Emotion and Sustainable Residential Interior Shape

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Abstract

Focusing on inhabitant's climate comfort causes the neglect of personal and aesthetic factors that have effects on emotions and psychological comfort. Blindly adhering to sustainable design principles regardless of the basic architectural design parameters cause similar interior spaces in today's housing of Iran. Interior space form is one the main design factors that has some effects on inhabitant's emotions. It is a correlation research to study inhabitant's emotions towards sustainable interior space by focusing on interior form. It illustrates that form can consider as an influential factor in creating and improving sustainable conditions according to inhabitant's emotions.

Keywords: sustainable interior design; emotion; shape; PAD

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1.0 Introduction

New developments and principles towards sustainable design cause most of the Iran's dwellings to have some basic sustainable conditions. Although sustainable principles have, the great impact on energy uses it pays less attention to personality, culture, and people's emotions towards spaces (Gifford, 2007). Besides the environmental factors in which architecture is created and exist, the social, cultural, and economic circumstances should never be ignored (Abdel-Hadi, 2012; Pardalos, 2012, p. 236). Sustainability has variety of aspects, and one of its main parts is about social sustainability, health, and mental health (Woodcraft, 2012). However, most of the regions in Iran follow the physical sustainability without paying any attention to social life and culture of that region.

Researches show that human's environment has some impacts on emotional state and feeling (Horayangkura, 2012; Kamil & Abidin, 2013; Marcus, 2006; Noiprawat & Sahachaisaeree, 2012). Clare Cooper Marcus (2006) stated the impact of our house on our emotion and identity. Architecture is not only a scientific field but has great artistic aspects that can have some effects on emotional states (Kukhta & Pelevin, 2015).

Different parameters are important in interior space designing such as; light, color, form, material and furniture (Haddad, 2014; Sufar, Talib, & Hambali, 2012). Among these parameters form or shape of space is based on architect's idea and desire. While light and color are flexible and can change easily by inhabitant's mood (Wardono, Hibino, & Koyama, 2012). Interior space form is one of the main design factors that can have special effects on inhabitant's emotions (Karslı, 2015; Yalçin, 2015).

Moreover, the importance role of the form can be found in nature, divers details in nature have various forms and shapes that are not only for aesthetic value, but they have functional values that are innate in their existence. Architectural design should be integrated with nature, and all its components should improve this integrity (El-Zeiny, 2012; Giurea, 2014).

Blindly adhering to sustainable design principles regardless of the basic architectural design parameters cause similar interior spaces in today's housing of Iran. It seems that today houses have climate comfort condition, sufficient lighting, ventilation, and insulation, but they have similar interior space shape or form. Focusing on climate comfort conditions causes the neglect of personal and aesthetic factors that have effects on emotions and psychological comfort (Gifford, 2007). Also, we face the same interior spaces not only in one city but different cities with different climate conditions in Iran. It seems that most of the sustainable residential interior spaces are designed regardless of the shapes or has false shapes with no function. It is needless, to say that structure creates the total shape of the place but by using today's structural technology we can work on new aspects of shapes that can help achieve sustainability. However, Iranian traditional architecture shows that interior space forms can support and improve sustainable conditions (Hensel, 2008).

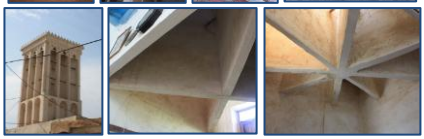
2.0 Literature Review

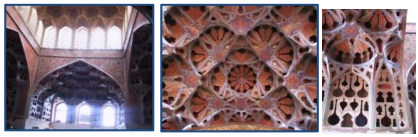
2.1 Form in Sustainable Designing

Some researchers have studied the form in sustainable designing. Baggs (2004) stated in his "Healthy House" book that pyramid forms have positive effects on growth of plants or even human being and have healing power (Baggs & Baggs, 2004, p. 56). He believed in the unseen power of shapes and had some ideas about "golden rectangle", "Fibonacci series" and "Platonic solids" and their effect on health (Baggs & Baggs, 2004, pp. 58,59). Practically it seems that forms are forgotten in today's sustainable architecture (El-Zeiny, 2012). While, the traditional architecture in Iran had a special form of each region's housing that had sustainable functions. The interaction between religious, cultural, ethical, and professional features of inhabitants and architect in a social system in the past had brought aesthetical and well-organized samples in which sustainability was implied not only on the surface but also in its structure and inside (Pardalos, 2012, p. 236).

Table.1 shows some examples of Iranian traditional architecture that the interior shape helps the sustainability of the spaces. For example, Ali Qapu Palace in Iran is a masterpiece for acoustical performance that created only by interior forms (Hensel, 2008). Traditional houses of Zavare and Gheshm cause ventilation and climate comfort in the hot region by changing in height and form of interior spaces (Iravani, Etessam, Masoud, & Mofidi, 2009). Also, traditional windows in Iran have great nature relatedness and daylighting with their special design and form (Iravani et al., 2009).

Table 1: Form in sustainable design, examples of Iranian traditional architecture

Sustainable parameters (LEED, 2009)	photos
Daylight (Dolat Abad, Yazd, Iran)	
Ventilation (Zavareh houses, Zavareh, Iran)	
Thermal comfort (Badgir, Gheshm, Iran)	

Acoustical performance (Ali Qapu,Palace, Isfahan, Iran)	
Nature relatedness (Lary house, Yazd, Iran)	

(Source: Authors)

2.2 Form and Emotion

There are two different opinions towards form in architecture; one can be in relation towards emotions (pleased, exciting, relaxing, etc.) that can be called "effective forms" and the other one is about the structural form that can be called "interpretation form"(Devlin & Nasar, 1989).

We understand our surrounding by our senses and feelings and emotion plays an important role in our interaction with the environment and especially architecture(Krukaset & Sahachaisaeree, 2010; Kukhta & Pelevin, 2015).

Studies show that using too much curve lines can cause more stress (Roelfsema, Scholte, & Spekreijse, 1999). Moreover, another study compared two different environments according to curvature and figured out that old people tend to prefer object-orienting interior spaces (curved walls) more frequently than the spatially-orienting features (squared off walls) (Shepley, 2005). It could be predicted that completely straight lines or too much curvature would be less preferred in an architectural interior setting (Dazkir, 2009, p. 33). Also other studies show that curvilinear forms of architecture have the vital influence on environment-behaviour (Adnan & Yunus, 2012). Totally, studies show that architecture form has some effects on emotional states (Kukhta & Pelevin, 2015).

3.0 Methodology

3.1 Participants

Forty people participated in this pilot study (17 m & 23 w, mean age: 24). We referred sample size to Kline (2010) and his studies about minimum sample size (Kline, 2010, p. 12). We used an accidental sampling method to choose participants from architecture students.

3.2 Materials and Measures

It is a correlation research in Semantic Differential scale. Participants answered to emotional PAD test (Pleasure, Arousal, and Dominance) questionnaire (Russell & Mehrabian, 1977) by using Self-Assessment Manikin (SAM) technique (Fig.1) 9 scales measured between +1 and -1(Bradley & Lang, 1994). The Cronbach alpha was acceptable, being 0.908.

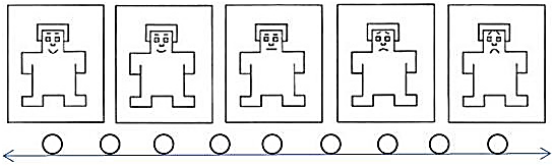


Figure 1: SAM technique, measuring pleasure
(Source: Bradley & Lang, 1994)

We evaluated the house's sustainability by asking participants in 4-points Likert scale to assess the sustainable parameters of the interior space of their house. We used Leadership in Energy and Environmental Design parameters to evaluate interior sustainability (ventilation, daylight, acoustical performance and thermal comfort) (LEED, 2009, p. 405).
To perform this study we needed to categorize different forms of interior spaces. Ching (2012) categorize interior space to point, line, surface, and volume (Ching & Binggeli, 2012, p. 3). We worked on surfaces according to rectangular and curvature shape to have a smaller number of samples that are more realistic.

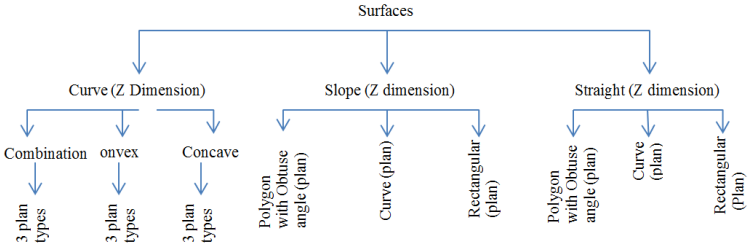


Figure 2: Categorizing interior forms according to surfaces (Source: Authors)

4. 0 Results and Discussions

Table.2 shows the One sample t-test result of sustainable parameters in interior spaces, according to participants scores. The mean frequencies show that houses have appropriate sustainable conditions based on inhabitant's desire.

Table 2: One sample t-test results for sustainable parameters

	N	Mean	Std. Deviation	Std. Error Mean	t	df	Sig. (2-tailed)	Mean Difference
Daylight	39	3.076	.664	.106	28.926	38	.000	3.076
Ventilation	40	2.900	.671	.106	27.303	39	.000	2.900
Thermal comfort in winter	40	2.225	.767	.121	18.334	39	.000	2.225
Thermal comfort in summer	40	2.125	.757	.119	17.744	39	.000	2.125
Acoustical performance	40	2.850	.833	.131	21.623	39	.000	2.850
Nature relatedness	40	2.700	.882	.139	19.341	39	.000	2.700

(Source: Authors)

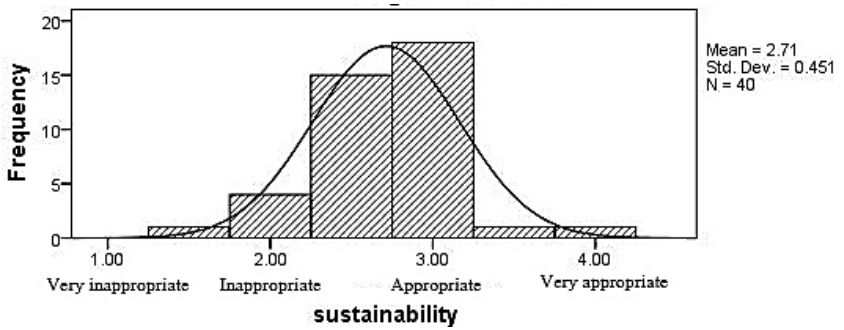
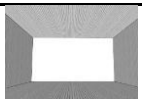
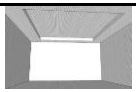


Figure 3: Sustainability histogram
(Source: Authors)

Table.3 shows the emotional state towards the most frequent shapes of participant's current living rooms. PAD test analysis shows that the first shape emotional state is +P-A-D (A is significant) and the second one is +P+A+D (P & D are significant). According to PAD test analysis +P-A-D feeling means quiet, protected, sleepy and tranquilize, and +P+A+D means admired, bold, creative, powerful and vigorous (Valdez & Mehrabian, 1994). Also, Table.4 shows the one-sample t-test for emotional state towards all forms of current living rooms that is +P-A+D (P & D are significant) which means comfortable, leisurely, relaxed and satisfied (Valdez & Mehrabian, 1994).

Also, Table.4 shows a significant result that the total living room shapes were pleasant (p=.001) and non-arousal (p=.022) that would be acceptable because of a long time of living in that place.

Table 3: Emotions towards most frequent living room shapes (* P<0.05)

Living room shape	PAD	Mean	Std. Deviation	Std. Error Mean	t	df	Sig. (2-tailed)	Mean Difference
	Pleasure	.170	.419	.083	2.028	24	.054	.170
	Arousal	-.310	.397	.079	-3.903	24	.001*	-.310
	Dominance	-.080	.437	.087	-.915	24	.369	-.080
	Pleasure	.472	.150	.050	9.430	8	.000*	.472
	Arousal	.055	.428	.142	.389	8	.708	.055
	Dominance	.222	.263	.087	2.530	8	.035*	.222

(Source: Authors)

Table 4: Emotions (pleasure, arousal & dominance) towards all form of current living rooms (* P<0.05)

	Mean	Std. Deviation	t	df	Sig. (2-tailed)	Mean Difference	95% Confidence Interval of the Difference	
							Lower	Upper
pleasure	.256	.429	3.776	39	.001*	.256	.119	.393
arousal	-.175	.464	-2.385	39	.022*	-.175	-.323	-.026
dominance	.050	.428	.739	39	.465	.050	-.086	.186

(Source: Authors)

We examine our hypothesis about any relation between sustainability and emotional state of inhabitants by using Spearman's rank correlation coefficient. Table.5 shows the correlation results that among all sustainable parameters only daylight and nature relatedness have a significant correlation with pleasure and arousal. Also, total sustainability has a significant correlation with pleasure. Besides, the living room shape has a significant correlation with pleasure, arousal, and dominance that shows the strong effect of forms on inhabitant's emotional state. Table 5 illustrates the weak relation between current sustainable parameters and emotions.

Table 5: Spearman's rank correlation coefficient (*Correlation is significant at the 0.05 level (2-tailed). ** Correlation is significant at the 0.01 level (2-tailed))

		pleasure	arousal	dominance
Daylight	Correlation Coefficient, (Sig. (2-tailed))	.413**, (.009)	-.010, (.950)	.117, (.479)
	N	39	39	39
Nature relatedness	Correlation Coefficient, (Sig. (2-tailed))	.323*, (.042)	.388*, (.013)	.075, (.645)
	N	40	40	40
living room shape	Correlation Coefficient, (Sig. (2-tailed))	.341*, (.031)	.351*, (.026)	.355*, (.024)
	N	40	40	40
Total sustainability	Correlation Coefficient, (Sig. (2-tailed))	.334*, (.035)	.116, (.474)	.194, (.229)
	N	40	40	40

(Source: Authors)

We can study different forms to figure out which forms improve the emotional state to use them in sustainable designing. Table.6 shows the PAD test results for 14 different shapes that we've created (Fig.2). According to a limited number of participants only some parts of PAD test were significant.

Table 6: PAD test for different shapes (*Sig. (2-tailed) <0.05)

		pleasure	arousal	dominance	Total emotion	shape
1	N Valid, (Missing)	40, (0)	40, (0)	40, (0)		
	Mean, (Std. Deviation)	-.1063, (.45954)	-.4188, (.47159)	-.2313, (.49156)	-P-A*-D* Bored	
	t, (Sig. (2-tailed))	-1.462, (.152)	-5.616, (.000*)	-2.975, (.005*)		

5		4		3		2	
t, (Sig. (2-tailed))	Mean, (Std. Deviation)	t, (Sig. (2-tailed))	Mean, (Std. Deviation)	t, (Sig. (2-tailed))	Mean, (Std. Deviation)	t, (Sig. (2-tailed))	Mean, (Std. Deviation)
-4.741, (.000*)	-.3625, (.48354)	1.657, (.105)	.1438, (.54856)	-1.292, (.204)	-.0813, (.39786)	-3.004, (.005*)	-.2188, (.46059)
.473, (.639)	.0375, (.50176)	-.589, (.559)	-.0438, (.46989)	-1.681, (.101)	-.1250, (.47027)	-1.676, (.102)	-.1375, (.51872)
.310, (.759)	.0313, (.63848)	1.181, (.245)	.0938, (.50220)	-1.483, (.146)	-.1188, (.50633)	-2.705, (.010*)	-.2000, (.46754)
-P*+A+D Cruel		+P-A+D Comfortable		-P-A-D Bored		-P*-A-D* Bored	
							

9		8		7		6	
t, (Sig. (2-tailed))	Mean, (Std. Deviation)	t, (Sig. (2-tailed))	Mean, (Std. Deviation)	t, (Sig. (2-tailed))	Mean, (Std. Deviation)	t, (Sig. (2-tailed))	Mean, (Std. Deviation)
-3.376, (.002*)	-.2750, (.51515)	-.801, (.428)	-.0813, (.64148)	-3.481, (.001*)	-.2625, (.47687)	-4.664, (.000*)	-.4000, (.54243)
-2.129, (.040*)	-.1688, (.50124)	1.473, (.149)	.1438, (.61729)	-.368, (.715)	-.0313, (.53765)	1.238, (.223)	.1375, (.70245)
-2.486, (.017*)	-.2063, (.52467)	.291, (.772)	.0250, (.54243)	-1.199, (.238)	-.1000, (.52745)	-.661, (.512)	-.0688, (.65776)
-P*-A*-D* Bored*		-P+A+D Cruel		-P*-A-D Bored		-P*+A-D Distressed	

13		12		11		10	
t, (Sig. (2-tailed))	Mean, (Std. Deviation)	t, (Sig. (2-tailed))	Mean, (Std. Deviation)	t, (Sig. (2-tailed))	Mean, (Std. Deviation)	t, (Sig. (2-tailed))	Mean, (Std. Deviation)
-.893, (.378)	-.0705, (.49321)	-4.789, (.000*)	-.3688, (.48697)	1.607, (.116)	.1625, (.63939)	-.726, (.472)	-.0688, (.59911)
3.065, (.004)	.2375, (.49013)	-.417, (.679)	-.0313, (.47430)	2.285, (.028*)	.1750, (.48437)	.433, (.667)	.0375, (.54758)
.000, (1.000)	.0000, (.51887)	-1.929, (.061)	-.1625, (.53274)	2.813, (.008*)	.2375, (.53394)	-.703, (.486)	-.0625, (.56259)
-P+A+D Cruel		-P*-A-D Bored		+P+A*+D* Admired		-P+A-D Distressed	

14	Mean, (Std. Deviation)	-.1688, (.56723)	-.1563, (.56808)	-.0125, (.53694)	-P-A-D Bored
	t, (Sig. (2-tailed))	-1.882, (.067)	-1.740, (.090)	-.147, (.884)	

(Source: Authors)

5.0 Conclusion

This pilot study shows the importance of considering psychological factors in sustainable designing. It illustrates that aesthetical and functional considering of different forms in sustainable interior designing can improve emotional states of inhabitants. Our results suggest forms as an influential factor in creating and improving sustainable conditions.
According to a limitation in our sample size and method further experimentation is necessary for this field.

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