

Environmental Affordances in Designing Child-friendly Residential Complexes: A Conceptual Model of Kids' Motivation to Play

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Abstract

Play has a wonderful effect on kids' development, as a tool for gaining experience. All developmental psychologists have emphasized the importance of childhood, play and appropriate play area. Nevertheless, today in designing residential complexes, less attention has been paid to the kids' needs, as a one of the most vulnerable groups of the society. Living in such environments has a negative impact on the individual and social health of kids. This paper focused on the effective factors and how they influenced enhancing kids' motivation to play (3 to 6 years) in residential complexes. The mixed method (Qualitative & Quantitative) was used as a research methodology. The survey was conducted by using the Delphi method. Factor analysis presented six major factors: a) supervision of the environment, b) legibility of child-centered environment, c) natural stimulant factors, d) social interactions (generational-intergenerational), e) vitality of environment, and f) sensory stimulation. Later in the paper, based on the analyses, a linear model was designed. The results showed that "vitality of the environment" and "natural stimulus factors" increased "stimulating the senses". "Natural stimulus factors", "vitality of the environment", "legibility of child-centered environment" and "supervision of the environment" increased "social interactions" and therefore improved kids' motivation to play in the residential complexes. Furthermore, in order to place greater emphasis on architectural discourse and move closer to the dimension of architectural design, practical examples and design strategies like: playing with natural elements, geometry of space, spatial coherency, direct and indirect visual permeability, and etc. are presented.

Keywords

Environmental Affordances, Child-centered Design, Motivation to Play, Child-friendly Environment, Residential Complex.

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Introduction

In general, play is a free physical or mental activity that affects the overall development of a child. They can express their feeling of vitality and cheerfulness (Hosseini, 2021). As Vygotsky quotes “Play is not just for fun; it is the work of childhood. Through play, children learn to give meaning to objects, to tease out relationships, to try on and practice different roles, to exercise their growing capabilities” (Vygotsky, 1999). Even though play is vital for a child’s development, nowadays, studies show children seldomly experience outdoor play. Instead, they spend most of their time inside buildings or vehicles, which leads to the commodification of the childhood (Marouf et al., 2015). Another study by Clements, gives fundamental reasons for the decline in outdoor play experience, including dependence on television and digital multimedia, as well as concerns about crime and safety (Clements, 2004).

Childhood experience of playing outside could be the most special, valuable and precious memories of a person’s life. However, the children and young people today are not currently experiencing public open spaces as the old generation, they might not have such memories when they become old (Shi, 2017). Another study, using observational data and behavioral mapping, examines how environmental design features in affordable residential complexes influence the physical activity and play of children. The findings indicate that open and high-quality outdoor spaces play a significant role in promoting children’s physical activity and play (Hejazi et al., 2026). Children prefer natural outdoor settings for their wide potentials for motor and social play (Evans, 2006). Natural environment also affords greater independence and mobility (Kyttä, 2004). In most urban environment, such opportunities are rare in natural setting. In return, the nearby home spaces replace the playgrounds and open spaces as the main social and play space for the children. Children activity spaces, particularly the outdoor nearby home spaces, play a major role in children’s life experience and development. What the spatial environment offers, could influence their well-being (Abdul aziz & Ahmad, 2012). The other findings confirm that there are social requirements for a child friendly space. This space attributes to a safe and friendly environment that is also enjoyable for the residents in the neighborhood. As a reference, Tim Gill (2014) also argued that “communities and neighborhoods that provide good play opportunities tend to be places that work well for everyone” (Blinkert & Weaver, 2015).

Neighborhood, a transitional space, has an important role in kids’ lives in the residential complex. Intermediate spaces between housing units and public areas influence children’s independent mobility. Using a qualitative approach, the recent study identifies key factors such as safety, human-scale design, natural surveillance, accessibility, and opportunities for social interaction as essential for encouraging children’s autonomous movement and spontaneous play (Mirsafa et al., 2022). Considering the importance of child-friendly environment, this study intends to create or increase kids’ motivation to play and, as a result, residential complexes will become a child-friendly environment. In this research, the hypothesis is that physical–functional and cognitive–perceptual factors can form some environmental affordances like variability, controllability, vitality, legibility and coherence to generate and enhance children’s motivation to be present in the intermediate (semi-public) space of residential complexes for play.

Parental perception–based measures of neighborhood child-friendliness are inherently subjective and may be influenced by personal experiences, safety concerns, and socio-cultural attitudes, which do not always reflect the objective conditions of residential complexes (Gong et al., 2024). On the other hand, obtaining the perspectives of preschool children (aged 3 to 6 years), due to their cognitive immaturity and limited ability to accurately perceive and interpret the environment, appears to be scientifically unreliable (Azemati et al., 2013). Therefore, this research first examined experts’ viewpoints using an adult-centered approach. Subsequently, in order to validate the findings, a child-centered approach was employed, incorporating children’s participation to assess and confirm the experts’ opinions. After testing the hypothesis regarding the relationship among the research variables, the results are presented in the form of the most appropriate model, and finally, design strategies are proposed.

Theories

The "Arousal Theory" as a recent theory of play derives from earlier behavioral learning theories. In this theory, Berlyne (1960) stated play as diverse exploration, functioning to decrease arousal motivation. His contribution was to draw attention to the motivating mechanisms of play. On the other hand, Ellis (1973) suggested an alternative to Berlyne's theory, that play can increase both stimulation and level of arousal. The difference between both these models of play can be seen in their responses. In Ellis's model an organism "seeks" stimulation whereas in Berlyne's model an organism responds to "produce" stimulation. In Hutt model (1979), arousal motivation goes from a "too much" to a "too little" cycle. Lack of play behavior is the result of both of these cycles. When arousal motivation is at a moderate level, the activity becomes either ludic (symbolic play) or epistemic (problem solving), in response. In Fein's approach (1981), play is viewed as a response-orientated activity served by a moderate level of arousal, which is not based on a particular stimulus in the environment. The environment is familiar but there is an absence of biological needs and social demands. An organism produces a new condition in a familiar environment. This organism may produce uncertainty, associated with a negative effect. This results in the organism attempting to achieve mastery, over the situation, by acting on it and therefore, reaching a positive effect. The action may be repetitive but appears with variations in both stimuli and responses. When variation in the responses is exhausted, play stops. This form of repetition is called the "boost/jag" mechanism and serves to explain why play often appears repetitious over a long period of time. In summary, arousal theorists view play as a mechanism associated with exploration and with regulation of arousal motivation (Takhvar, 1988).

Regarding the literature review above, it can be stated that in order to satisfy the play need, as a factor of intrinsic motivation, kids show interest in the physical environment. So, they gradually start to change that physical environment. Furthermore, the physical environmental stimuli play an important role in kids' motivation to free play, as a factor of extrinsic motivation. Based on Gibson's "Theory of Affordances" (1979), the result would be to create environmental affordances which can be entitled environmental affordances to motivate kids to play (EAMKP). It's noteworthy that individual features, physical and socio-cultural environments are also considered as the effective factors on kids' play (Figure 1).

The purpose of environmental affordances to motivate kids to play (EAMKP) is to make the environment usable for children's play behavior (autotelic or free play), as being a potential or functional affordance. Eventually, kids have the freedom to act in accordance with the goals and motivational resources as well as to interact with the environment. More precisely, quality of the elements and physical components of the environment to encourage kids to play, as the extrinsic motivation factor. Therefore, their motivation to free play will increase in physical environment. The final result is the transformation of the physical environment into a playful environment for kids. Summaries of the discussed issues are presented schematically in the figure below (Figure 2):

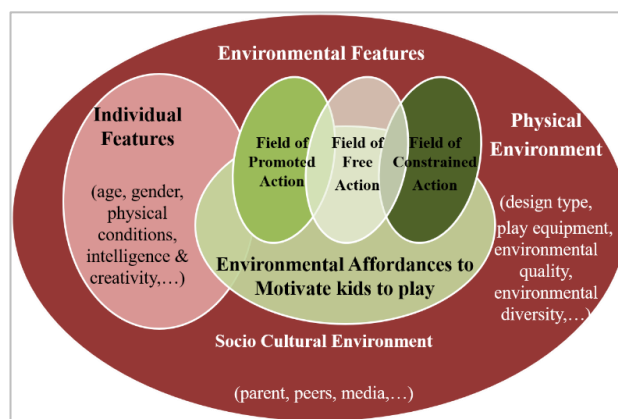


Figure 1: Environmental Affordance to Motivate Kids to Play (EAMKP) (Hosseini, 2021)

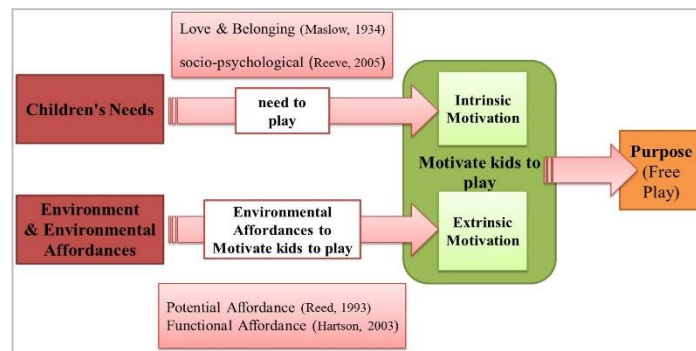


Figure 2: Kids' Motivation to Play in the Physical Environment (Hosseini, 2021)

This research intends to cover the influential factors and how they influence in enhancing of kids' motivation to play, in which so far, no other comprehensive research has done before. In (Table 1), the other researches related to kids play in residential environments are presented below as well as their similarities and differences with the present research.

Table 1: Abstract of research related to children and their play in residential environments

References	Similarities	Differences
(Elnesr, 2023)	<ul style="list-style-type: none"> Examining how the environmental features of residential spaces influence children's play behavior Applying Gibson's Affordances theory to examine how environmental features influence children's behavior 	<ul style="list-style-type: none"> Concentrating on children aged 5 to 12 years Residential neighborhood as a whole, encompassing courtyards, pathways, gathering areas, internal yards, and so on.
(Faizi et al., 2018)	<ul style="list-style-type: none"> Introducing design Guidelines of residential environments Concentrating on preschool children 	<ul style="list-style-type: none"> Focusing on stimulating children's creativity
(Shi, 2017)	<ul style="list-style-type: none"> Exploring children's outdoor play spaces of community areas discussing the play time, activity types and friends to play with in the outdoor play spaces Multi-functional structure as a way to design outdoor play spaces 	<ul style="list-style-type: none"> Concentrating on children aged 0-12 in high density cities Improving children's physical and psychological functioning with the regard to their intellectual and social needs
(Shabak et al., 2015)	<ul style="list-style-type: none"> Investigating the children's perception in order to determine a successful residential common open space by stressing on physical characteristics of the place attachment. 	<ul style="list-style-type: none"> Concentrating on children's sense of attachment to the residential common open space in high-rise gated communities
(Blinkert & Weaver, 2015)	<ul style="list-style-type: none"> Exploring the quality of the space around children's homes affecting the amount of time they play Discussing relation between the quality of the 'action space' available to children and the economic and cultural resources of their families 	<ul style="list-style-type: none"> Concentrating on children aged 5 to 9 years
(Latfi & Karim, 2012)	<ul style="list-style-type: none"> Planning guidelines for children playing spaces Focusing on the types of playing behavior, the location of playing patterns and playing problems 	<ul style="list-style-type: none"> Concentrating on playing spaces in a low-cost housing area
(Li et al., 2012)	<ul style="list-style-type: none"> Studying the relationship between place characteristics and child behavior 	<ul style="list-style-type: none"> Concentrating on residential landscape spaces (public area) Comparison action capabilities of school and preschool children
(Abdul aziz & Ahmad, 2012)	<ul style="list-style-type: none"> Exploring children's outdoor activities and relates them to flats layouts that affect the different patterns of children outdoor activities. Focusing on development and social experiences 	<ul style="list-style-type: none"> Concentrating on Low-Cost Flats Outdoor Space (different flats configurations)

Materials & Methods

1. Hypothesis

The research methodology design began with an initial hypothesis: Physical-functional and cognitive-behavioral factors can create or increase kids' motivation to play in residential complexes by forming the environmental affordances like variability, controllability, vitality, legibility and coherence.

2. Research approach and techniques

Based on a combination of theories related to the research subject, mixed method (Qualitative & Quantitative) was used as a research methodology. More precisely, this study has been conducted in two main stages: the first stage (hypothesis formulation) by logical argumentation method and the second stage (hypothesis testing) survey based on Delphi method.

3. Subject & Sites

Research in early childhood is very necessary due to limited free play and access to spaces related to residential environments. This study focused on 3- to 6-year-old children living in mid-rise residential complexes in Isfahan, Iran. A related case study was conducted in two sites, Moshtagh and Olive residential complexes. These two sites were purposefully selected, because they were gated and medium-sized (200-500 units) complexes.

4. Procedures

After formulating the hypothesis by logical argumentation method, the survey based on Delphi method was used, as the primary data collection method to test the hypothesis. This method includes three steps: open-ended, closed-ended and children's visual function questionnaire (CVFQ). As there was no related standard test, researcher-made tests were used in order to gather the experts' attitudes. In the open-ended questionnaire step (step 1), the sample consisted of 20 experts (architects and psychologists) using convenience sampling. After examining the validity of the test, the data was analyzed using qualitative content analysis. In the closed-ended questionnaire step (step 2), the sample consisted of 100 architects who were selected using convenience sampling. After examining the validity and reliability of the test, the data was analyzed using descriptive-inferential statistics. Therefore, using factor analysis method, the influential factors were extracted. Also, the hypothesized model was designed. Then, the relationship between factors and the degree of their influence on each other were obtained using path analysis and the model was revised. Finally, the relationships between the factors were analyzed and interpreted. In the final step, the obtained results were transformed into comprehensible images for kids, and then put to the test of kids living in the two residential complexes stated above.

Results

1. Open-ended questionnaire

The data was collected and a qualitative content analysis approach was used. The results showed the physical-functional characteristics of the architectural environment including variability, controllability, vitality, legibility as independent variables and Cognitive-Behavioral Characteristics including sensory stimulation, curiosity and social interactions as dependent variables (Table 2). These variables could be effective on kids' motivation to play in residential complexes.

2. Closed-ended questionnaire

The closed-ended questionnaire was designed for architectural experts. This researcher-made test was based on the purpose-content table obtained from the qualitative content analysis of the open-ended questionnaire. The closed-ended questionnaire was assessed by factor analysis using SPSS version 23.

Factor Analysis

By factor analysis, KMO test was used to determine the sampling adequacy and *Bartlett's test* of Sphericity was used to assess the suitability of the sample. KMO index was 0.647 (> 0.50) which was acceptable and

Bartlett's test of sphericity was significant ($p < 0.05$) meaning that a factor analysis was useful with data. The Cronbach's alpha value ($\alpha = 0.884$) indicated the reliability of the test. Method of exploratory factor analysis (EFA) was used to extract the factors affecting the kids' motivation to play. Principal components analysis (PCA), a technique employed to extract factors, the eigenvalues are greater than 1. Examination of the amount of variance for each factor showed that if six factors were extracted, the percentage of common variance becomes describable. Finally, in order to achieve an optimal factor structure with the help of varimax rotation method, eigenvalue of six factors with more uniform distribution were extracted as the main factors (Table 3). The scree plot also showed that the slope of the curve was clearly leveling off after the sixth factor (Figure 3).

Table 2: *Dependent and Independent Variables of Kids' Motivation to Play*

Independent Variables		Dependent Variables	
Physical-Functional Characteristics for Kids' Motivation to Play	variability	Cognitive-Behavioral Characteristics for Kids' Motivation to Play	sensory stimulation
	controllability		curiosity
	vitality		social interactions
	legibility		

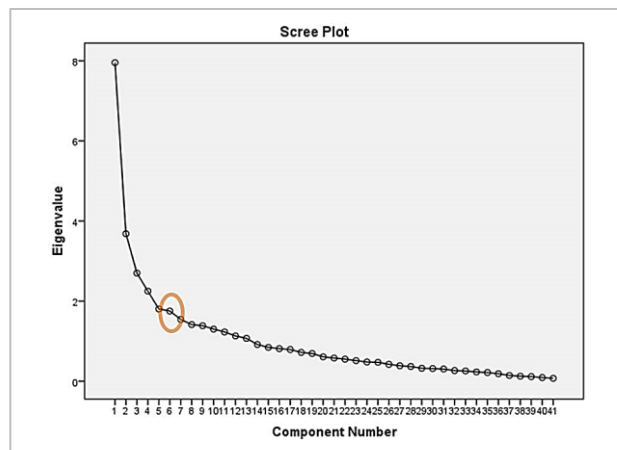


Figure 3: *The scree plot for the factors affecting kids' motivation to play*

Table 3: *Total variance explained*

Component	Initial Eigenvalues			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	7.954	19.399	19.399	3.387	8.262	8.262
2	3.682	8.980	28.380	3.292	8.030	16.292
3	2.699	6.582	34.962	2.717	6.627	22.920
4	2.249	5.486	40.448	2.432	5.932	28.851
5	1.804	4.399	44.847	2.348	5.726	34.577
6	1.542	3.762	52.882	2.231	5.442	44.465

By considering the common content of the questions related to each factor, the appropriate words were interpreted and labeled:

Factor 1. Supervision of the environment

It is an affordance of the physical environment to provide parental visual permeability and thus to create security and peace of mind for both parents and kids. This affordance can enhance kids' presence and motivation to play. A supervised (controllable) environment increases the possibility of kids being supervised by parents and, on the other hand, does not hinder their free play.

Factor 2. Legibility of the child-centered environment

It is an affordance of the physical environment to provide easy understanding by kids and consequently, create a clear mental image in order to once again enhance kids’ presence and motivation to play.

Factor 3. Natural stimulus factors

Using natural elements are environmental attractiveness factor that stimulate kids’ senses for presence, mobility and motivation to play.

Factor 4. Social interactions (generational-intergenerational)

he intention of social interactions is creating opportunities for adults (father, mother, grandparents) to play with kids as well as parents interacting together in order to improve the physical presence of them and thus, enhance kids’ motivation to play.

Factor 5. Vitality of the environment

An affordance of the physical environment is to provide a diverse range of activities (plays) and consequently, kids’ presence and motivation to play. This factor offers lovable experiences; so that the environment transforms into a livable, lively, legible, attractive and dynamic environment for kids.

Factor 6. Stimulating the senses

Stimulation of kids’ five senses (sensory stimulation) become affected by natural features as an environmental stimulus that leads to their behavioral reaction and finally motivation to play.

Structural equation Modeling

The present study shows a relationship between physical-functional variables such as "supervision of the environment (SE)", "legibility of child-centered environment (LCE)", "natural stimulus factors (NSF)", "vitality of the environment (VE)" and behavioral-cognitive variables affecting the environmental affordances to motivate kids to play like "social interactions (generational-intergenerational) (SI) " and "stimulating the senses (SS)" in residential complexes. Based on the relationship between these variables, a hypothesized model was proposed. The linear model was evaluated and modified by the path analysis method using Amos version 23. The analysis estimated direct and indirect effects of the variables, standardized coefficients β , standard Errors (Std. Err.), and p -values (Table 4).

Table 4: Standardized regression weights of direct and indirect effects of variables

Type		Standardized estimates	Standard error	p-value
Direct effects	NSF → VE	0.3	0.071	$p < 0.001$
	VE → SS	0.16	0.09	$p < 0.001$
	NSF → SS	0.22	0.066	$p = 0.073$
	VE → LCE	0.47	0.167	$p = 0.005$
	SE → LCE	0.34	0.073	$p < 0.001$
	LCE → SI	0.21	0.07	$p = 0.003$
Indirect effects	NSF → SS	0.049	0.037	$p = 0.039$
	VE → SI	0.099	0.041	$p = 0.008$
	NSF → LCE	0.16	0.049	$p = 0.015$
	SE → SI	0.072	0.051	$p = 0.002$
	NSF → SI	0.034	0.02	$p = 0.011$

Table 5: Indicators of the Model Fitness

Indicators	Symbol	Value	Acceptable Domain
Degrees of freedom	DF	9	$DF \geq 0$
Absolute fit indicators	Chi-square	CMIN	$CMIN \approx 0$
	Root Mean Squared Residual	RMR	$RMR \approx 0$
Incremental fit indicators	Comparative Fit Index	CFI	$CFI > 0.9$
	Incremental Fit Index	IFI	$IFI > 0.9$
Parsimony fit indicators	Chi-square to degrees of freedom	CMIN/DF	$1 < CMIN/DF < 5$
	Parsimony Comparative Fit Index	PCFI	$PCFI > 0.5$
	Root Mean Squared Error of Approximation	RMSEA	$RMSEA < 0.1$

Goodness-of-Fit Tests

Multiple “Goodness-of-Fit” tests were applied to ensure the accuracy of the proposed model. Some indicators like DF, CMIN, RMR, CFI, IFI, CMIN/DF, PCFI, NFI and RMSEA have been used in this test. The values of these indicators supported a good and acceptable result for the model, shown in Table 5.

In the proposed model, "environmental supervision" was treated as an independent variable. "Environmental vitality" and "legibility of the child-centered environment" functioned as mediating

variables, while "sensory stimulation" and "social interactions (intra- and intergenerational) " were considered dependent variables. In addition, a confounding (latent) variable, "natural stimulus factors", also played a significant role as an independent variable in the model (see Figure 4). Analysis of both the direct and indirect effects of these factors indicated that the relationships among the variables were statistically significant at the 95% confidence level."

Discussion & Conclusion

Based on the model analysis, research literature and the result of open-ended questionnaire, the findings were interpreted, stated below. The findings showed that "vitality of the environment" and "natural stimulus factors" had a positive and significant effect on "stimulating the senses". The impact of "natural stimulus factors", "vitality of the environment", "legibility of child-centered environment" and "supervision of the environment" in the residential complexes have also a positive and significant effect on children's "social interactions (generational- intergenerational)":

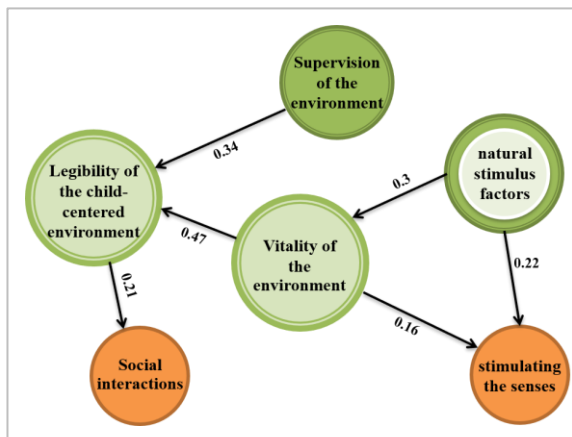


Figure 4: The Structural Equation Model for the Relationship of Environmental Variables and Kids' Motivation to Play in Residential Complexes

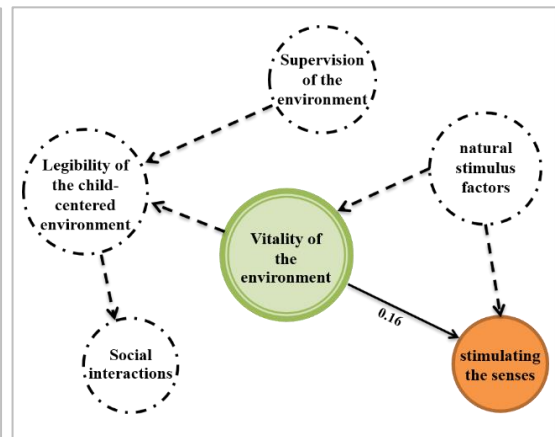


Figure 5: The relationship between the "Vitality of the environment" and "stimulating the senses"

1. "Vitality of the environment" is effective on "stimulating the senses" of kids (Figure 6)

Many quotes have supported the idea of "vitality of the environment" being effective on "stimulating the senses" of kids (Şensoy & İnceoğlu, 2015). Consequently, creating play opportunities (sensory-motor play) using various natural elements, make the environment dynamic and livable for kids, which can be effective in stimulating their five senses, leading towards their behavioral reaction and finally motivate them to play. For example, physical vitality takes place due to the presence and possibility of playing with natural elements such as water, wood, sand, vegetation and various green spaces (maze, tree house, etc.), playing under the trees, gardening by kids, the presence of birds and pets, playing with light and shadow and communication with the sky, as well as functional vitality (allocating spaces for jumping, rolling, etc.) that can eventually create or enhance kids' motivation to play in a residential complex (Figure 6).

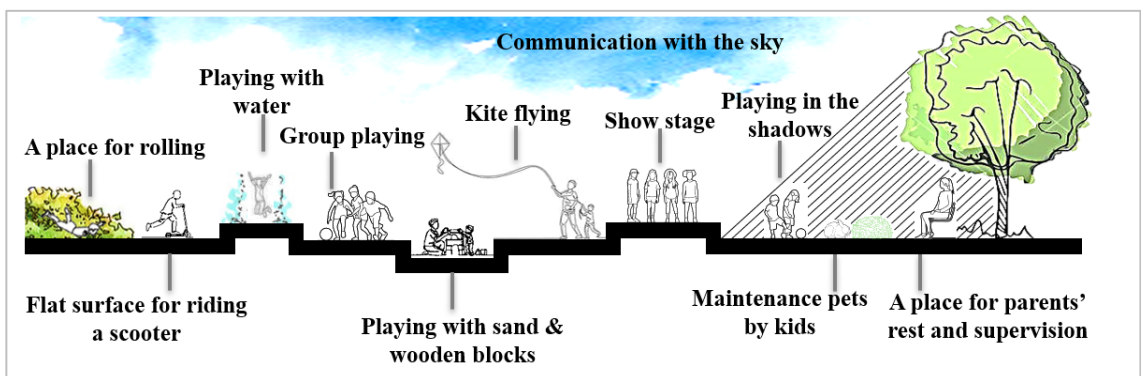


Figure 6: Physical and functional vitality of the environment

2. "Legibility of the child-centered environment" is effective on kids' "social interactions (generational-intergenerational)" (Figure 7):

The concept of legibility (also called imageability and visibility) proposed by Kevin Lynch, means the degree that a person can easily understand the environment or remember it (Lynch, 1960). Legible environments invite the children to move around and give them directions to different routes, in order to play freely and interact with other children (Tabatabaian & Fayaz, 2017) (Figure 8).

Accordingly, geometry of a space (using simple, regular and understandable shapes, using scale and childlike proportions in space design); spatial coherency (designing direct routes for easy access and proper wayfinding); environmental integrity (reducing environmental details, simplicity and to avoid the complexity and ambiguity in space design); using a variety of colors, natural or man-made images and elements (the presence of meaningful elements for kids, such as their own painting, animal sculpture, etc.) and to avoid creating overly complex and challenging spaces that make them confused, that can affect kids motivation to play in a residential complex.

3. "Natural stimulus factors" are effective on "stimulating the senses" of kids (Figure 9):

A plethora of theories and empirical studies suggest that children's contact with natural environment is crucial to their physical, social and cognitive development of any child (Chawla & Heft, 2002). Therefore, the stimulation of natural elements can be used to create or enhance kids' motivation to play in residential complexes. For example, using diverse vegetation, cheerful and natural colors in creating green walls and protected flower surfaces, as well as the possibility of playing with water or sand are some of the solutions in designing a residential complex (Figure 10).

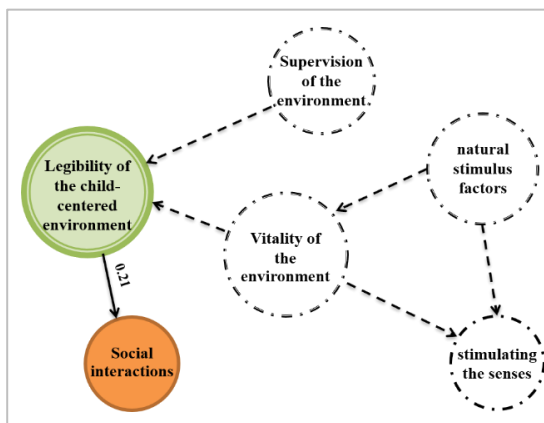


Figure 7: The relationship between the "legibility of child-centered environment" and "social interactions"

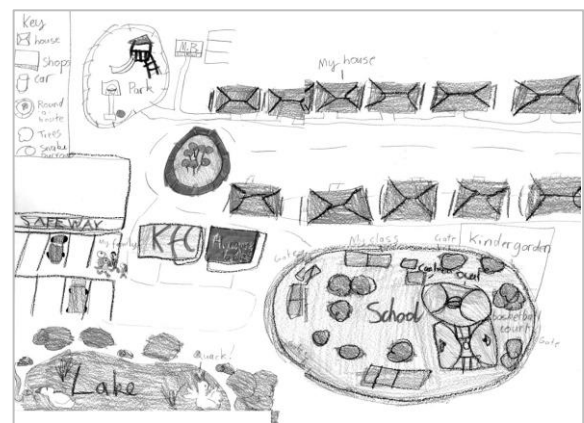


Figure 8: A child cognitive map has shown legibility of the local neighborhood (Hume et al., 2005).

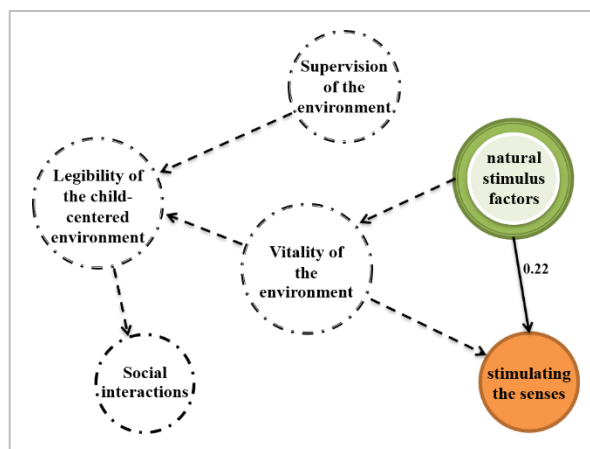


Figure 9: The relationship between the "natural stimulus factors" and "stimulating the senses"

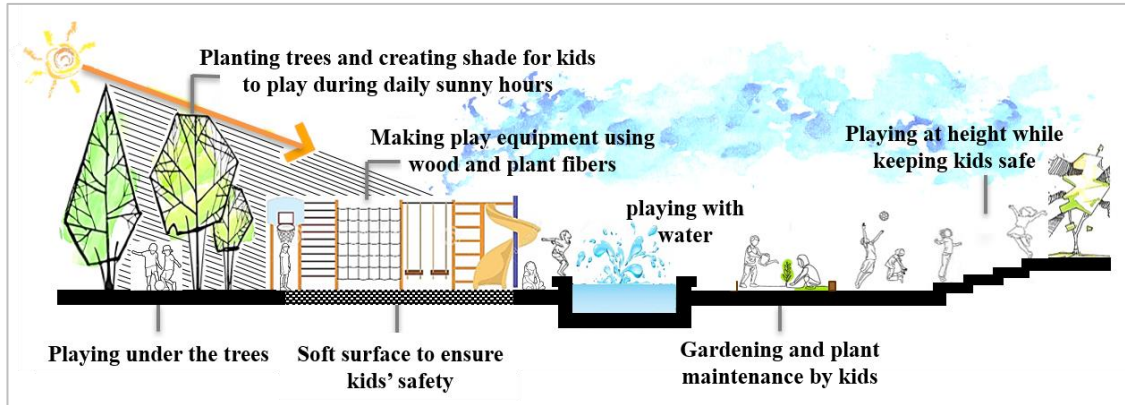


Figure 10: Kids' play with natural stimulus elements

4. "Supervision of the environment" with the mediation of "legibility of the child-centered environment" is effective on kids' "social interactions (generational-intergenerational)" (Figure 11)

Children, the future and hope of human beings, are the most vulnerable social group. Play is central to their process of socialization, and during these years they assimilate environmental experience and information through play which enhances their cognitive abilities (Şensoy & İnceoğlu, 2015). Primary school-age children have little action capability, so their behavior remains unstable and random. During this period, children need adult supervision to play and socialize with their peers peacefully and without any stress. In conclusion, direct visual permeability is provided by physical presence of parents (the opportunity of parent-child play, the existence of attractive functions for parents age groups, installing furniture next to the kids' playgrounds). Also, indirect visual permeability such as installing CCTV cameras, designing flexible walls in the vicinity of play spaces, controlling the environment through openings, not using dense green spaces, and proper lighting, enclosure (defined scope and privacy, designing enclosed play areas), geometry of space (eliminating or reducing blind spot) can enhance kids' motivation to play in a residential complex by creating a sense of security and peace of mind. (Figure 12)

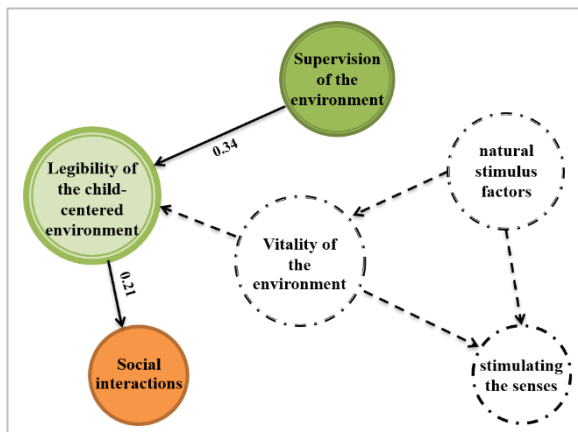


Figure 11: The relationship between the "Supervision of the environment" and "social interactions"

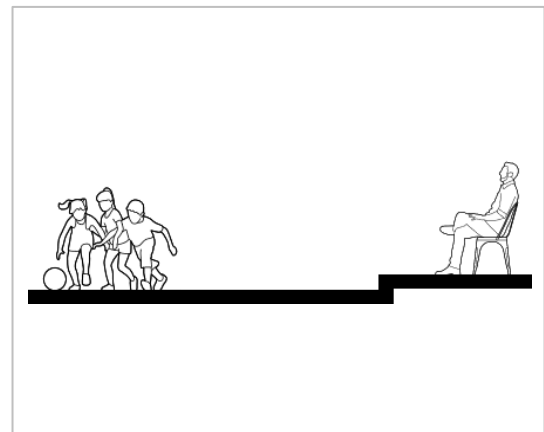


Figure 12: Designing furniture next to the kids' play spaces

5. "Natural stimulus factors" with the mediation of "Vitality of the environment" are effective on "stimulating the senses" of kids (Figure 13)

Environmental stimulation is referred to some spaces that offer a variety of challenges and support as well as suggest activities that are essential for children development. It can be explained that physical vitality due to the presence of natural elements is effective on stimulating kids' five senses and thus motivating them to play. Possibility of playing with natural elements such as water, light, vegetation, etc. and combining them with man-made elements (granular flooring, etc.) in a residential complex, lead to play

and gain lovable experiences for kids. In other words, physical vitality converts man-made environment of a residential complex to a lively and dynamic environment for kids due to the presence of natural stimuli and ultimately stimulates kids' senses to participate in play.

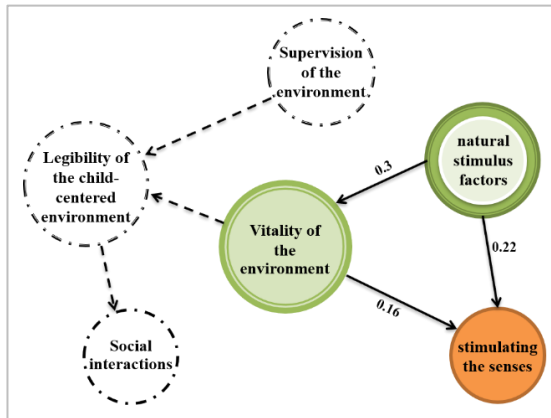


Figure 13: The relationship between "natural stimulus factors" and "stimulating the senses"

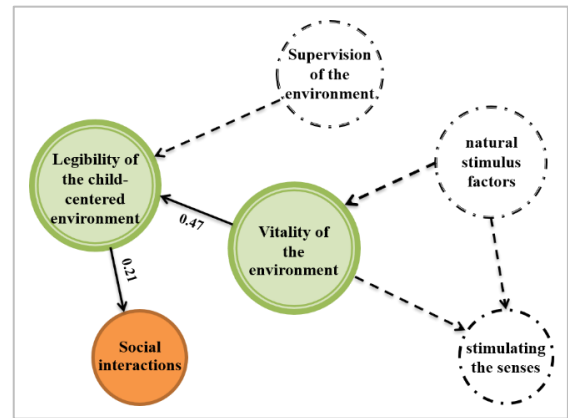


Figure 14: The relationship between the "Vitality of the environment" and "social interactions"

6. "Vitality of the environment" with the mediation of "legibility of the child-centered environment" is effective on kids' "social interactions (generational-intergenerational)" (Figure 14)

Functional vitality transforms the environment into a perceptual environment by kids due to creating various play opportunities in a residential complex, as the first space for kids to enter the social world. Continuously, it improves their social interactions (generational-intergenerational) and finally increases their motivation to play. For example, designing spaces with different affordances for a variety of dramatic, symbolic, participatory, group and physical plays appropriate to their age, designing spaces for cognitive learning (direct environmental experiences), and health facilities are again some of the solutions in designing a residential complex (Figure 15).



Figure 15: Designing spaces with diverse environmental affordances for kids

7. "Natural stimulus factors" with the mediation of "Vitality of the environment" and "legibility of the child-centered environment" are effective on kids' "social interactions (generational-intergenerational)" (Figure 16)

The presence of natural stimuli in a residential complex creates a clear mental image of the environment for kids by transforming the environment into a livable, lively, legible, attractive and dynamic environment. This presence would be effective in improving social interactions and motivation to play with their peers and parents. For example, the presence of natural sounds (water, birds and pets); appropriate vegetation height or playing relaxing and happy music; visual diversity using natural signs for kids are good ideas for designing a residential complex (Figure 17).

In order to validate the research findings, children's visual function questionnaire (CVFQ) has been used. To investigate kids' motivation towards each example of the design, semi-public spaces of the Moshtagh and Olive residential complexes were first photographed. Then, design changes were applied based on the research results obtained from the previous stages using Adobe Photoshop software. The content validity of the images designed by the children and their reliability were evaluated by expert architects specializing in attitude assessment, and the images were revised if necessary. Subsequently, the approved images were administered to the children using convenience sampling and after obtaining parental consent, and their

tendency to the occurrence of each example was examined (Figure 18). In this survey, the majority of the kids expressed their interest with great enthusiasm and excitement towards these changes. Finally, some of the limitations aroused were stated and their motivation to present and play in the residential complexes were retested.

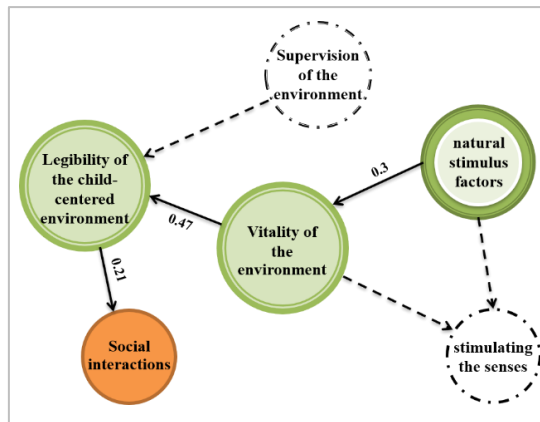


Figure 16: The relationship between the "natural stimulus factors" and "social interactions"

Figure 17: A child painting also has shown nature and diversity are her ideal characteristic of preferred places for playing with friends near home (Ghanbari-Azameir et al., 2015)



Figure 18: Parts of Children's Visual Function Questionnaire (CVFQ)

For instance, in the case of a child playing with sand, the possibility of contamination of hands and clothes was mentioned, and parental permission and fear of inappropriate treatment due to getting dirty was stated by the kids themselves. Regarding to the example of the combination of natural and man-made elements in creating spaces for cycling, swinging, etc., they also mentioned the possibility of falling down and other injuries. About sociable spaces, the recent Covid 19 pandemic introduced as an unexpected limitation by kids. After stating such limitations, in some cases, some kids became hesitant. After making sure that those limitations were eliminated, the CVFQ images were retested. Despite these concerns, at the end of the test,

their motivations were still above 90%. Therefore, it can be concluded that this test emphasized the validity of the research results.

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AI Usage Disclosure

Artificial intelligence (AI) tools were used only for minor language refinement and grammatical correction. No AI tools were used in data analysis, interpretation, or visualization.

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