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## **THE INFLUENCE OF THE SENSORY STIMULI ASPECTS FOR THE EFFICIENT USE OF URBAN SQUARES IN IRAQ**

**Omar Hussein Ali<sup>1</sup>, Nor Haslina Ja'afar<sup>2</sup>, Nor Zalina Harun<sup>3</sup>, Mohd  
Khairul Azhar Mat Sulaiman<sup>4</sup>**

*<sup>1,2,4</sup> Architecture and Built Environment Department, Faculty of Engineering  
and Built Environment*

UNIVERSITI KEBANGSAAN MALAYSIA

*<sup>2,3</sup> Institute of the Malay World and Civilisation (ATMA)*

UNIVERSITI KEBANGSAAN MALAYSIA

### **Abstract**

This study aims to examine the impact of user sensory stimuli aspects (comfort, passive and active engagements, relaxation, and discovery) on the efficient use of urban squares in Erbil, Iraq, through public interaction. A questionnaire survey (298 respondents) was employed to collect users' opinions and was validated through expert interviews (13 interviewees) and field observations. PLS-SEM was used as the research method in this study to analyse the influence structure of the 298 respondents. The predicted model of the research can contribute to the body of knowledge among academics and practitioners. Findings revealed that the aspects of sensory stimuli have a significant influence on the efficient use of urban squares. For the efficient use of urban squares, comfort showed the greatest influence on social interaction.

**Keywords:** social interaction, sensory stimuli, PLS-SEM, urban square, Erbil, efficient use.

<sup>1</sup> PhD student at Universiti Kebangsaan Malaysia. Email: omarali.ud@gmail.com

## **INTRODUCTION**

Urban squares are frequently used by people of all ages throughout the world's cities, especially when commercial buildings are densely packed. These locations are also designated for public activities. Globally, the continuous growth of city centres increases the demand for more effective urban spaces to serve the public and their social activities (Acar et al., 2020; Mandeli, 2019). The presence of an urban square is critical for public life, even more so in densely populated cities such as Erbil. However, urban square design has been reported to be mainly ineffective in meeting people's needs (Hatefishoja, Islami, & Rezaei, 2020; Zamanifard, Alizadeh, Bosman, & Coiacetto, 2018). The majority of studies examined physical aspects of the built environment in order to determine the most efficient use of successful urban squares. Nevertheless, studies that focus on sensory stimuli dimensions in order to optimise the use of urban squares in city centres are still insufficient. This study examines four major dimensions of sensory stimuli: comfort, discovery, active and passive engagement, and relaxation of users as they relate to social interactions and the efficient use of an urban square in Northern Iraq. The present study also aims to estimate the effect of the sensory stimuli in Erbil Square on social interaction in order to determine the most influential factor in enhancing social interaction in city centres. Comfort, active and passive engagements, discovery, and relaxation aspects are analysed through a questionnaire survey, supported by semi-structured interviews and field observations. The effects of these aspects are assessed using the partial least squares-structural equation model (PLS-SEM) and data from the questionnaire survey.

### **The relationship between sensory stimuli and user interaction in an urban square**

Sensory stimuli in the form of spaces and their surroundings will cause us to walk and activate memories associated with those locations (Treib, 2008, Chapter 12). People are more likely to stay in an urban square if there is a comfortable place to sit, particularly if there is some protection from the elements (Mehta, 2014). People influence and are influenced by the environment, and for this contact to occur, it must be perceived that triggers in the form of sight, sound, smell, or touch will offer clues about the environment. "Sense" refers to the response of a person's sensory systems towards environmental stimuli. Pleasure resulting from a sensory insight in public space is influenced by various sensations experienced in the environment (Sulaiman, Abdullah, & Othman, 2019).

Non-visual aspects of sensation and perception are often underdeveloped and underutilised, despite adding to the richness of experience (Mehta, 2014). Pleasant sounds (waterfalls, fountains, etc.) can mask unpleasant sounds such as traffic noise (Carmona, Tiesdell, Heath & Oc, 2010). Previous studies (Carmona et al., 2010; Zamanifard et al., 2018) addressed the notion that

comfort, as well as active and passive engagements with the environment, are essential aspects of creating a good urban square as a public space. The user's presence in the urban square in witnessing, experiencing, and conversing with the community is referred to as passive participation (Nday & Manu, 2018).

Active engagement involves making the direct experience of the public in urban squares more enjoyable. To be an ideal urban square, it must provide opportunities for contact and spontaneous social interaction. By contrast, passive engagement with the environment refers to an encounter with an environment without actively participating in it, resulting in a sense of relaxation (Askari, Soltani, & Ahmad, 2015). In other words, the passive engagement design criterion necessitates an encounter with the environment but does not require active participation. As Carmona et al. (2010) explained, this can be accomplished through the incorporation of aesthetically pleasing design elements such as fountains, views, public art, and performances into the design of public spaces adjacent to pedestrian flow.

Previous research related the relevance of comfort in urban squares to a variety of elements, including safety (Mehta, 2014; Wang, Brown, & Liu, 2015; Yung, Conejos, & Chan, 2016), the effect of lighting (Ekdi & Çıracı, 2015; Nasar & Bokharaei, 2016), and noise aspects (Lam, Ng, Hui, & Chan, 2005) that would affect the comfort of users and their activities in these areas. Based on previous studies (Carmona et al., 2010; Shaftoe, 2008), people's comfort directly correlates with their feeling of safety inside the urban square. Concerning the benefits of public spaces, Yung et al. (2016) stated that the critical role of safety is to enhance social interaction and people's sense of community. Besides, a study by Zamanifard et al. (2018) found that the user's comfort in the urban square can be affected by other users' activity inside or outside the space. This activity has an effect on land use, pedestrian mobility, noise and odour, and automobile movement. Comfort, protection, efficient lighting, and a peaceful atmosphere all contribute to older people's stay in public open spaces (Zakariya, Harun, & Mansor, 2017).

The urban square should be viewed as a public space within a community, a place to unwind and enjoy the urban familiarity of the city, a location for a variety of different activities ranging from outdoor dining to space entertainment, and a place for social interaction (Van Hecke et al., 2018). In other words, no one goes to a public place to rest; they sit while eating or relaxing instead (Kim, 2018). Moulay (2017) focused exclusively on neighbourhood open spaces, which are regarded as the foundation of public space programmes, as they enable people from all walks of life to recreate, congregate, relax, and socialise on a regular basis within their residential community. In his research, Shaftoe (2008) discussed how people are fascinated by the possibility that there is more to spaces than meets the eye and that stepping through them will reveal a more interesting discovery.

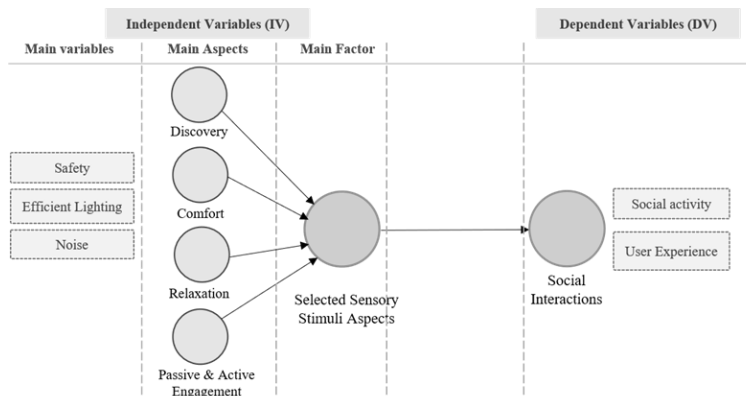
### **Social interaction in the urban square**

Interactions in everyday life between people from different ethnic groups foster social cohesion because they serve as the foundation for bonds between individuals (Peters, Elands, & Buijs, 2010). Social connection is also characterised as a process of mutual stimulation and interaction between at least two people (Hari & Kujala, 2009). In this case, social interaction does not apply to society as a whole; instead, it refers to creating users in the urban square through perception, activity, behaviour, and experience (Dias & Ramadier, 2015).

The urban square is a site of diverse interactions, experiences, and relations between multiple stakeholders whose decisions and activities influence the locations' qualities (Zamanifard et al., 2018). Social interaction in the urban square can be stimulated by watching others, having a short conversation, and sharing information, which results in a wide range of interpersonal relationships (Carmona et al., 2010). Few studies of the functional dimensions often come under what is generally referred to as "public space environmental attributes." In this sense, aspects of the urban square are described as a collection of processes and practises that ensure an urban square can perform all of its legitimate functions while managing the interactions and effects of these multiple functions in a manner that is acceptable to its users (Carmona, 2018; Zamanifard et al., 2018).

However, cities have struggled to design urban environments that promote social cohesion and sustainability due to a lack of public engagement (Moulay et al., 2017; Zakariya et al., 2017). This occurs despite the fact that urban squares are frequently constructed and designed to serve as alternatives for social activities (Moulay et al., 2017). Besides that, public spaces are frequently associated with social sustainability due to the increased social contact among urban residents (Zakariya et al., 2017), encouraging them to engage in social activities with their families, friends, and the larger public. This involves identifying with the culture and society as a whole (Emanuel, 2017). These events assist in bringing people together, reducing negative social activity, and providing significant sociocultural benefits, such as group satisfaction and crime reduction (Moulay et al., 2017).

This study investigated a model that incorporates variables as primary sensory stimuli for the efficient use of urban squares through social interaction (Figure 1). The objective of this study is to verify the effectiveness of the sensory stimuli aspects (comfort, passive and active engagements, relaxation, and discovery) on social interaction in the urban square.



**Figure 1:** An integrated model of this study.

*Source: Author*

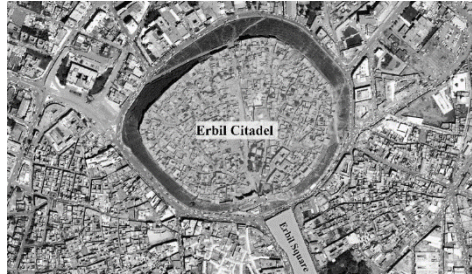
## METHODS

### Summary of Data collection technique

While other studies have collected data through observation and in-depth interviews, this study discovered that a questionnaire survey is the most effective method for examining the effects of user comfort, relaxation, discovery, and engagement on the efficient use of urban squares through social interaction. However, to enhance the reliability of the data, the study used in-depth interviews and observations as a secondary technique to corroborate survey results. To ensure a representative sample size and thus the reliability and validity of the results, a randomly selected group of 298 respondents from passers-by who frequently used the study area was chosen. A semi-structured interview with 13 former and current experts in urban design, architecture, planning, and landscape architecture was conducted to validate the survey results. Furthermore, the observation was conducted to document the facts about the research region's situation as well as the pattern of people's needs across various age groups.

### *Selection of Location*

The study area for this research was Erbil Square in northern Iraq's Erbil City Centre. The Erbil Square is located in front of the Erbil Citadel, the city's most recognisable landmark and a UNESCO World Heritage Site (see; <https://whc.unesco.org/en/list/1437>) (Figure 2). Erbil Square is a significant urban space that facilitates a diverse range of social interactions and is generally safe (Ali, Ja'afar, & Sulaiman, 2020; Ibrahim, Mushatat, & Abdelmonem, 2015). The square is served by the city's primary public transportation system and is a relatively pleasant location for the public to congregate, sit, stroll through the city centre, shop, take photos in front of the historic citadel, and seek other forms of entertainment (Al-Hashimi, 2016).



**Figure 2.** Erbil Square location in the south of Erbil Citadel in the city centre of Erbil, northern Iraq  
*Source: Author*

### The study variables

As illustrated in Figure 1, this study examines several independent variables related to sensory stimuli and dependent variables related to user interactions with the urban square. Comfort, passive and active engagements, discovery, and relaxation were selected as independent variables based on previous research and field observations of the urban square. Based on the analysis of previous studies, the aspects of social interaction (social activity and user experience) selected as the dependent variables were “activity type,” “social contact,” “interesting,” “enjoyable,” and “pleasing.” Based on the literature, this study explored a number of variables based on prior research for efficient urban squares (Table 1). The purpose of this study is to determine the effect of sensory stimuli variables on the efficient use of the Erbil Square via users’ social interaction.

**Table 1:** Variables used to analyse efficient use of urban square and associated aspects

Main variable	The Selected Characteristics	The measured items in survey
Aspects of Sensory Stimuli	Efficient Lighting	The place is Lighted enough at night
		I feel the natural lighting is appropriated in this square.
	Comfort	Feel safe in the place
		Feel very restful in a place
	Noise	It is free from negative activities
		The square is quiet from activities inside the place
Relaxation	Noise from Heavy traffic around the place	
	Space where we can meditate	
Passive engagement	Attendance	Can breathe fresh air in place
		Verity of entertainment activities in the place
	Watching	Possibility to capture many images because of a lot of surrounding scenes

Main variable	The Selected Characteristics		The measured items in survey	
Social interaction	Discovery		It reminds me of sweet memories The place reflects the city identity	
	Activity type		times have been visiting the place have friends in the place	
		Social activity	Social contact	Meet & communicate with people from different social & cultural classes easy to start a conversation with unknown people inside the place
	User experience		interesting	Attendance to place The square is a public recreational space
			enjoyable	The square is a suitable place to spend leisure time
			pleasant	Participate in the public space.

### Method of Analysis

In this study, PLS-SEM was used to identify the causal relationships between variables. The analysis was done using PLS-SEM to minimise prediction errors (Hair, Risher, Sarstedt, & Ringle, 2019). The study adopted SmartPLS software as the main tool to address the PLS-SEM method techniques (Ramayah, Cheah, Chuah, Ting, & Memon, 2018). However, this software was used to analyse the quantitative approach (survey questionnaire) to answer the hypothesis in this study. This study addressed the path coefficient analysis of the model to identify the effect of the sensory stimuli aspects on social interaction and the importance of these aspects to enhancing the efficient use of the urban square.

### RESULTS AND DISCUSSIONS

The path coefficients for all sensory stimuli variables explained 26.2% of the variation in the social interaction of the urban square's environmental attributes (R-squared = 0.262).

The findings indicate that the sensory stimuli aspects significantly influence Erbil Square's efficient use for social interaction. According to Table 2, these variables are classified into four categories. The comfort variable's path coefficient is highly significant and predicts social interaction ( $\beta = 0.251$ ,  $t = 10.688$ ,  $p < 0.01$ ). In other words, comfort as sensory stimuli aspect has a more positive effect on social interaction with the highest absolute value for the most efficient use of Erbil Square.

**Table 2:** Standardised coefficients (path coefficients) of the sensory stimuli

IV <sup>1</sup> » DV		Coefficients $\beta$	T Value	P Values
Comfort » SI <sup>2</sup>		<b>0.251</b>	10.688	<b>0.000</b>
Second Order (Comfort's Sub-variables)	Safety » SI	<b>0.151</b>	10.433	<b>0.000</b>
	Efficient Lighting » SI	<b>0.110</b>	9.439	<b>0.000</b>
	Noise » SI	<b>0.056</b>	8.283	<b>0.000</b>
Relaxation » SI		<b>0.137</b>	9.804	<b>0.000</b>
Active & Passive engagement » SI		<b>0.131</b>	9.144	<b>0.000</b>
Discovery » SI		<b>0.114</b>	9.500	<b>0.000</b>

\*\*\*  $p < 0.01$  ( $t > 2.58$ ), \*\*  $p < 0.05$  ( $t > 1.96$ )

IV<sup>1</sup>: Independent Variables, DV: Dependent Variables

SI<sup>2</sup>: Social Interaction

The first variable in the comfort aspect is safety. The path coefficient values of safety have a significant positive effect on social interaction (*coefficients*  $\beta = 0.151$ ,  $t = 10.433$ ,  $p < 0.01$ ). According to the survey results, 69.5% of users report feeling safe in Erbil Square. The finding implies that a sense of security-induced comfort may have a significant impact on social interaction and the efficient use of the urban square. The interviews corroborate this finding, indicating that the urban square may not be entirely free of negative activities. The interview with experts added that while certain negative activities, such as selling unregulated mobile phones or watches, are not dangerous, they are also undesirable. According to the observation, some individuals use a seating bench to sell their merchandise, while others, such as homeless individuals, use it as a place to sleep. This indicates that, while this was a harmless practise, it was inconvenient for many visitors to the urban square and harmed Erbil Square's success, necessitating additional oversight by public authorities to regulate these activities.

Efficient lighting in the second comfort dimension shows a significant positive effect on social interaction (*coefficients*  $\beta = 0.110$ ,  $t = 9.439$ ,  $p < 0.01$ ). A well-lit space, in particular, can provide and emphasise a sense of comfort, safety, and reachability at night, while also reducing any negative activity. The following sentences, quoted from the experts, support the results:

*“Through my observation, most Erbil Square visitors prefer to gather or stay in the middle of the square or to the south of it, especially at night, where most activities happen, and these area parts are well-lighted (9). In contrast, they are less interested in the north part, specifically the north-east, because it is less lighted and fewer business activities occur there (5,9)”* (interviewee 5,9).



The majority of Erbil Square is illuminated at night, as users feel more secure in a lit area, and people prefer to be near the action. However, observation revealed that a few sections are poorly lit at night due to broken lights and a lack of proper maintenance, discouraging users from visiting that area at night. As a result, users will feel unsafe at night, highlighting the critical nature of the lighting experience for user interaction. Additionally, businesses and activities are necessary to enhance the users' sense of security and comfort in Erbil Square. However, due to the direct and intense sun rays, a sunny day can be uncomfortable for visitors as well, and people may avoid the urban square during these hours (between 11 a.m. and 5 p.m.). The urban square should consider adding shade to certain areas, similar to what private businesses provide on Erbil Square's east side.

As a follow-up to the preceding, the finding shows statistically significant but weak path coefficients of the noise variable (one of the comfort aspects) impacting on social interaction ( $\beta = 0.056$ ,  $t = 8.283$ ,  $p < 0.01$ ). It can be explained, for example, that noise has a less significant but still substantial effect on social interactions and efficient use than safety and efficient lighting does on the comfort dimension. This can be explained by the fact that the abundance of attractive features in Erbil Square makes it more desirable for users to visit the space, despite the presence of some background noise.

The observation revealed that the majority of the traffic noise originates on the square's west and south sides. The road on the west side of Erbil Square is a major thoroughfare in the city centre, and it is frequently congested (Figure 3). This street is less than thirty metres from Erbil Square's central area. To put it another way, a quiet place is always a comfortable place, and thus, social interaction should be incorporated into any urban square, but not at the expense of all users. The Erbil Square hosts a variety of activities and performances, and some of these events may be noisy (music and festivals).



**Figure 3:** The Traffic Around the Erbil Square in Middle of Day.

*Source: Author*

Continuing with the sensory stimuli aspect of the study, the relaxation aspect demonstrated a significant positive effect on social interaction (Table 2), with an absolute value of  $\beta = 0.137$ ,  $t = 9.804$ , and  $p < 0.01$ . The findings indicated

that Erbil Square is more of a resting place than a place for meditation, owing to its location in Erbil's city centre, one of the most crowded areas. The expert interview substantiated the conclusion and discussed how Erbil Square is a hub of activity and cannot be used for meditation by a large number of users. In addition, the observation supports this finding, demonstrating that the activities in Erbil Square and the congested streets surrounding it may make it unsuitable for meditation or getting some fresh air.

Passive and active engagements were found to have a significant positive effect on social interaction in Erbil Square (*coefficients*  $\beta = 0.131$ ,  $t = 9.144$ ,  $p < 0.01$ ), as shown in Table 2. Thus, passive and active engagements are necessary to increase social interaction in the urban square. Correspondingly, the interview with experts stated that both active and passive engagements (variables of sensory stimuli aspect) are essential for the efficient use of urban squares: “... *Providing different activities can encourage people to participate and engage in the Erbil Square and increase the sense of interest and anticipation of attending the place...*” (Interviewee 7)

According to the statement above, the urban square can facilitate social interaction if it considers the needs of different genders and ages. The findings indicate that an increase in entertaining events on the urban square, such as annual festivals, open markets, and taking photographs of the surroundings, may have a beneficial effect on social interaction in Erbil Square.

According to Table 2, the discovery variable is the final variable in the sensory stimuli aspect (*coefficients*  $\beta = 0.114$ ,  $t = 9.500$ ,  $p < 0.01$ ). In Erbil Square, the results indicated a significant positive relationship between the discovery variable and social interaction. More precisely, the history of Erbil, the historical citadel, the heritage market “Souq,” and the social environment in which multi-cultural people coexist define the Erbil identity; all Erbil Square users believe that the urban square reflects the city's identity. Generally, analysis of interviews and field observations indicates that sensory stimuli are classified into categories and subcategories, as shown in Table 3. The observation demonstrates that users prefer Erbil Square over other locations because the urban environment enables them to view the majority of Erbil's elements (Figure 3). This means that the advantage of the square can stimulate people's memories, thereby affecting user interaction within the space.

According to Table 3, interviewees identified significant markers for sensory stimuli that may contribute significantly to the efficient use of urban squares. These indicators, which include easy walking, night lighting, and a safe and welcoming environment, all contribute to Erbil Square's effective use for social interaction and user experience. Apart from that, a constant theme of discovery and enjoyment is the development of a vibrant atmosphere and seasons.

**Table 3:** Categories and Subcategories of Sensory Stimuli

Sensory Stimuli Aspects	Indicator
Efficient Lighting	The urban square areas should be well-lit all the time.
Safety	The urban square user should feel safe inside the urban square, and the location should be protected from all negative activities.
Safety	It should be easy to walk around in the urban square.
Noise	The urban square should be protected from external environmental disruptions, such as noise and other kinds of pollution.
Noise	The square should be surrounded by trees to protect the internal urban square area from external pollution.
Relaxation	The urban square should have places where users can meditate and relax.
Passive and Active engagements	The urban square should be able to allow different activities that encourage users to participate and engage with the environment.
Discovery	The design of the urban square should reflect the identity of the space environment.

*Source: Interviews and Field Observations*

## CONCLUSION

Among other sensory stimuli aspects (relaxation, active and passive engagements, discovery), comfort had the highest significance and was predicted ( $\beta = 0.251, t = 10.688, p < 0.01$ ) in social interaction. To enhance the urban square's comfort factor, its first level of mandatory activities, such as seeing, listening to, and being seen by others, should not be excessively large. This implies that one's distances and spaces must allow noticeable sight and visibility. People will use the urban square more often if they feel secure, comfortable, and relaxed while walking and sitting in it (night lighting, a safe and welcoming environment, and prohibiting traffic from driving near to the urban squares to reduce noise). The findings indicate that when architecture addresses the constant, seasonal, and vibrant use of space by tourists, the efficiency of an urban square in terms of exploration increases. Urban squares, for example, attract people when they are vibrant, colourful, clean, and exciting. As previously stated, relaxation is a critical aspect of sensory stimuli. It is accomplished primarily through the provision of suitable locations for sitting down, relaxing, eating, drinking, and conversing.

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