



Functions and Features of the Residential Spaces Matching Children's Needs*

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ABSTRACT: The houses which are not suitable for children's behavioral needs and are not proportionate to their cognitive patterns cannot play a significant role in reinforcing children's physical and mental development process. Meanwhile, living in these houses is inevitable due to numerous reasons including economy. The extreme results of this form of life can lead to consequences such as children's overweight, spatial cognition development problems in analyzing and recognizing the environment, children's sociability problems as well as an increase in the number of children whose physical development does not match their age range. In such situation, taking residential spaces which are suitable for children into account can be influential in their cognitive and behavioral patterns development. Therefore, the present study aims to scrutinize the appropriate features of children's spaces through their recognition and understanding of their behavioral and cognitive characteristics. These spaces need to match their behavioral features and should meet their cognitive needs. To this end, the functions of spaces in connection with children and their influential spatial characteristics were determined through the analysis of the data collected from library resources. Thereafter, these initial features were adjusted to the opinions of architectural experts and professors. To this purpose, correlation research approach and survey questionnaire technique were applied. Finally, the achieved data was analyzed using factor analysis statistical test in SPSS software. In the end, using the findings of theoretical field studies, the necessary features of residential spaces that should be adjusted to children's cognitive and behavioral needs were provided.

Keywords: Housing, Cognitive Needs, Behavioral Needs, Children, Residential Spaces.

INTRODUCTION

It seems that the houses designed today are not well-adjusted to children's needs. Economic constraints, unfamiliarity of some architects with design principles of spaces matching the users' needs and limited apartment sizes are among the most important causes of this situation. These spaces do not meet esthetic, psychologic and perceptual needs in cognitive perspective, and do not conform with the need of personal space and territory in behavioral perspective and also do not possess the necessary qualities for children, especially those who spend most of their time at home. Watching television continuously, lack of physical movement

and also children's unsociability is the result of computer and television use. Social incompatibility, unsociability and depression can be either the direct or indirect consequences of space inappropriateness for children's needs. Therefore, caring about the spatial necessities of children in residential spaces seems to be of great significance; because it can highly influence their behavioral and cognitive patterns and limit children's space incompatibility consequences. To this end, the present study aims to respond the following questions based on children's cognitive and behavioral needs and improve children's cognitive and behavioral compatibility

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with their spaces:

a) What are the spatial features in houses which are in connection with children's cognitive patterns?

b) What are the features in houses which can reinforce children's behaviors?

According to the answers of the above questions, the qualitative features of residential spaces for being compatible with children's cognitive and behavioral needs are suggested. To this end, through the use of psychological discussions, putting the emphasis on children and caring about their cognitive patterns, the environmentally expected functions have been determined and then the spatial features relevant to these functions have been recommended. In the next stage, these factors have been experimented in a field study. The field study was conducted using "Survey questionnaire" technique.

Psychologists, institutions and organizations relevant to children affairs do not possess similar perspectives toward the definitions of childhood, childhood age and the age of childhood end. In children's right conventions (passed by the General assembly of the U.N.) as indicated in the international legal documents in this case, "children are those who are younger than 18, otherwise, a lower age needs to be defined according to the national laws" (Fashandi, 2005, p. 7). Meanwhile, the borderline of childhood and teenhood has been controversial among psychologist. Arnold Gozal, for example, defines childhood age up until the age of 10; Eric Mandelson considers it to the age of 12 and believes teenhood starts after 12. Jean Piaget also considers the age of 12 as the end of childhood and Skinner thinks of 13 as this age (Seyf, 2007). People under the age of 12 are considered children in Canada. People under the age of 14 are defined as children in Australia and in Japan children's television materials are produced for people under the age of 15. People under the age of 16 are referred as children in Belgium, while, this age is 18 in Germany and England (UNESCO, 1987). In Iran, people under the age of 18 are defined as children.

In the aforementioned age borderline, childhood was introduced briefly which includes the time from birth to the end of teenhood. However, there are innumerable distinctions among the children before the age of school, children in primary school age, in junior and senior school age (Delavar, 2005). In this end, Ahadi and Jomehri (2015) divide childhood into two major periods: The first period includes the age of 2-6 and the second one includes the age of 6-12. Teenhood starts after the age of 12. Accordingly, although there are some slight differences among childhood definition and its range, it seems that most of definitions share the idea of 12 as the end of childhood and the beginning of teenhood. The age

of 0-2 is also considered as infancy. In the childhood age range, i.e. 2-12, children possess their own behavioral and cognitive features which are quite different from the ones before and after that.

Knowing about children's physical and physiological conditions as well as determination of their developmental norms are among the research fields of developmental psychology. Development of children occur in the three fields of cognitive, physical and social issues (Freund & Baltes, 2000). Accordingly, children's development is divided in these three aspects which can lead to a balanced development. Freud, Erikson, Piaget, Vygotsky, Kohlberg et al. provide us with informative and comprehensive understanding of childhood process, its development and needs which reveals that the children development is not the result of their genes merely. It is also the result of their health care, diet and any type of physical exercises to which children are interested (Thelen & Adolph, 1992). These factors influence children's characters through their physical development and growth. Accordingly, the necessities of children development can be categorized into three issues (Mozaffar, Hoseini, Bagheri, & Azemati, 2008).

a) development in environmental perception and cognition.

b) development in health, physical safety and skills.

c) development in emotions, connection to the environment and motivations.

In the current research, these necessities are focused on the role of children's living environment and its facilities to let children move freely and independently, develop physical capabilities and making mental as well as sensational connections with them. Therefore, a house is a part of the initial condition for children's development and it is of great necessity to be considered as a crucial element in their development at any age.

To this end, playing, cognition and learning development are among the most significant motivators in children's cognitive and mental development in various ages (Ebrahimzadeh, 2013). In the following paragraphs, the notions of playing, cognition and learning will be discussed and their connection to the space will be pointed out.

Playing

There is no comprehensive definition of playing confirmed by all theorists and psychologist (Motahari, 2007). Culture and background defines playing as "any type of sport or physical activity for the purpose of fun, do an activity briskly" (Ghirshman, 2016). In Gorki's perspective, "playing is a path to child's perception".



Gemes considers playing as an internal willing and believes that children tend to play due to their willingness to struggle physically (Riahi, 2001, p. 53). Erikson also believes that playing is a human willingness to touch and perceive the world, bring it under the control and get familiar with it. Children have special sense of life; therefore, one of the most important practical and visual motives of children is to be able to practice this special form of life through playing and exploring their environment (Case, 1985). Harlouk defines playing as any kind of activity to enjoy without focusing on the final result. Human beings tend to play these game naturally and no external force influences it. Piaget introduces five factors to distinguish playing from working: a. Playing includes a goal; b. Playing is not forceful; c. Playing is joyful and pleasure; d. There is no order and organization in playing; e. there is no challenge and aggression in a play (Seyf, 2007). Mazloumi considers childish plays initially as a way to get to know the environment and then as an experience to apply functions, culturalism and finally as a way to educate. Garous, in the 19th century, provided a new theory about playing through studying animals' plays. He believes that playing is a practice to prepare human for future life and can influence their physical development and learning significantly. In this end, Garous divides plays into two categories: a. Plays in which there is a public action; b. Plays which determine a specific action. Therefore, through playing children examine their capabilities and improve their social senses.

Children grow physically through playing. Plays can develop language learning ability and form children's social and moral criteria (Chamberlain, 1999). Confirming this issue, Piaget believes that this theory just cares about the action perspective of playing and cannot distinguish symbolic plays from each other because children imagination is superior to their instinct practice. Symbolic plays, in Piaget's perspective, mean attraction of reality in thoughts and therefore, he divides childish plays into three categories: a. Exercising plays, which mostly deal with children's movement and sensual activities, b. Secret plays, which are developed by children and is

played alone which contains a lot of imitation, c. plays with specific rules and regulations which are imposed by a group. However, the role of rules is condemned in these sorts of plays (Riahi, 2001).

Playing is not only an entertainment for children but it also has a significant role in their education, physical and mental development as well. If plays are designed thoughtfully, they can provide children with the opportunity to improve their emotional, mental and physical aspects and therefore teach them social and moral principles well (Riyahi, 2001). Regarding the importance of playing for children's development, UNESCO (1987) considers that playing and its space should meet the children development needs in a. Physical growth, b. Sensational development, c. Social development and d. Perceptual development aspects. In this end, what signifies the importance of playing in connection with architecture is the point that although playing has an internal essence, it does not happen in deplete built environment, paves the way for its occurrence.

As the most important practical activity of children, playing have a great part in sharing information between children and the environment. Because the most obvious influence of environment on children's is through its appearance in the environmental experiences which occur in various experimental forms in order to meet needs and practice variety of actions. It does not mean, though, architecture is responsible for teaching children "how to play", because children have already learned it. Through reciting their experiences, they only explore how to manage the space for playing (Mozaffar et al., 2008, p. 62). Accordingly, the role of architecture is a kind of facilitator in providing space and qualities required for various plays. Architecture, through facilitation of playing, can improve its quality and play a significant role in children's development. The question is "what are the factors in architecture that can facilitate playing?". Children's various forms of playing, which could be facilitated in space through architecture are briefly explained as follows:

Table 1. Plays and their Age Ranges

Plays	Exemplified	Age Range
Playing without Preoccupation	These sort of plays are basically sensual-movement which aim to discover the traits of objects	One year old
Playing Alone	Playing on their own	Continues
Observer Plays	Watching others, imitating children around, no cooperation	At the end of one and two years old
Parallel Plays	Playing around with others without involving them	Two and three years old



Symbolic plays	Playing various roles and applying the sense of imagination	Begins at the age of two and continues to the early childhood
Cooperative Plays	Playing with others without continuing the interactions	Three and four years old
Plays Involving Collaboration	Continuing interactions, playing various and easier roles in them	Five and six years old

(Kaplan, 2016)

Perception

Space perception is a complex phenomenon. Children are required to both distinguish themselves in the world and analyze this world. They do this through exploring objects around, though, they see the world different from the adults' point of view. Children perceive the environment through direct experience of the surrounding world. Piaget believes children see phenomena and objects as a general issue at first and then define them by distinguishing each one. Children possess a topological interaction with the environment. Instead of distances, aspects, angles and areas, relations such as vicinity, separation, symmetry and continuity are at the focus of children in topological perception. So, children perceive initial disciplines based on symmetry which are defined by continuity and vicinity. They perceive places by the sense of symmetry and locality, paths based on continuity and connections based on the formed surfaces. When children, for example, see a tree in an empty yard, they do not perceive the geometrical features of the tree such as size, height, etc. They just perceive the locality of tree in its environment. Space perception qualities such as solidarity, secrecy, adjustability, familiarity, crowd or relaxation will influence children's preference in using spaces for a variety of purposes (Mozaffar et al., 2008).

Therefore, it seems crucial to make a motivating environment in order to challenge their skills and capabilities based on their age. Variety in materials, books available as well as possible plays provides children with the experience to work with different materials through trial and error. Children are required to feel comfortable

and relaxed in built environment and also while living in them. Darkness as well as inappropriate forms might frighten them more than the other things. Places with happy, bright and also unrecognizable colors (e.g. when they paint with water color) can provide children with emotional sensations because they can make them imagine dreamy and imaginary subjects. For less young children, mild colors with determined borders, more details and soft curves seem to be more subjective (Mozaffar et al., 2008). In addition, sense of belonging is among the most important elements affecting space quality. Therefore, children, just like adults, are required to have the sense of belonging toward the environment. In Becker's viewpoint, privatization of a place can strengthen the sense of belonging toward that place. Therefore, a place that can provide children with privatization might be more successful in forming the sense of belonging in them (Lang, 1987).

Colors, among the other environmental elements, are more influential in forming people's perception, especially children's. Colors can produce exciting experiences such as happiness, joy, grief, relaxation, motivation, immobility and excitement. These features are stronger in children. They prefer complex and stronger colors which have been blended suitably (Piaget & Inhelder, 2017). Children specifically enjoy major saturated colors. It seems that children's first reactions to colors are dependent to their emotional characteristics, but during the time they learn to watch and perceive them critically (Scott, 2010). Accordingly, Children's perceptual properties are briefly categorized as follows:

Table 2. Children's Perceptual Properties

Property	Exemplified Issue
Geometric	- Recognition of vicinity, separation, symmetry and continuity instead of dimensions and areas - Perception of spaces and objects with the sense of symmetry and locality - Perception of path with the sense of continuity - Perception of crosses based on the surfaces
Experimental	- Experiencing materials through trial and error - Experiencing masses and structures - Experiencing colors, patterns and textures
Emotional	- Formation of emotions to space (such as being afraid of darkness) - Formation of sense of belonging toward the place (such as privatization of objects and spaces)



Learning

The environment can influence children learning ability significantly. Based on cognitive psychologists' definitions, learning means the creation of stable changes in children's behavior along with a behavioral influence which is the result of experiences. Learning is required to be well-matched to every child's personal needs and their level of perception as well. Children should be provided with the opportunity to form their own knowledge (Seyf, 2007).

Learning happens in children in two periods of time: the period of pre-school and after that. In pre-school period, children learn how to learn. A pre-school child might learn and perceive using the measurements for foods. At this age, children perceive mathematic notions such as big, bigger and the biggest. Spending every hour with other children and talking to them either about dolls or the colors of building blocks is crucial for their language and perception development. They learn how to get along with others and begin to form their communication skills. Pre-school children perceive their environment through playing, observation and experimenting their environment such as the things that float. They experiment the features of materials when playing with sand and water. They also

learn the important notions of physics such as balance and stability when they use building blocks to build houses. They learn vocals with songs. They explore every text to get the message of every single word. Children also explore the society and its people through going to different place.

Children tend to learn everything about the world and how things work at the school age. They have developed a lot in comparison to the pre-school age. They are older and more cooperative. Children are more developed mentally and are better able to concentrate on activities for longer time. They are more developed socially and are better in making friends and working as a team. They possess more complex thinking capabilities and have better perception and answers to their questions. At this age, children even use pets' and humans' body to explore life. They specifically learn about time and locations and get ready to develop their world beyond their houses as a bigger society. Through active as well as cooperative explorations, they develop their perceptions. At this age, children learn through excitement. Excitement allows them to be attracted to the unknowns around themselves. They strive to answer these unknowns through explorations, making explanations and asking more questions (Levin, 2013).

Table 3. Children Learning Traits

Post-primary School Age	Pre-school Age
Learning from animals and plants	Learning through playing, observations and experiment
Learning language through songs	Learning through comparison (Such as size and mass)
Learning the time and exploring seasons	Learning through talking (Such as general shapes)
Learning cooperative works and social development	Learning through relationship
Learning through the sense of excitement, love to explore and concentration on activities	Learning through texts and the message
Unpreparedness toward perceiving the abstract and complex notions	Learning through touring and visiting
Learning basic skills through practices	Learning through songs (such as vocals)

(Levin, 2013)

Generally, studies about three basic aspects of development in children (playing, perception and learning) reveal that it is expected that some basic functions for environments related to children be found. These functions, which provide a constructive interaction between children and their environments, are divided briefly in following categories:

- a. Facilitating playing in the spaces;
- b. Promoting perception of children;
- c. Providing a learning environment for children.

THEORETICAL FRAMEWORK

Through the study of research aimed to improve space matching children's features, this study tries to reinvestigate the environmental functions and recognize their relevant spatial characteristics simultaneously.

Mozaffar et al. (2008) have studied the correlations between the quality of the environment and children's creativity. They think most of spaces provided for children are being designed without considering



children's real needs and are just based on designers' personal experiences, interests and perceptions or according to some general psychological characteristics such as variety in colors, shape, etc. Therefore, these spaces are not appreciated by children due being inappropriate to their needs. This study, based on needs, capabilities, mental and physical development of children demonstrated that neighborhood parks and green spaces have a deep influence on the development of children's creativity. Also, physical features of public spaces can either pave the way or hinder creativity development in children. Using content analysis method, the relation between open spaces of neighborhoods and behavioral-perceptual needs of children were studied. Finally, some features of open spaces in residential areas have been provided, such as availability and movability of spaces, attractiveness, safety, responsiveness and comfortability of spaces and properness of space for cooperative works and collaborative plays.

Ebrahimi, Saeedi and Maani (2012) tried to provide some novel principles for designing spaces for children's playing, the ones aged between 5 to 12. They think the expectations of today's children from playing in a space is beyond traditional viewpoints which requires reconsideration. Moreover, the design of spaces for children's play influences their behaviors and expectations. Accordingly, researchers have studied the relations between design features of spaces and the behaviors of children. Two neighborhoods of Golsar and Lakan in Rasht, as case studies of an old and a new neighborhood, have been compared to explore the influence of the environment on children's playing behaviors and their physical activities. The findings of this study showed that: a. The social, economic and cultural features of families such as age, job, income and education of parents in one hand and the amount of social interactions as well as the relationship among the people of the neighborhood in other hand are directly related to children's playing behavior in informal places without the presence of their parents; b. The distance between house and school affects children's physical activities; c. There is a direct relationship between children's presence in playgrounds and the type of their living place (i.e. house, apartment and etc.). To discover children's expectations of playing spaces, researchers used a number of techniques such as drawing, interview and questionnaires in order to gather the necessary information about various kinds of plays and their favorite type of playgrounds. The given principles include the necessity of considering details (such as building materials, colors, odor, noise, etc.) in order to improve children's senses, the necessity of improving

children's relations with the environment, the necessity of designing discoverable and different spaces, the necessity of conformity with children's need in creating spaces and considering children's proportions in spaces.

Noghrekar, Mozaffar, Saleh and Shafaei (2009) tried to use an explorative methodology to explore the design principles of educational spaces for children in order to improve their creativity. Complexity in studying children, constraints in evaluating creativity using relevant tests as well as the numerous intruding variables in the case of creativity had made the researchers to apply an explorative research method as an appropriate model. Finding of the research shows a relation between caring about environmental motivators as the independent variable and children's playing (and cooperation), flexibility of functions and imagination as the mediatory variables.

Azemati, Zarghami, Sedghpour and Azemati (2011) in order to improve creativity in children's play spaces, analyzed three fields of society, aesthetic and ecology and referred to some criteria to design preferred spaces for children's creativity development. Pointing to the specific characteristics of children, the researchers put their emphasis on the necessity and importance of using the capabilities of civil parks in order to develop children's creativity. Based on the hypothesis of this research, the designs of civil parks have influence on children's creativity. The researcher used an experimental methodology to perceive parents' point of view (who are the closest people to their children and recognize their needs better) in order to study the potentialities of civil parks in development of creativity in children. Findings were briefed in four major criteria: Playability, mobility, safety and stimulatory of space.

Kiani & Esmaeilzadeh (2012) referred to several approaches to create opportunity for children in order to form or change their environment. This research aimed to find an answer to this question: what is the most favorite city in children's viewpoint? This question is rooted in this basic theory that children-loving cities can be designed in a way to be conformed with children's needs and desires. Accordingly, a group of students were asked to speak about their viewpoints on most favorite cities. Findings showed: a. Most of them preferred to stay home in their free time due to the distance of parks from their houses, inappropriateness of parks and unsafety of streets; b. Most of the urban children love green, clean and playable spaces in their neighborhoods; c. Children enjoy being in safe and danger-free spaces which imply unsafety of their current living places; d. Most of the children pointed out that they feel insecure at the time of their playing and walking due to the commute of transportation means as



well as problems made by other people.

Kamelnia & Haghiri (2009) tried to find the criteria to design green spaces in a children-loving city. Accordingly, within a cooperative research method, researchers utilized a discussion group technique such as storytelling, tables and puzzle making, modelling, drawing and etc. to collect and analyze children's viewpoints about green spaces. Findings revealed that green spaces are suitable areas in which the level of children's interactions and cooperation can be increased. Demands of children were green space in combination with playing areas full of trees and flowers, small lakes or pools, special areas for children while letting parents monitoring, places for writing their memories, using materials such as wood, grass, use of spatial elements for learning, use of bright colors, sunshade and lighting and indirect paths and bike lanes.

Sajadi Ghaemmaghami, Poordeihimi and Zarghami (2010) studied the influential factors in the stability of residential complexes in social viewpoint including children's development, justice, aesthetic, comfort and safety. Researchers think the current style of massive housing productions has led to a situation in which limited space is allocated to children and they have to participate in their parents interactions and conversations. Besides, findings of this research demonstrated that children's direct relationship with open spaces or nature is among the most important factors for their development which provide them with the possibility of skills and health improvement. Therefore, playfulness of multifunctional and open spaces for children is of great significance in designing residential complexes. Meanwhile, it seems necessary to care enough about parents' monitoring and observations. The quality of space in terms of playfulness, stimulatory, safety and security needs to be taken into consideration as well.

Mansouri & Gharehbaglou (2012) tried to find out the influential factors (subjective, objective) of urban areas which improve interactions of children with the city. Through considering that urban spaces which meet children needs and desires can help their physical and social development, this research provided qualitative factors in designing urban open spaces such as the possibility of free activity of children, presence and significance of the nature, children's participation as citizens in the design and considering adults monitoring on children. In addition, some recommendations are provided to improve the quality of urban open spaces to interact with children in Iranian cities, through utilization of Iranian traditional architecture.

Fathollahi (2012), focuses on sense of safety in designing children's parks. This study aimed to explore children's mindset about the concept of being safe and secure which is significantly influenced by their relations with others and their environment. Information was collected through analytic-descriptive technique. Findings show creation of familiar spaces for children in which children feel at home as well as applying movement plans and safe ground in design can create the sense of safety in both parents and children. Although considering safety as an influential parameter in children's interaction with the environment is among the strengths of this research, generalization of this research to Iran seems to be hard, since this research was conducted in the city of Moscow.

Kashipazha (2012) tried to achieve some criteria to design parks based on the sense of finding territory in children. Considering the fact that park plays a significant role in flourishing children's talents, the researcher believes that if the place is designed in a way that its meet children's perceptual needs, they would feel a sense of belonging in these spaces. Therefore, a park turns into a territory. Using comparative-descriptive technique, the researcher provided a collection of design principles including childish scale, cozy spaces, necessity of space control by children, need of nature, diversity, playability and collectiveness of places.

Although most of these research dealt with the collection of some principles to improve open spaces in connection with children's needs and rarely cared about internal spaces, the findings might be influential in collecting design principles of closed spaces matching children's behavioral-cognitive needs. Accordingly, the findings of the previous sections of this research, i.e. theoretical framework, research background and basic concepts, are summarized in table 4. The first column represents the environmental triple functions in relation with children. In other words, the environment possesses features to provide these triple functions in order to create a significant and influential interaction with children. Second column deals with the necessary features to achieve these functions which have been gained from the previous studies. In advance, it seems necessary to study the correlation between these two types of factors to explore which environmental features improve each of the triple functions for children. This issue can be studied through a correlational-statistical test. The relationship between every single feature and the environmental functions for children should also be clarified. This part of the research has been conducted through a subject factor analysis statistical test.



Table 4. Environmental Functions for Children and their Relevant Environmental Features

Environmental Functions for Children	Physical Environment Features to Provide Functions
Providing a Learning Environment for Children	Playability: (Noghrekar et al., 2009), (Kiani & Esmailzadeh, 2011), (Azemati et al., 2011).
	Physical Security: (Mozaffar et al., 2008), (Kiani & Esmailzadeh, 2011), (Naghizadeh, 2001), (Azemati et al., 2011), (Kamelnia & Haghiri, 2009).
	Environment's Stimulation: (Noghrekar, 1388), (Mozaffar et al., 2008), (Ebrahimi et al., 2012), (Azemati et al., 2011), (Kamelnia & Haghiri, 2009).
Facilitating Playing in the Spaces	Environment's Mobility: (Mansouri & Gharehbaglou, 2012), (Azemati et al., 2011).
	Space Flexibility: (Noghrekar et al., 2009), (Mozaffar et al., 2008), (Azemati et al., 2011).
Promoting Perception of Children	Childish Scale: (Mozaffar et al., 2008), (Ebrahimi et al., 2012).
	Child Participation: (Noghrekar et al., 2009), (Mozaffar et al., 2008), (Kiani & Esmailzadeh, 2011), (Razavi, 2011), (Ebrahimi et al., 2012), (mansouri & Gharehbaglou, 2012).
	Relationship with Nature: (Azemati et al., 2011), (Ebrahimi et al., 2012), (Mozaffar et al., 2008).
	Safety: (Kiani & Esmailzadeh, 2011), (Razavi, 2011), (Mozaffar et al., 2008), (mansouri & Gharehbaglou, 2012), (Naghizadeh, 2001), (Azemati et al., 2011), (Kamelnia & Haghiri, 2009).
	Familiar Environment: (Azemati et al., 2011).

METHODS

The previous studies revealed some of the influential features in making spaces suitable with children's needs, though, they do not provide us with the exact influence of each measure. Therefore, an explorative study was utilized to perceive these features in the form of variables and to weigh them. The main achievement of this field

study is the determination of the influential coefficient of each variable in matching spaces with children's needs. Weighing variables can reveal their role in the amount of a house's compatibility to children's needs. Therefore, an enclosed questionnaire with ten questions was prepared to evaluate the weight of each variable using Likert scale. In this questionnaire, the dependent, independent and field variables are as follows:

Table 5. Research Variables

Variables	Variable Types	Variables Scale
Facilitating playing in the spaces	Independent	Nominal
Providing a learning environment for children		
Promoting perception of children		
Playability, Physical Security, Environment's Stimulation, Environment's Mobility, Space Flexibility, Childish Scale, Child Participation, Relationship with Nature, Safety, Familiar Environment	Dependent	Ordinal

The viewpoints of people about the variables have a qualitative nature. Therefore, techniques are required in which qualitative responses can be turned into measurable quantitative variables for their evaluation. In this end, Likert scale, among the others, was applied. In

the one hand, there were equal numbers of positive and negative viewpoints; on the other hand, not many factors and judgments were required. Therefore, the findings are more valuable and accurate. The statistic population in this research included architecture professionals with master



and Ph.D. degree. Due to the constraints of the research, 45 individuals, among the architecture professors of various universities were selected. To select this population, education, gender and geographical distribution of the

individuals was taken into consideration in order to make the population distribution more balanced, reliable and generalizable. Accordingly, the sample population characteristics are as follow:

Table 6. Demography of the Sample Population

Gender	Education		Total
	Ph.D.	M.A.	
Female	17	3	20
Male	19	6	25
Total			45 individuals

To analyze the findings of the questionnaire, two statistical tests were utilized. These tests were factor analysis test and correlation coefficient test. The analyses were conducted by SPSS software. To investigate the reliability of the questionnaire and accuracy of the factors representing functions as well as the factors representing features of spaces, subjective analysis test was utilized which is commonly used to validate the measurements. Then, to study the correlation between independent and dependent variables, correlation coefficient test was applied. First, it is crucial to ensure that the number

of samples are enough for this test and also the test is suitable for the purpose of factor analysis. KMO and Bartlett significance level were the first tests of factor analysis. When $KMO > 0.6$, factor analysis can be easily conducted. As seen in Table 7, KMO is 0.616 which reveals that the number of samples (individuals) is sufficient for factor analysis. On the other hand, 314.07 in Bartlett statistical amount, and freedom degree of 45 and sig. amount of 0.000 demonstrate that exploration subjective analysis is suitable for data.

Table 7. Bartlett's Test Results and KMO Index

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.	.616
Bartlett's Test of Sphericity Approx. Chi-Square	314.070
df	45
Sig.	.000

FINDINGS

The data of the questionnaires completed by 45 respondents were entered into SPSS. Then, using the

descriptive information table of this software, the abundance distribution of each variable was investigated which has is provided in Table 8.

Table 8. Frequency Distribution of Variables in Research

Variable	Frequency of Responses				
	Very low	Low	Moderate	High	Very high
Playability	0	0	(31.1)	(37.8)	(31.1)
Physical Security	(2.2)	(4.4)	(15.6)	(33.3)	(44.4)
Environment's Stimulation	0	0	(37.8)	(40.0)	(22.2)
Environment's Mobility	0	0	(37.8)	(37.8)	(24.4)
Space Flexibility	(2.2)	(4.4)	(8.9)	(31.1)	(53.3)
Childish Scale	(2.2)	(4.4)	(15.6)	(28.9)	(48.9)
Child Participation	(2.2)	0	(31.1)	(40.0)	(26.7)



Relationship with Nature	0	0	(26.7)	(46.7)	(26.7)
Safety	(2.2)	0	(35.6)	(42.2)	(20.0)
Familiar Environment	(2.2)	0	(33.3)	(44.4)	(20.0)

Table 8 demonstrates the abundance distribution of the variables with the given total scores for each variable in the form of percentages. Minimum 82.4 percent and maximum 62.2 percent of the respondents believed that the given independent variables were influential in the conformity of the residential areas with children's needs. This amount is given through the addition of the total numbers of "high" and "very high" options and the mean average of the responses to these two options was 70 percent. On the other hand, at least one individual chose "high" or "very high" options to determine the influence of the variable. It reveals that the given variable cannot be excluded and its influence might be less than other variables. Therefore, at this stage of study, independent variables of the study can be put into the correct order based on their influence. Then, statistical test needs to be applied in order to gain the influence coefficient of each

variable.

In the next step, according to Table 4, it is necessary to study the correlation between two types of factors (functions for children and features of spaces) to explore which environmental features improve every one of the triple functions for children. For this purpose, an exploratory factor analysis test is utilized. In this test, according to the level of correlation, the data for each independent variable are exposed to each factors to evaluate the level of correlation between two variables. In the case that outcomes of the test are the same as the conducted studies, findings will be confirmed. SPSS software provides a table called the initials that is achieved after the factor analysis test and right before showing the final output. Table 9 shows the initial and achieved findings.

Table 9. The Initial Factor Analysis Test

Independent Variables	Communalities	
	Initial	Extraction
Playability	1.000	.686
Physical Security	1.000	.913
Environment's Stimulation	1.000	.901
Environment's Mobility	1.000	.705
Space Flexibility	1.000	.856
Childish Scale	1.000	.816
Child Participation	1.000	.858
Relationship with Nature	1.000	.586
Safety	1.000	.935
Familiar Environment	1.000	.838

The first column shows the initials before deriving the subject(s). This is why all the initials are equal to one. In the second column, the bigger the derived amounts, the better the factors can show the variables. In the case that the derived amounts are very small (<0.5), they must be excluded and it might be crucial to derive another factor (Samiezade, 2008). As shown in Table 9, none of the variables have the similar derived amount less than 0.5. Therefore, all the variables are still included in the test.

After this stage, according to the data and the settings, the components matrix table will be designed which includes subjective loads of each variable after their turn. Table 10 shows the turned matrix table of the research components. This matrix has classified the independent variables into three subjects. The bigger the absolute amount of these coefficients, the more significant the role of subject on the total amount of the variable changes (variance).



Table 10. Factor Analysis Test Results

Independent Variables	Component		
	1	2	3
Playability	.821	-	-
Physical Security	-	-	.945
Environment's Stimulation	.935	-	-
Environment's Mobility	.810	-	-
Space Flexibility	-	-	.921
Childish Scale	-	-	.889
Child Participation	-	.916	-
Relationship with Nature	.744	-	-
Safety	-	.960	-
Familiar Environment	-	.896	-

As seen in Table 11, the given independent variables based on the responses in the questionnaire can be categorized into three subjects. This statistical test relates the first factor to the following variables: Playability, environment's stimulation, environment's mobility and the relationship with nature. Variables like child participation, safety and familiar environment have been taken as the sub category of the second factor and finally, the variables of physical safety, flexibility environment and childish scale have been introduced as the third factor. The variables found from the theoretical studies related

to the topic have been classified into three categories: "learning environment", "behavioral needs", and "perception". According to the correlations among the variables of each category and the variables of the three factors found from the field studies, every of the factors introduced from the statistical test can be related to one of these categories. Based on the conclusion of the research theoretical framework, the first, second and third factors can be introduced as "providing a learning environment for children", "facilitating children's behavioral needs", and "promoting perception of children", respectively.

Table 11. Dimensions of Child Interaction with the Environment and Related Criteria

Dimensions of Child Interaction with the Environment	Component
Providing a Learning Environment for Children	Playability
	Environment's Stimulation
	Environment's Mobility
	Relationship with Nature
Facilitating Children's Behavioral Needs	Child Participation
	Safety
	Familiar Environment
Promoting Perception of Children	Physical Security
	Space Flexibility
	Childish Scale

Table 12 shows the correlation coefficients among the main derived factors for the variable before and after the turn. As seen, correlation coefficients between the first

and the third, the first and the second and the second and the third are 0.527, 0.584 and 0.618 respectively.



Table 12. Coefficient of Correlation between Component

Component	1	2	3
1	.618	.584	.527
2	.728	.172	.664
3	.297	.794	.531

CONCLUSION

Children's interactions with their environments has always been considered as a significant factor in their physical, mental, psychological and social development. Therefore, through their provision, the environment can facilitate their development. This paper tries to find out the characteristics of suitable places for children based on the recognition of their behavioral and mental needs. Hence, based on the research findings, the main environmental functions to make houses appropriate for children's needs can be classified into three main categories: "providing a learning environment for children", "facilitating children behavioral needs", and "promoting perception of children". On the other hand, the variables "Playability", "stimulation of the environment", "environment's mobility", and "relationship with the nature" can be considered as the most influential factors in providing a learning environment for children. On the other hand, "children's participation", "safety", and "familiar environment" are considered as the most influential factor in facilitating children's behavioral needs. Finally, "physical security", "flexibility of the space", and "childish scale" are recognized as the most functional factors in promoting perception of children. Taking the aforementioned issues into consideration for designing houses can make spaces compatible to children's behavioral and cognitive needs and provide children with the opportunity to cooperate and play their social roles in order to improve the social knowledge and creativity. Findings of this study can be utilized to collect design principles compatible to residential spaces for children's needs. Due to the necessity to combine these findings with other influential factors in residential design, these principles require an explorative study to be confirmed.



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