subjects: attendance duration in the pace, frequency of presence in the space, and duration of exposure to the sound of space. Accordingly, three categories of individuals are present in Tabriz Bazaar: marketers who spend a long time daily in the bazaar, citizens who sometimes come to the bazaar, and tourists who come to Tabriz Bazaar in limited numbers. Accordingly, a non-random purposive sampling method was used in this study. It means that the author tried to select respondents from all three mentioned groups in each studied space. Moreover, respondents filled out the questionnaire at the peak time of people attending, that is the more crowded and noisy hours of the bazaar to observe uniformity in test conditions.

### 3. FINDINGS

Findings obtained from the research survey can be

examined within two categories of soundscape quality and sound source acceptability, which are addressed herein:

#### 3.1. Soundscape Quality of Studied Spaces

The quality of soundscapes of Tabriz Bazaar's spaces has been surveyed through questionnaire analysis within three general parts: subjective or perceptual sound loudness and acoustic comfort, the desirability of heard sounds, and soundscape descriptors. The perceptual sound loudness and acoustic comfort are directly correlated. The higher the acoustic comfort, the higher satisfaction with the soundscape will be. The mean score of sound sources indicates to what extent sound sources are pleasant for people. Therefore, increased desirability of heard sounds will improve the soundscape quality. Soundscape descriptors determine how people perceive and describe the soundscapes of spaces in Tabriz Bazaar. Table 2 reports the mean score of soundscape descriptors, the desirability of sound sources, sound perceptual loudness, and acoustic comfort in each space of the bazaar. The mean score of each component has been measured in three rows to compare the soundscape qualities of different spatial types.

**Table 2. Soundscape Quality of Studied Spaces based on the Users' Expressions**

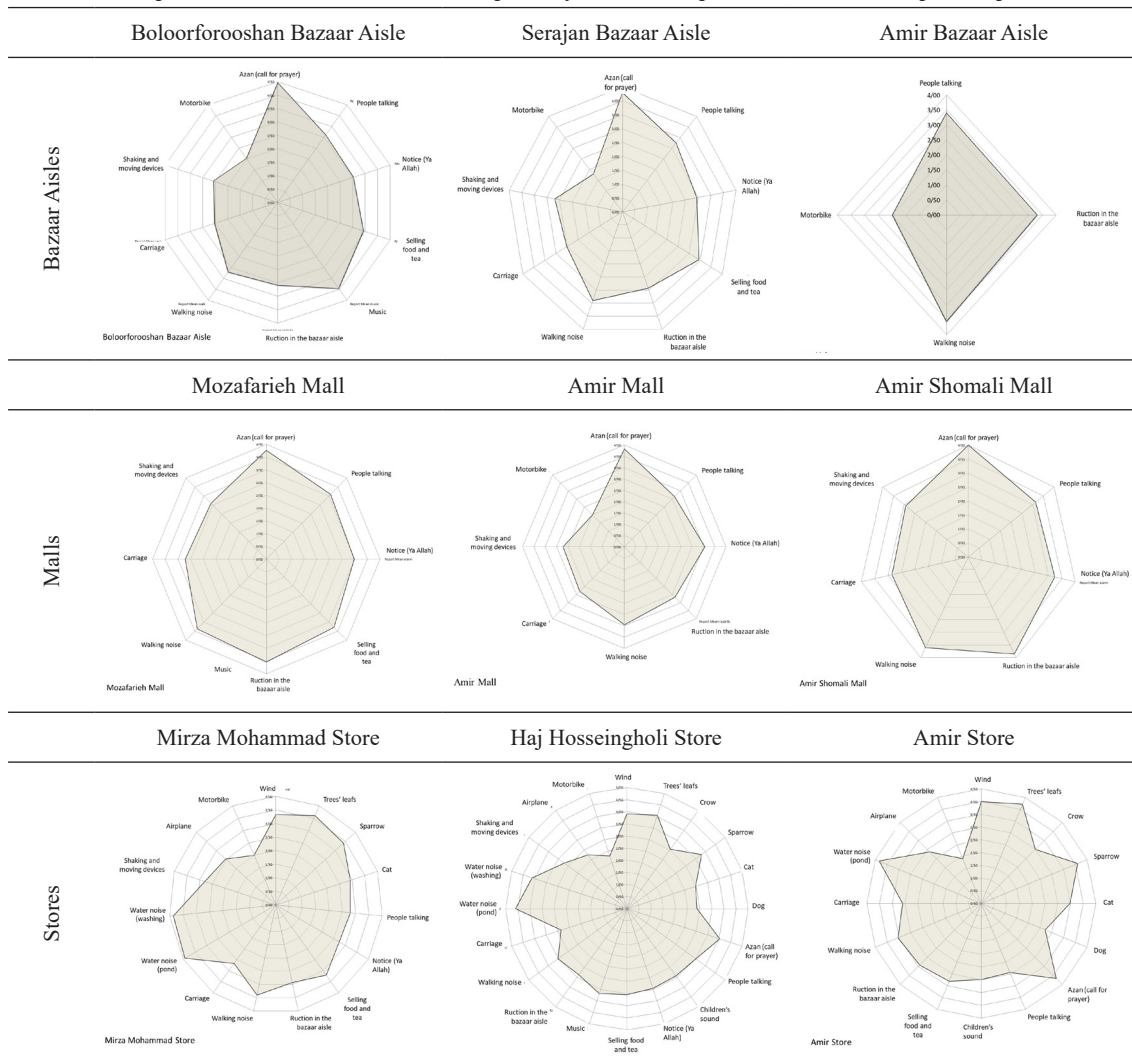
	Sound Loudness	Acoustic Comfort	Sound Source Desirability	Interesting	Lovely	Natural	Pleasant	Beautiful	Safe	Energizing
Amir Bazaar Aisle	19.3	38.3	06.3	87.3	97.3	47.4	11.4	17.4	15.4	85.3
Serajan Bazaar Aisle	95.2	08.3	03.3	75.2	43.3	96.3	04.3	49.3	54.3	09.3
Boloorforooshan Bazaar Aisle	00.3	18.3	14.3	42.3	67.3	92.3	02.4	67.3	69.3	26.3
The Mean Score of three Bazaar Aisles	04.3	21.3	07.3	34.3	69.3	11.4	72.3	77.3	79.3	40.3
Amir Shomali Mall	60.3	00.4	37.3	50.4	53.4	73.4	40.4	60.4	43.3	27.4
Amir Mall	38.3	67.3	14.3	00.3	82.3	33.4	88.3	94.3	83.3	29.3
Mozafarieh Mall	03.3	47.3	67.3	20.4	39.4	45.4	35.4	42.4	26.4	31.4
The Mean Score of the three Malls	33.3	71.3	93.3	90.3	24.4	50.4	21.4	32.4	84.3	95.3
Amir Store	09.3	30.3	38.3	95.3	82.3	00.4	92.3	03.4	00.4	58.3
Haj Hosseingholi Store	37.3	31.3	45.3	03.4	04.4	50.4	17.4	55.4	21.4	00.4
Mirza Mohammad Store	53.3	13.3	08.3	33.3	17.4	17.4	00.4	55.4	10.4	08.4
The Mean Score of three Stores	33.3	24.3	30.3	77.3	01.4	22.4	03.4	37.4	10.4	97.3

#### 3.2. Acceptability of Sound Sources in the Spaces

Table 3 reports the acceptability of sound sources in

studied 9 spaces by using spider charts.



**Table 3. Spider Charts of Sound Source Acceptability in Studied Spaces based on the People's Expressions**

Moreover, Table 4 summarizes the most desired and undesired sounds in the studied spaces and their

source, emission, and semantic aspects.

**Table 4. The Most Desired and Undesired Sounds in Studied Spaces and their Specifications**

	Desired Sounds	Sound Source	Sound Emission	Linear	The Annoying Sounds	Sound Source	Sound Emission	Sound Semantic
Amir Bazaar Aisle	Walking	Anthrophony	Zone	Keystone	Motorbike	Anthrophony	Linear	Signals
	Ruction in Bazaar Aisle	Anthrophony	Zone	Keystone				
	Talking	Anthrophony	Zone	Keystone				
Serajan Bazaar Aisle	Azan (call for prayer)	Anthrophony	Point	Marks	Motorbike	Anthrophony	Linear	Signals
					Carriage	Anthrophony	Linear	Signals
	The Sound Produced by Tea and Food Sellers	Anthrophony	Linear	Marks	Notice (Ya Allah)	Anthrophony	Linear	Signals
					Throwing an Object	Anthrophony	Point	Signals

	Desired Sounds	Sound Source	Sound Emission	Linear	The Annoying Sounds	Sound Source	Sound Emission	Sound Semantic
Boloorforooshan Bazaar Aisle	Azan (call for prayer)	Anthrophony	Point	Marks	Motorbike	Anthrophony	Linear	Signals
	Music	Anthrophony	Linear	Marks	Carriage	Anthrophony	Linear	Signals
	The Sound Produced by Tea and Food Sellers	Anthrophony	Linear	Marks	Ya Allah	Anthrophony	Linear	Signals
					Throwing an Object	Anthrophony	Point	Signals
Amir Shomali Mall	Azan (call for prayer)	Anthrophony	Point	Marks	Carriage	Anthrophony	Linear	Signals
					Ya Allah	Anthrophony	Linear	Signals
					Throwing an Object	Anthrophony	Point	Signals
Amir Mall	Azan (call for prayer)	Anthrophony	Point	Marks	Motorbike	Anthrophony	Linear	Signals
					Carriage	Anthrophony	Linear	Signals
					Throwing an object	Anthrophony	Point	Signals
Mozafariieh Mall	Azan (call for prayer)	Anthrophony	Point	Marks	Throwing an Object	Anthrophony	Point	Signals
	The Sound Produced by Tea and Food Sellers	Anthrophony	Linear	Marks				
Amir Store	Pond Water	Geophony	Point	Keystone	Motorbike	Anthrophony	Linear	Signals
	Sparrow	Biophony	Zone	Keystone	Airplane	Anthrophony	Linear	Signals
	Azan (call for prayer)	Anthrophony	Point	Marks	Talking and Children	Anthrophony	Zone	Keystone
	Pond Water	Geophony	Point	Keystone	Motorbike	Anthrophony	Linear	Signals
Haj Hosseingholi Store	Azan (call for prayer)	Anthrophony	Point	Marks	Airplane	Anthrophony	Linear	Signals
					Dog and Cat	Biophony	Point	Keystone
Mirza Mohammad Store	Pond Water	Geophony	Point	Keystone	Motorbike	Anthrophony	Linear	Signals
					Airplane	Anthrophony	Linear	Signals
					Carriage	Anthrophony	Linear	Signals
					Ya Allah	Anthrophony	Linear	Signals
					Throwing an Object	Anthrophony	Point	Signals

#### 4. DISCUSSION

The answer was given to the first question of the study in section 3.1. indicated how soundscapes of different spatial types of Tabriz Bazaar are perceived. The factors affecting the quality of soundscape were used to select the subjects. It was explained in section

1 that distance from adjacent streets (Herranz-Pascual et al. 2017), overcrowding (Meng, Sun, and Kang 2017), the dynamic or static status of space and sound source (Hong and Jeon 2015) are significant components used to select the studied spaces. Hence, the obtained results can be generalized to spatial types of Tabriz Bazaar.

Research findings are discussed regarding the second question of the study, which identifies factors affecting the quality of soundscapes in spatial types of bazaars. It was explained in section 1 that effect of four components (distance from the street, overcrowding and population density, dynamic or static spaces, and sound source specifications) was studied as the research hypothesis. This part of the study discussed the effect of mentioned factor by analyzing the results conducted in section 3.

- Distance from the street: previous studies (Herranz-Pascual et al. 2017) have confirmed the negative effect of the street on the perceptual quality of soundscape. The shorter the distance from the street, the lower the soundscape quality will be due to the louder noise of the street. The present paper studied two areas in terms of distance from adjacent streets. The immediate area far from the street included the Amir bazaar aisle, store, and mall, while the other studied spaces were located in the context of the market. According to surveys, the noise of the street and traffic is not heard in the immediate area of the street. The market body indeed serves as acoustic insulation preventing the street noise from getting into the indoor space of the bazaar. However, distance from the street had no significant effect on the soundscape quality of the studied spaces.

- Spatial proportion (static and dynamic) and population density: in terms of spatial proportion, bazaar aisles are dynamic, while malls and stores are static spaces in this study. In terms of population density bazaar aisles are the most crowded spaces, and stores are more crowded than malls.

In terms of perception, the sound is louder in bazaar aisles (Rasteh) rather than in stores (Sarai) and malls (Timcheh), while no difference exists between Sarai and Timcheh. On the other hand, acoustic comfort is directly affected by the sound loudness. Hence, the same level of perceptual sound loudness exists in Tismche and Sarai, while acoustic comfort in Timcheh is considerably more desirable. On the other hand, Rasteh is noisier than Sarai but no significant difference exists between them in terms of acoustic comfort.

Hence, the effect of static or dynamic status and overcrowding of the space on the soundscape quality is revealed. The difference between Timcheh and Rasteh in terms of their transition or static nature and overcrowding affects the desirability of the soundscape. When people are present in a pause, and static space with a low population are more satisfied with the acoustic environment compared to the time when they are in transition spaces with more crowding. This case can be explained in comparison between Timcheh and Sarai. These two types are static spaces, while the soundscape is more comfortable, lovely, and pleasant when population density is lower. This result is in line with findings obtained by previous studies (Meng, Sun, and Kang 2017; Zhao et al. 2018;

Meng and Kang 2015; J. Li and Meng 2015).

- Sound sources; sound occurrence: nature of sounds heard in spaces and occurrence method are other important factors that affect the acoustic comfort of each space and its soundscape quality. According to research findings, the most undesirable sounds in all studied spaces are those sounds with sudden occurrence in the space. The sounds produced by carriages that shout "Ya Allah" and the sound generated by moving or throwing objects disturb the comfortable conditions of the environment (Table 3). This issue got worsened due to the sudden presence of motorbikes. In summary, the monotone low-pressure ruction of the bazaar is not annoying for people. However, a sudden noise may cause instant fear in people. In many cases, people get anxious after hearing the sound of "Ya Allah." Loud noise does not indeed disturb a quiet space but sudden sound with "SPL difference" disturbs the acoustic comfort.

- Sound sources; nature of sources: another tip is about the nature of sounds heard in the studied spaces. Soundscape descriptors obtained similar scores in stores and malls. However, the considerable point was the greater desirability of sound sources and the natural status of soundscapes in malls rather than stores.

Many studies have concluded that natural sound increases soundscape pleasant (Hong and Jeon 2015; C. Li, Liu, and Haklay 2018; Ren et al. 2018; Zhang et al. 2018); however, findings indicate that this statement is not necessarily true in all circumstances. Although natural sounds (e.g., birds, wind, and water) are heard in stores, malls have more natural soundscapes and more desirable sounds. Accordingly, people prefer to hear sounds associated with the activities done in a place like a bazaar which is a business space. Hence, malls have more desirable soundscapes. Therefore, the concept of "sound preference" implies that people present in a space prefer to hear or not hear the sounds that are related to the nature of each space.

On the other hand, the conducted survey indicated a dramatically high desirability of natural sounds in stores. Hence, the abovementioned point does not mean that natural sounds decrease the desirability of sound sources; it means that these sounds are in contrast to the bazaar-related sounds. In other words, the human-natural sounds that are heard simultaneously in the bazaar proved less desirable compared to human-produced sounds.

- Summary: research results indicated that distance from the street had no significant effect on the soundscapes' quality. Malls are static spaces, so are considered secluded places in terms of population density. In these spaces, one can easily stand, pause, watch, and even hear or drink. The zone sounds in malls become point sounds and are heard weakly. The sounds heard in malls are of the "bazaar sound" type, and are matched with users' sound expectations. When people attend in a space with bazaar nature, they are



willing to hear sounds produced by human activities. Moreover, when they can pause, watch, or experience comfort they show a higher tolerance threshold

against heard sounds and perceive soundscape more pleasantly and desirably.

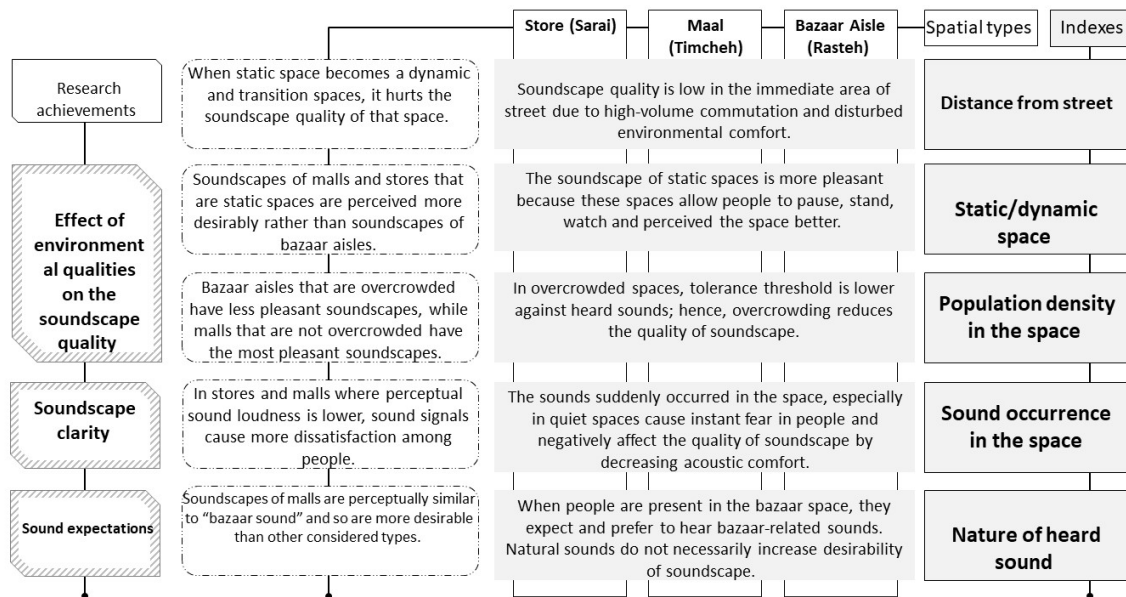


Fig. 2. Conceptual Model; Effect of Spatial Typology of Tabriz Bazaar on its Spaces' Soundscape Quality

## 5. CONCLUSION

The following results were obtained from the study conducted on the soundscape quality of three bazaar aisles, three malls, and three stores of Tabriz Bazaar:

- **Urban Soundscape Clarity:** clarity is one of the acoustic components pointing to sound pressure level differences in architectural spaces. Clarity is widely used in architecture acoustic, while it has not been applied in studies about city sound and urban soundscape. This research gap may be rooted in studies conducted on city sound that have addressed the noise and sound pollution issues, as well as high SPL, so tried to find a solution for reducing SPL in urban spaces. However, this study was conducted on the soundscapes of nine spatial spaces in Tabriz Bazaar and showed that the soundscape of these urban spaces is a such quiet and calm atmosphere that some sound with SPL differences can negatively affect the acoustic comfort and perceptual quality of their soundscapes. In other words, the comfortable soundscape of Tabriz Bazaar does not necessarily follow its quietness. Hence, further studies on the soundscape quality of quiet urban spaces must address soundscape clarity.

### - Effect of environmental qualities on the soundscape:

as mentioned before, the survey carried out on the soundscape qualities of spaces in Tabriz Bazaar indicates a more pleasant and desirable soundscape of malls and stores rather than bazaar aisles. Tabriz Bazaar indeed provides static and quiet spaces that allow people to stand, watch, sit, and even experience comfort; hence, people have a greater tolerance threshold to surrounding sounds and enjoy the heard sounds in this place.

- **Sound expectations:** since natural sounds have high desirability, it is assumed that these sounds can improve the soundscape quality. Nevertheless, this study showed that heard sound-space match in Tabriz Bazaar had a more significant effect on their desirability rather than the natural or human source of sounds. This case can be seen in the desirability of sound sources in malls (sounds produced by human activities in the bazaar and lack of geophony and biophony sounds) compared to stores (with geophony and biophony sounds). In other words, people prefer to hear the sounds produced by business activities in the bazaar, which is a business space.

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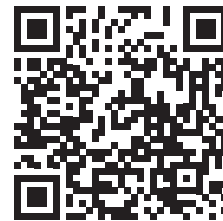
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