

Impact of Spatial Design on Children's Perception and Behavior Analyzing the correlation between children's interaction and memory with Plan Design and Digital Appliances

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ABSTRACT

Nowadays, designing open plans is still common as a heritage of modern architecture. Digital appliances are also used in spatial designs due to their daily expansion and importance. But what is crucial today is user-based design. Minding childhood's considerable part in developing one's personality, it is required to pay special attention to children and their needs as main users of the design. This research addresses the correlation of common features mentioned in design for child users. After studying children's psychology and environmental psychology, it was revealed that interaction and memory are important variables in childhood. The correlation of these variables with the type of plan (open or divided) was measured in two experiment stages with two children in each stage. Using digital features, the correlation of these variables with the design was also tested. After analyzing the data, it was found that there was a positive correlation between the divided plan design and interaction in children and the memory of the activity, which seems to be due to a more appropriate scale and stimulation of curiosity in children. Positive correlations were also found between the environment with digital facilities, the memory of the activity, and the children's interactions. However, digital devices and appliances are a new phenomenon, and younger generations are accustomed to them differently from the previous. Therefore, the positive correlation may be due to the relationship of the recent generation of children with digital appliances. In addition, it needs to be performed with more controlled factors in mind to get more accurate results.

Keywords: Child, Open Plan, Digital Appliances, Interaction, Memory.

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1. Introduction

It is possible to observe two features of designs by looking at current designs. The first feature is the designers' desire to design open plans, and the second is digital appliances in design. The open plan design issue has been common since its beginning. Since modern architecture, it has appeared when there has been an independent spatial design from the building structure. Digital appliances in design are also a new issue that is becoming continuously popular. It can be considered a digital age product in which many different aspects of human life are related to digital technologies. User-based design is one of the most important areas. Children are a very special group among the different groups of users. The children users are important because they are the basis for the personality and mentality of individuals' formation, and the design according to their needs and behaviors are effective in this formation. Generally, judgments about both open-plan and digital appliances in design may differ. But this study examines the desirability of this issue in design for specific users such as children, which is an important and sensitive issue. In design for children, a question discusses the effect of open plans design and digital appliances on the formation of spatial memories and children's interaction. This question has been definitely presented in the project's process related to these users. This study is also conducted to eliminate these ambiguities. The child should be necessarily analyzed as the main user to answer the question. A person has the highest growth rate in all of his life in childhood. Therefore, it is necessary to know the manner and type of these changes to gain knowledge and an overview of childhood. Humans affect the environment as much as they are affected, possibly in childhood to a greater extent. Therefore, discussing the impact of the environment is important for both adults and children. This issue makes it necessary to research environmental psychology. Modern psychology is rooted in positivist thinking, and phenomenological theories influence environmental psychology. Although digital spatial is a new phenomenon, we can say that positivism agrees with it if we look at it as technological advancement, and phenomenology offers a reading of technology that is not inconsistent with its nature. In this research, the required theoretical foundations are first studied. Experiments have been designed to measure the research question variables according to the usual research methods in the studied fields. The obtained data are analyzed, leading to the result and the answer.

2. Research Methods

The present study analyses the answers to two questions in parallel. The data are obtained through a combination of documentary and field studies. Documentary studies examine theoretical issues in children and environmental psychology. The key age group of

the research is determined by examining the topics of child development psychology. Environmental psychology studies the relationship between the environment and children's behaviors. Environmental psychology general topics are not addressed due to its wide scope. In environmental psychology, data are collected from the five main methods of questionnaires, laboratory simulation, computer simulation, field studies, and case studies (Steg, 2012, p.7-9). In this research, situation simulation and testing are used to obtain data because children's amount and understanding type make it difficult to use these methods. Since the research questions are detailed and numerous, they are discussed with a detailed description and explanation of the experiments and various cases. Except for the part where the target group is adults, it is impossible to collect data directly from children through questionnaires. Therefore, questionnaires are interviewed and measured according to the designed assessment to collect test data.

3. Theoretical framework

According to the research method, theoretical studies are conducted in environmental psychology and developmental psychology. Definitions and characteristics in childhood and child psychology are first examined, and then developmental theories and age groups characteristics are studied.

3.1. Child

We search various scientific perspectives to understand the child's concept and define childhood and its scope. In Dekhoda's dictionary, the word child refers to an infant, little boy or girl, and an immature child. Legally, United Nations defines a child as a person under 18 unless he reaches the majority age according to the child's rights (1989 Convention on the Child's Rights). In the medical definition, a child is a person who is in the period between birth and puberty. (Mosby, 2013). The childhood concept is not defined with these definitions. According to the positivist researcher's point of view, children are physical beings and subject to the laws and principles that govern the world. It means that they are intelligible, objective, and measurable beings, and all their behaviors, perceptions, knowledge, or organized concepts are general or universal (Davis, 2009). Constructivist researchers believe that children are social, autonomous, and dynamic beings with special needs. They are constantly interacting with the physical and social environment around them, and they make distinct concepts in a specific field in their minds (Barker & Weller, 2003). Qara Biglou also defines the child as the product of nature's interaction with upbringing, inheritance with the environment, and experience of nature. In other words, the child is a mechanism made by nature and the environment or education and experience (Gharehbeiglou, 2010).

3.2. Fundamentals of Developmental Psychology

First, it is necessary to define the development concept before examining the theories and concepts of developmental psychology. According to Kaplan, development is a chain of physical, social, and personality changes that occur over time. The child growth branch deals with the scientific study of this period. (Kaplan, 2016). The human has both individual and social dimensions, and his presence in natural and artificial spaces is possible in both individual and collective forms. Therefore, developing development psychology with an attitude towards these two dimensions is necessary. For this purpose, Piaget and Erickson's theories have been selected from a wide range of development theories in this study. Piaget gives a good view of children's individual development by focusing his studies on children, their way of thinking, and their perception of the world around them.

On the other hand, Ericsson considers continuous individual development until middle age and examines all its stages in social development.

3.3. Stages of cognitive development

Piaget is one of the theorists of developmental psychology who believes that children have had a deep experience to achieve adult thinking, and their actions in life have a significant and sensitive effect on their development. He also depicted that intelligence development in each individual is a kind of adaptation to the environment. He finds the intelligence concept wider than the quality measured by the test. Based on his point of view, intelligence affects all individual activities such as thinking, perception, language, and ethics. Piaget finds intelligence development an evolutionary process in which knowledge acquisition progresses together (Butterwoth, 2014). According to Piaget's point of view, the main developmental stages that all children pass are described in Table 1.

Table 1: Cognitive development stages based on Piaget's theories

| The level | Age | Feature |
|----------------------|---------------------------|---|
| Sensory-motor | Birth up to two years old | Discovering the environment according to the ability, at the end of the ability stage to think and language, self-centered |
| Preoperative Thought | 2 to 7 years old | Learning logical or operational thinking, use of symbols and mental images, thought without logical system, self-centered continuity |
| Tangible actions | 7 to 11 years old | The ability to think logically about objective and real problems (systematic thought), thinking only in the face of tangible actions and thinking of things and places apart from oneself. |
| Formal actions | 11 years old and later | Thinking about abstract or hypothetical problems, especially in the field of scientific reasoning and inference, using symbols and abstractions in representing space and forming larger maps |

3.4. Psychosocial development

Erickson is a leading psychologist and theorist in developmental psychology and the inventor of an identity crisis. He has divided developmental stages like Piaget. On the contrary to Piaget, Erickson does not limit the stages of psychosocial development to childhood and has followed this process until the end of his life. Table 2 summarizes the eight stages of

psychosocial development. According to the development theories, the most appropriate age group for this research are children in primary school age. The child has reached a good mental understanding of the world around him during this period. He also acquires a form of social independence and is provided with a wider range of connections. In addition, the longest period of development in human childhood occurs at this age.

Table 2: Psychosocial developmental stages based on Erickson theories

| Level | Age | Feature |
|----------------------------|-------------------------|---|
| Trust versus mistrust | Baby | Depending on the other for survival, the importance of a desirable social relationship equals meeting material needs |
| Independence against doubt | Two or three years old | Communicating well with others while acquiring new physical skills, rejoicing in independence in doing certain things despite continuing dependence on caregivers |
| Initiative against guilt | Three to five years old | Development of mental and motor abilities, undertaking new activities, and bold plans |

| Level | Age | Feature |
|---|---|---|
| Hard work against feelings of inferiority | Elementary school years | Despite entering the primary school environment, parents are still under the influence of gaining some important cognitive and social skills that require the approval of the peer and adult group. |
| Authentication versus confusion | Youth | Facing the issue of identity and trying to identify the job, social, religious, sexual status, and interpersonal relationships |
| Intimacy versus isolation | The end of adolescence and early youth to the beginning of middle age | Approximate end of family support and consideration as an adult, sense of responsibility and independence, emotional communication |
| Fertility against stagnation | From 35 to 65 years old (middle age) | Helping the next generation through caring for others or creative and fruitful work, striving for the benefit of the family or community |
| Perfection against despair | From the age of 65 (old age) | The final stage of the development process, reviewing and evaluating issues and stages of life, feeling of development, perfection and maturity, and a positive attitude towards the past |

3.5. Development of children 5 to 12 years old (primary school)

The children's developmental tasks are to strengthen and improve the needed skills to meet society's expectations. At this stage, the child learns more small and large attention skills and acquires new and more complex cognitive and language skills. The child should

also adapt to normal and abnormal social and emotional situations with adults and peers. During this period, the child understands others and self-concepts more abstract and precise. Therefore he acquires social support networks outside the home (Schreoder, 2014). Table 3 summarizes the characteristics of mental and physical development of primary school children

Table 3: Children's characteristics of mental and physical development
Primary school children's characteristics of mental and physical development

| | 7 to 8 years | 9 to 11 years |
|------------------------|--|--|
| | Increase problem-solving ability | Ability to plan for the future |
| | Ability to focus longer | Ability to solve simple physical problems |
| Mental growth | Lack of logical knowledge of all the consequences of their behaviors | Inability to logically recognize all the consequences of their behaviors |
| | Ability to recognize practical issues | Willingness to join groups |
| | Black and white vision, good and bad to the phenomena | |
| | Hardly accepting failure and criticism | |
| | Good ability to balance | Girls 'physical growth compared to boys |
| | Skills such as shoelaces | Expanding orientation and reaction time |
| Physical growth | Ability to catch small knobs | Increasing physical strength and agility |
| | Relative ability to detect the distance and speed of objects | |
| | Brain size close to an adult | |

3.6. Child and environmental psychology

In architecture, the knowledge of environmental psychology examines people's perceptions of space and

their behavior. The present article scope is not possible to pay attention comprehensively to this area. The children are categorized and examined in child

and environmental psychology if they show specific behaviors of their age group in the face of these spaces as users of natural and artificial spaces according to their perception and mental structure. According to the research methods in environmental psychology mentioned earlier, we refer to similar previous research to better understand the concepts in this field and find a suitable path for conducting experiments and field studies of the present subject.

4. Research history

According to the research on childhood memories and desirable space in this period, emotions are correlated with space. Space can create a sense of privacy, control, and security. In addition, these studies indicate the need to be alone, escape from social pressures, and the spatial importance of privacy. Given the data collected from children aged 4 to 12 in the late 1980s, open environments are emotionally more attractive to children than other special spaces such as landscapes, hidden spaces, trees, hills, even if they are banned

from attending (Hart, 1979; Young, 1978). 19 to 30% of children's normal activities include talking to each other and playing less active games (Moore & Young, 1978). It is crucial to have space for privacy. Therefore, losing all or part of the space can be emotionally difficult for a child (Hart, 1979). Children can also feel negative about space and consider them scary or dangerous (Hart, 1979; Matthews, 1992). Research shows how children overcome these fears in different ways. For example, repeating reassuring phrases such as "Do not worry" when passing through space with a negative feeling. The natural environment elements are unattractive to children and seem dull, scary, or dangerous (Bechtel, 2002). Some studies have reported differences in the choice of natural or private environments of interest at different ages concerning the selected age group and the desired space for children based on their age (Pihlström, 1992; Sommer, 1990), and in others studies, no or very little difference is found. (Malinowski & Thurber, 1996; Schiavo, 1988; Silbereisen & Noack & Eyferth, 1986) (Figure 1).

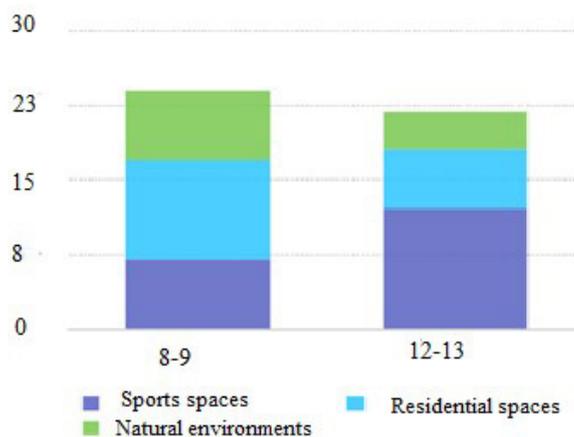


Figure 1. Popularity and choice of space by age group

According to studies on children's preference for environments from the 1990s onwards, the home, natural environments, social spaces, and artifact public environments have the same importance (Chawla, 1992). But there are exceptions. Research shows that 7- to 9-year-olds prefer natural and outdoor environments more than 11 to 13-year-olds, both of them more than 15- to 16-year-olds. The conducted theoretical generalization about how the children's environmental preferences change and spread with their age is small, and an insufficient amount of all studies conducted in this field affect it. These studies are usually conducted by comparing age groups in cross-sectional study projects. A research review on the use of space, spatial preferences, and behavioral records shows that identity growth and development, the need for privacy, and social affiliation are responsible for spatial preferences' expansion and change. Middle childhood, ages 6 to 11, is defined with extensive exploration and identification of the environment, collaboration with other peers in this exploration through games, defining identity through gaining skills and physical endurance, and building houses and castles (territories) in the environment. Due to the vast partnership with the surrounding landscape, a new period of forming groups of different genders and turning to the privacy of the home begins along with same-sex friendship groups (Chawla, 1992). Spatial preferences in childhood and maturity are recognized as a fulcrum for developing identity formation, the need for security, social dependence on caregivers and peer groups, and the practice of social roles. However, spatial preferences are not generalized to meet all growth needs (Bechtel, 2002).

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A harmonized reference framework forms when children's formal logic and abstract understanding develop in the elementary years. It is possible to decompose the fixed mental reference frameworks in harmony with the environment and the main path understanding (Hart & Moore, 1973). In addition, the children's self-centeredness sooner than this age may lead them to prefer places where satisfaction, support,

and security are significantly available (Malinowski & Thurber, 1996). This issue explains the preference for more public and social places between 5 and 10. A mature understanding of fixed reference frameworks at the age of 9 to 13 makes them focus on the purpose and function of places that create spatial preferences based on the function of the environment (Bechtel, 2002) (Figure 2).

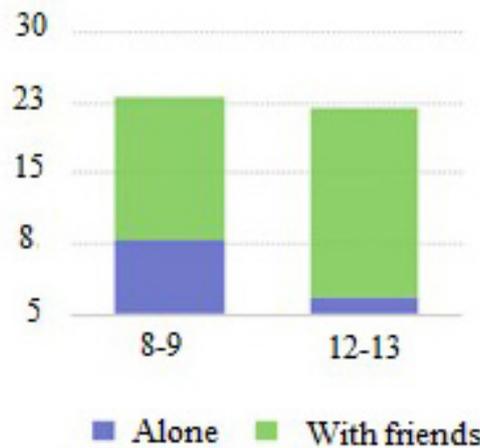


Figure 2. Accompaniment rate in the selected place

Children choose their favorite places based on the scope of their territory. Children's knowledge of their environment, their desire to search and explore the environment, and their curiosity act as intervening variables that influence the scope of children's territory (Wohlwill & Heft, 1987). On the other hand, social (parental) and physical (travel restrictions) restrictions hinder children from having a wide range of territory in the environments where they acquire the emerging spatial preferences. Through family negotiation, the parents set the restrictions, including adult fears, care contracts, judgments about children's intellectual maturity and preferences, gender-based expectations, and cultural orientations (Matthews & Limb, 1999; O'Brien, 2000). This issue is visible in the type of plan design, its limitations, and possibilities to explore the environment. Therefore, the amount of movement and the child's desire to explore the environment are factors in measuring the child's interaction with space. According to children interacting with each other, dialogue is one of the common behaviors of children in doing less sedentary activities with peers and a measurable factor. Another part mentions cooperation in games with peers as another relevant factor for measurement. In the meantime, privacy and the desire for privacy are generally mentioned in which the extent of physical privacy, how to be in space, and the number of peers entering each other's privacy is part of their interaction. This research has studied people's memories of space, environment, and pleasantness. Therefore, in addition to the pleasantness of the measured factor, the number

of recorded details of space, events, and people are measured as keywords of the concept of memory. The test description considers details of measurable items from these studies.

5. Research issue and question

This study's main question is whether the open-plan design and digital appliances affect these characteristics or measure their correlation. It is necessary to physically shape the desired designs in controlled conditions, place the child as a user in it, and record and examine his behavior and perception to test such characteristics. The relationship between the type of plan design (open or divided) and the child's social behaviors. The effect of plan design type (open or divided) on activities memory in the child's mind. The relationship between the environment and digital appliances and the child's social behaviors. The effect of the environment with digital facilities on the memory of activities in the child's mind. The above statements summarize the main problems of the experiment. Therefore, it is concluded that all variables (type of plan, environment with digital appliances, interaction, and memory) are independent in these experiments, and the goal is to obtain their correlation. For this purpose, the test groups are considered the control group. We turn query variables into keywords derived from the research history to convert them into measurable variables. There are two categories of evaluation factors for each question. The first category measures the concept of interaction, and the other category is the memory concept. It is necessary to experiment with

two steps in two different spaces to measure these variables. The data of different modes are measured, each evaluation factor is scored, and the two modes are compared. Then, the highest score is known as the optimal status. It is measured after testing whether space provides the factors.

6. Test description

In the following, the design of two-stage experiments is described to measure the mentioned variables. This section describes how to answer the questions and the

evaluated factors.

6.1. Evaluation criteria

Dialogue: Having a conversation together or with educators in assessing children participating. The dialogue is acceptable even if it is short and interactive.
Collaboration: Cooperating in assessing children in any way (consultation, cooperation in drawing, delivery of tools, and). Children are asked to connect the drawings to measure this factor in the experiment.
Physical distance: Indicating that children should stay in each other's personal physical space (50 cm)

Table 4: Variables to measure the relationship between the type of plan design with the child's social behaviors and memory of activities in his mind

| Evaluation Subject | | Evaluation | | | |
|---|----------------------------|---------------|-----------------------------|--|-------------------|
| Interaction | Dialogue | Collaboration | Physical distance | The desire to know and move in the environment | |
| Correlation of memory with the type of plan | Details of space recalling | | Details of recalling events | pleasantness | Recalling people* |

Table 5: Variables to measure the relationship between the digital possibilities of space and the child's social behaviors and memory of activities in his mind

| Evaluation Subject | | Evaluation factors | | | |
|---|----------------------------|-----------------------------|----------------|-----------------------|--|
| Interaction | Sitting position | Communicate with each other | Attention rate | Reaction to the story | |
| Correlation of memory with the type of plan | Details of space recalling | Details of recalling events | Analysis | pleasantness | |

Desire to know the environment: If the participating children are interested in moving and recognizing different parts of the space. **Details of space recall:** If the child mentions details of the space (a little) during the interview, this factor is measured in the experiment development by drawing a general space plan and its adaptation degree to the building reality. **Details of events:** If the child remembers the main parts and details of the event, the generalities, and details of the drawing or the story and events. **Pleasantness:** If the child is interested in repeating the experience. This factor is measured in people in the experimental development section as a reminder of more pleasant memories and feelings. **Recalling people:** The first and second modes of the experiment are about recalling the activities of other people, and expanding the first experiment is recalling other people who were present at the time. **Sitting position:** An overview of body language, desire towards the speaker, or the play screen **Communication with each other:** If children have verbal or non-verbal communication with each other while telling stories. **Reaction to the story:** If the child has reacted noticeably to different story parts. **Analysis:** If the child properly analyzes the whole and the story's main message. A score of 1 to 5 has been given in evaluating each of the mentioned factors' intensity to convert the variables and their sub-factors into measurable variables. The number 5 and

1 represents the highest and the lowest amount, respectively. Finally, the average score of the children participating in each test mode is considered in the final evaluation. Children were interviewed, and the perception of their answers is considered according to the type of perception and mental structure of children. According to an interview with the first experimental group about interaction measurement questions, the children have decided not to connect the drawings, which is a good example of a high-scoring collaboration.

6.2. Test conditions

It is necessary to consider controlled variables in each experiment to obtain correct results. In the following, these factors are controlled, and their conditions are described.

Table 6: Characteristics of participants in the experiment of the relationship between the type of plan design with the child's social behaviors and memories of activities in his mind

| The experiment of the relationship between the type of plan design and the child's social behaviors and memories of activities in his mind | | | |
|---|-------------|--------|-----|
| Experiment mode | Individuals | Gender | Age |
| The first case (Divided plan) | 1 | Girl | 9 |
| | 2 | Girl | 9 |
| The second case (Open plan) | 3 | Girl | 9 |
| | 4 | Girl | 9 |
| Extend the test (Divided plan) | 5 | Female | 26 |
| | 6 | Man | 23 |

Table 7: Characteristics of participants in the experiment of the relationship between space and digital facilities with the child's social behaviors and memories of activities in his mind

| Experiment with the relationship between the environment and digital possibilities with the child's social behaviors and memories of activities in his mind | | | |
|--|-------------|--------|-----|
| Experiment mode | Individuals | Gender | Age |
| The first case Space with digital (appliances) | 1 | Girl | 9 |
| | 2 | Girl | 9 |
| The second case Space without digital (appliances) | 3 | Boy | 10 |
| | 4 | Boy | 11 |

Environment: Open and closed plan spaces without any special elements in the design and with walls, floors, ceilings, and furniture with neutral colors have been selected to create a controlled environment.

Activity: The most important issue was the lack of complexity of the activity, and the greatest possibility was finding the child's mood, behavior, and thoughts in choosing the type of activity for different modes of testing the effects of open and closed plans. Therefore, painting is chosen from the usual games and activities for children.

The choice of activities, facilities, and complex topics has been avoided to control variables in testing the effect of using digital facilities. A storytelling video is finally planned with a fixed theme.

6.3. Test implementation

6.3.1. First experiment

The relationship between the type of plan design (open or divided) and the child's social behaviors The effect of the type of plan design (open or divided) on the memory of activities in the child's mind In this

mode, two children were asked to draw a picture with the theme of "favorite house" in a space with a divided plan. They can connect their houses by drawing if they want. Children were informed that they could operate in any part of the space and any position (behind a desk or on the floor). Two instructors attended the experiment (30-40 minutes) to care for the children and control the experiment. Instructors moved randomly and slowly in space to not affect the children's desire to rotate in certain parts of the plan. The second mode of the experiment was performed in an open-plan space under the same conditions as in the first case and with two other children (in the same age group). After three days, participants were interviewed to obtain data.

6.3.1.1. Questionnaire

- Do you remember the day you came and painted?
- Can you tell me what you did and what happened?
- What was the house you built? How about your friend's house?
- Did you like this activity?
- Do you want to do it again?

Table 8: Relationship between the types of child social behavior plan

| Subject of assessment | Interaction | |
|-----------------------|----------------------------------|-----------|
| | Divided plan | Open plan |
| Evaluation criteria | Dialogue | 4 |
| | Cooperation | 5 |
| | Physical distance | 5 |
| | Tendency to know the environment | 5 |
| Score | 19 | 11 |

Table 9: Correlation of memory with plan type

| | Divided plan | Open plan | |
|-----------------------|---|------------------|----|
| Subject of assessment | Correlation of memory with the type of plan | | |
| Evaluation criteria | Space details | 3 | 1 |
| | Details of events | 5 | 4 |
| | Pleasantness | 5 | 5 |
| | Recalling people's activities | 4 | 3 |
| Score | Space details | 17 | 13 |

6.4. Expansion of the first experiment (relationship between open or divided plan design with the child's social behaviors and memory of activities in his mind)

According to the data obtained in the first case (split-plan) measurement of memory correlation with the type of plan, the plan's impact needs to be measured longer and in adulthood. In this part of the experiment part, the experiment was done in the form of a questionnaire and interviews with adults who were present in a specific space with a closed plan as a child because the goal was to measure variables in the coming years, and it was not possible to access the people present at the experiment at that time. At one assessment stage, participants were asked to outline what they remembered to analyze the data better. These people were present in the desired space during primary school. On the other hand, the average period

of activities and presence in space is 17 years.

6.4.1. Questionnaire

What is the first memory you have of this place? (the memory can be an image, an event, the shape of a place, and in general, anything that comes to your mind at the first moment.) Consider the green space and draw the shape you remember from this place.

- Which activities do you remember from the activities you did in this space?
- What was your favorite part of this building? What activities did you do there?
- Is there a space in this building where you feel uncomfortable? If yes, why?
- How do you feel about your experience in this place when you think about this building and its space? (Very bad - bad - not too bad and not too good - good - very good)

Table 10: Correlation of memory with plan type, experiment development

| Experiment expansion (divided plan) | | |
|--|---|----|
| Subject of assessment | Correlation of memory with the type of plan | |
| Evaluation factors | Space details | 4 |
| | Details of events | 4 |
| | Pleasantness | 3 |
| | Recalling people | 4 |
| Score | | 15 |

6.5. The second experiment

The relationship between the environment and digital appliances and the child's social behaviors The effect of the environment with digital appliances on the memory of activities in the child's mind A storytelling video was broadcast for two children in space using digital playback appliances. In the second mode, a teacher told the same story to two other children of the same age in a completely similar atmosphere. Participants were interviewed after three days to obtain data.

- Can you tell me what you did and what happened?
- What do you think was the crow's mistake?
- What do you think was the best part of the story? Why?
- Did you like this activity?
- Do you want to do it again?

6.5.1. Questionnaire

- Do you remember the day you came and heard the story?

Table 11: Correlation between design and digital appliances and child social behaviors

| Subject of assessment | Space with digital appliances | | Space without digital appliances |
|-----------------------|-------------------------------|----|----------------------------------|
| | Interaction | | |
| Evaluation factors | Sitting position | 5 | 2 |
| | Communicate with each other | 4 | 1 |
| | Attention rate | 5 | 4 |
| | Reaction to the story | 3 | 3 |
| Score | | 17 | 10 |

Table 12: Correlation of memory with design and digital appliances

| Subject of assessment | Space with digital appliances | | Space without digital appliances |
|-----------------------|--|----|----------------------------------|
| | Correlation of memory with design and digital appliances | | |
| Evaluation factors | Space details | 3 | 1 |
| | Details of events | 5 | 1 |
| | Analysis | 5 | 4 |
| | Pleasantness | 5 | 5 |
| Score | | 18 | 11 |

7. Analysis and summary of findings

Before the experiment, due to the large space available for movement and activity, open-plan spaces were expected to have better results, both in terms of interaction and the type of memory of the space. Contrary to what was predicted, the participating children had more tendency to recognize, be present, and rotate in different parts of the space in a space with a divided plan from the beginning of the experiment. Such a tendency was not observed in children in the open-plan space. Therefore, the dividend plan has successfully interacted with space in this research. In addition, the results remain almost the same over a longer period. The scale and children's curiosity arousal in the divided spaces is responsible for these results. In the case of children's social interaction, the divided plan could be considered more appropriate because the children's interaction with each other and the educators during the experiment were more in the divided plan space than the open plan. There is a positive correlation between the plan design in terms of being open or divided and the child's memory of the performed activity based on the evaluation of comparable data of two test modes in the correlation of plan type with memory. Additional experiments seem to be performed using psychologically examining children's drawings and more controlled factors such as gender and the number of tested subjects to obtain more accurate data. The type of memories and interaction in the design with digital appliances seemed weaker before obtaining data. We also need to consider the type of relationship the children's current generation has with these facilities and its differences with the children of previous generations. Therefore, there is a need for more reflection and experiment due to the novelty of this issue. More accurate results are

obtained by testing more people. In addition, more accurate data are obtained with more control over the test factors, such as the type of storytelling or the gender of the test subjects.

8. Conclusion

According to studies, special attention should be paid to children as a growing and highly influential creature in designing for children. In environment psychology, it is very important to measure the memory of spaces and their impact on users' interaction with each other in the desired design. This research's main issues were evaluated by considering the appropriateness of open plan design and spaces with digital appliances, which are the concern of designers today due to the heritage of modern architecture and the increasing development of digital technologies. According to the experiments, there is a positive correlation between designing a divided plan with both child's social behaviors and spatial memory in the child's mind in response to the research questions. In addition, there is a positive correlation between the environment and digital appliances with the child's social behaviors and the spatial memory in his mind. The appropriateness of the scale and the appropriate context for activating the child's curiosity is probably the reason for this positive correlation. Despite the initial expectations that such designs are inappropriate in design with digital appliances, spaces with this feature are desirable in terms of the type of memory they create or their impact on user interaction. These possibilities should be measured considering the new lifestyles and values. The criteria for this experiment need to be changed generally to answer the second question.

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