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SPATIAL COGNITION DEPENDING ON THE SPATIAL ORDER IN EDUCATION BUILDINGS

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ABSTRACT

The aim of this study is to investigate the relationship between the spatial order of typologically produced educational buildings and the cognitive perceptions of students upon them. The main hypothesis of this study is that children's perceptual, social and pyhsical relations differ via the spatial configuration of educational buildings and cognitive maps of the students can be a tool to understand these relationships.Within the scope of the study, a comparative method has been followed on cognitive maps in order to examine the perceptual relationship of two different educational institutions' students between the ages of 8-12. At the end of the study, it was found that (1) the cognitive interaction that the students established with their school buildings changed according to the spatial order and (2) social interaction of students with each other affected when the spatial organization has no supportive qualities of visual interaction. In addition, it has been seen that when the spatial order has supportive visual qualities in educational buildings children can have attached feelings to their school buildingsand have more meaningful relationships with their surroundings.

Key Words: Child, Spatial Cognition, Spatial Order, Cognitive Map

INTRODUCTION

Human nature is a social asset. When considered within the context of environmental and behavioral theories, the environment is a holistic concept that encompasses not only the physical characteristics that can be understood by the senses but also the social life in which is experienced. As a result of a child's basic nature, he/she is in constant development and change with the effect of constant stimuli from a holistic environment. In the design of educational buildings that constitute / limit / define the environment in which has a significant part of children's daily lives, spatial designs are made only within the needs of an educational program, regardless of the need of the spatial stimuli for the cognitive and social development of students.

The school space in this context consists of a spatial plan which has deep relationships by the space for its pedagogical and social rules. The spatial diversity within the school structure supports the development of students by allowing for the great possibilities between the interests of the students and the parameters of the areas allowed for their use (Wachs, 1987). According to Saeki (1995), learning takes place in a dialogue between the child, the adult, and the structure that makes up the environment. The social relations of children with each other and with their teachers may either be supported by the physical space, or they may negatively be affected (Itoh, 2001).

When we look through the historical process, the educational structures that emerged as a design problem are basically confronted as a structure composed of educational units in different functions and sizes that are shaped by the main corridor space and articulated to this main space. In changing and developing educational concepts, corridor areas can sometimes be transformed into the spaces that include some educational purposes with different pedagogical approaches as some other have only circulation purposes. On the other hand, while the educational building plan represents a mechanical system according to the scheme, it has an organic form in sociologically. It is possible to assume that different spatial configurations can have positive or negative effects on the social behavior and cognitive perceptions of the students when the educational spaces are treated as a closed system as addressed through different variables such as bounding, connecting and separating in which learning takes place.

Considering the school as a spatial configuration where students have a true sense of life rather than a place where they learn by following a specific educational program is a necessity. Education becomes effective and meaningful when children encounter social interactions, acquire their identity and attached to the places via educational buildings' physical characteristics. According to Proshansky, the space created by spatial arrangement is caused by the social identity of the physical identity with the self, spaces constitute the infrastructure of constructing an identity that the individual sets up with his cognitive structures as well as his experiential qualities (Proshansky and Fabian, 1987).

In this context, the school consists of an order which has deep relationships with space for its pedagogical and social rules. Altman (1992) emphasizes that these relations have become an integrated system in the context of time and space, together with the school, student, learning process and learners (Lippman, 2010). Low and Altman (1992) emphasize that spatial bonding also occurs as the sense of place evolves they are connected to space by the effective bonding that develops among people.

King and Marans (1979) emphasize that the philosophy of study on education and the social order should be looked at from a larger scale rather than class scale if it is to be studied through student and teacher behavior in relation to an architectural configuration. From a wider perspective, space has its own meaning with its structural and conceptual features, and the space organization is associated with the logical process of an environment that serves the functional purpose of each community (Hillier and Hanson, 1984).

Therefore understanding the physical, social and programmed rules and limitations are necessary to comprehend the meaning of the designed spaces and to define the relationship between the multiple space cells. The definition of the relations necessary for the meaning of spaces in the designed spaces and reading the relation between the multiple spaces are related to the physical, social and programmatic rules and restrictions of the spaces (Şalgamcıoğlu, 2013).

Therefore, in the light of these theories, educational buildings can be accepted as made up configurations with their spatial identities, which have become an extension of everyday experiences of the students. The parameters of the reflection and assembly of these spaces into the cognitive maps of the students are also a tool in the analysis of the contents of the spatial order in educational buildings. In this context, it is aimed to investigate the relationship between characteristics of spatial order in education buildings and its cognitive perceptions of children. For this reason, the spatial parameters of the education structures can be determined

by the cognitive analyzes performed by the students and the social, behavioral and perceptual results revealed by the school design.

In this direction, the field study focuses on the cognitive maps obtained from children who are educated in two different facilities and aims to provide a theoretical discussion on the level of children's perception of the buildings spatial orders.

METHOD OF THE STUDY

The spatial cognition, including the process of spatial or environmental information coding and the process of structuring various causal processes related to spaces (Montello, 2001), is defined as the comprehension of spatial relations and structures with internal or cognitive representation (Hart ve Moore, 1973). The mental maps, which are repeatedly structured by the reflection of the assumed reflection of space, are also described by Downs and Stea (1973) as a psychological process in which the spaces experienced by the individual in his daily life and the characteristics of these spaces are coded in the mind, re-remembered and deciphered. These mental schemas formed in the direction of the environmental experiences and perceptual processes of individuals are important for solving the meanings of the places that are constructed in the mind and how they are contained for the individual.

According to Piaget, in the period of 7 / 8-12 years, when the information is given in the concrete form, a child can process this information systematically and logically. In this age period, the concepts such as time, space, dimension, volume, distance starts to settle in the logical thinking and it is defined as the concrete process period according to the cognitive development theory. This age range is a period in which the existence of a fixed reference system is developed in children (Piaget, 2004). Upon this period, the child can establish a new fixed reference system in his/her mind by using markers such as house and school when putting himself in the origin of the reference system while defining spatial associations, and realize that spaces are related to each other independently of each other (Çanakçıoğlu, 2010). When children make a complete transition to concrete transactions, they begin to think of the place as a whole; directions, places, and distances are linked together to form an entire picture of the child's actual familiar area and it is called creating a map area (Trawick-Switch, 2013). It is expected that the spatial characteristics of the cognitive data obtained from children in this age range will be more detailed and representations of the motion range will be observed in the drawings.

In this context, the school is one of the most important physical environments in which children interact cognitively. The child develops various cognitive schemes about the school building that he or she is experiencing repeatedly. These mental schemes, formed in the direction of environmental experiences and perceptual processes, are important for the analysis of how real spaces are coded and understood in the mind. For this reason, within the scope of this study, the educational institutions in which the students in this age range are educated is selected.

In the field study, educational buildings are selected based on their spatial differences and focused on the cognitive interactions of students which they have established with their own buildings. The building with the inner courtyard plan is defined as the "Type 1" educational building, the one with the linear plan diagram is defined as the “Type 2” educational building (Figure 1).

The "Type 1" educational building has a plan scheme with separate break-off halls which are located around the inner courtyard at the center. The break-off halls are divided into two as

west and east halls. In the planned program, the administrative units are located on the west hall side while the classrooms are located are in the east hall. These break-off halls are connected to each other through narrow corridors to the north and south where there is a window to the inner courtyard. In addition, there are single-lane student stairs to the right and left of the inner courtyard, and at the beginning of the west hall the administrative stairs associated with the administrative units.

Figure 1.Type 1 and Type 2 educational buildings' plan diagrams.

The "Type 2" educational building has an H-type spatial order via a linear corridor scheme. It is observed that the administrative units in this education building are generally gathered at the middle area but do not have sharp distinctions as administrative and classroom area. In the middle of the building and at intersections of the corridors there are also corridors and interactive staircases. It is seen that stairs are not defined to use for students or administrators in this building and students can use all spaces freely between the floors.

In addition to these basic comparisons, the entrance to the building of "Type 1" is divided into two as students and administrators in design, and students are forced to interact with the west hall. On the other hand, the canteen area, which is located in the east ground hall is not at a point where it can be interacted visually. The spatial division of the building restrain the visuality on the floor plan and therefore, the general spatial order of this building is come up with a separate arrangement.

On the other hand in the "Type 2" building, there is no distinction between student and administration entrance, and entrance to the building is provided through a large entrance hall. Visual interaction with the canteen area can be achieved after entering the building. In all floors, including the ground floor, plan diagram that can be comprehended as a whole.

In this study, a comparative research method has been adopted over the cognitive maps to examine how the education buildings affect the perceptions of the students over spatial orders. And in this regard, a cognitive map study was carried out with the question of *"Can you draw how you spent a day in your school?"* A class determined at each class level in order to examine the contents of the cognitive relation that the students had with the spatial order in the schools. Expressions in their drawings are categorized as spatial unit expressions, social expressions, and closed spaces (classrooms and administrative areas) / circulation areas (open and closed recreational areas).

FINDINGS

The cognitive maps of the study were collected from 221 students of 5, 6, 7, and 8th grades, all of whom had 9-14 years of age. In "Type 1" building, a total of 114 students, 56 female, 58

male students participated to the study, in "Type 2" building, a total of 106 students, 45 female, and 61 male students participated to the study.

In order to search the effect of spatial order in the perception of the main spaces in school building design programs, classrooms, corridors and canteen area expressions of the students were examined in spatial unit expression category. A total of 131 spatial unit expression values were obtained from the students of "Type 1" building, while 147 spatial unit expression values were obtained from the students of "Type 2" building.

In the building "Type 1" which has an inner courtyard with separate plan order, 70 expression values and 54% classroom areas were identified in the maps. In addition, corridor areas were identified with 24 expression values and 18%. The canteen area, which is one of the basic elements of the education buildings and allows students to socialize with each other, has 37 values and 28% of the maps.

In "Type 2" building, which has a linear plan scheme, classroom expression was identified in 49 expression values and 34%. On the other hand, corridor areas which are the basis of the spatial organization in these buildings are transferred to the maps as 47 expression value and 32%. The canteen area, which is located on the ground floor of the building, is also seen as an average identified area, such as classrooms with the value of 51 expressions and 34%.

In the percentage distribution of the data from both schools, the students of "Type 1" building reflect classrooms at the highest level in the cognitive maps, while in "Type 2" building students reflect classrooms, corridors, and canteen areas in equal ratios (Figure 2).

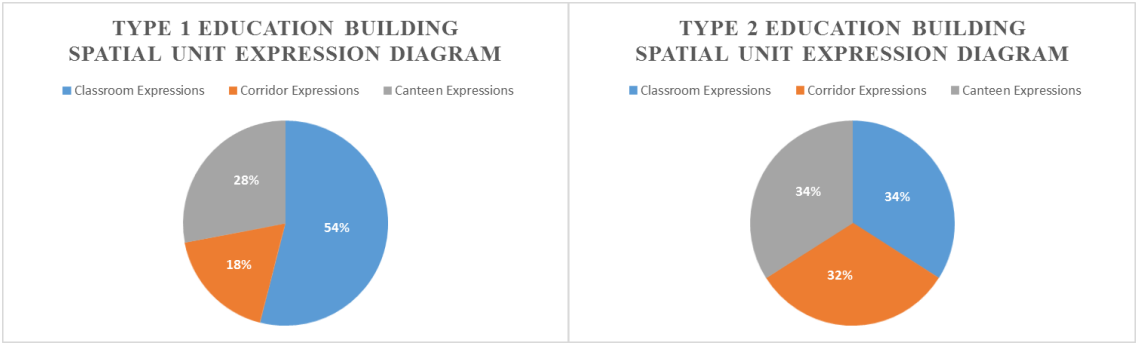

Figure2. Spatial unit expressions distribution graphs obtained from "Type 1" and "Type 2" building students

When this distribution is analyzed through the spatial order, the "Type 1" building with the inner courtyard plan scheme is also verified on the maps that the courtyard and the stairs on the middle has a negative effect in visual perception of the floor. This disconnected relationship at the spatial order can be seen from the classroom-oriented drawings of the students in "Type 1" building, while children in "Type 2" building represents corridors and break-off areas as well as the classrooms.

In other words, while the visual interaction is negatively affected via the inner court and staircases attached to it in "Type 1" building, children develop a relationships with their classrooms rather than with break-off halls or corridors where they meant to relax in off-class times. On the other hand "Type 2" building students can visually dominate the entire floor with connected halls and separate staircases and develops wholistic relationships with their surroundings.

On the other hand in order to search the effect of spatial order in perceiving general spatial layout; classrooms, other defined interior areas, the circulation areas and break-off spaces expressions were examined. When the data of closed spaces and circulation areas in cognitive maps were taken into consideration, a total of 165 expressions were obtained from the students of "Type 1" education building. There are classroom expressions with 58 expression values and 35% while 50 expressions and 30% other non-classroom interiors, in general, were included in cognitive maps. It is seen that closed break-off areas and corridors have the least expression value at a rate of 14% with expression value of 22.

In addition to that, a total of 159 expression values were obtained from students who were participated in "Type 2" building. 56 values and 35% open break-off areas were obtained at the highest value while 44 expression values and 28% closed break-off areas were at the second place. At the lowest rate, there are 24 expressions and classroom descriptions with 15%. It can be seen that open break-off area expressions as open break-off areas transferred to the maps in both buildings in high degrees. On the other hand, other expressions rather than open break-off areas; "Type 1" building students preferred to express their classrooms while in "Type 2" building students represents corridors and out-of-class spaces in their maps (Figure 3).

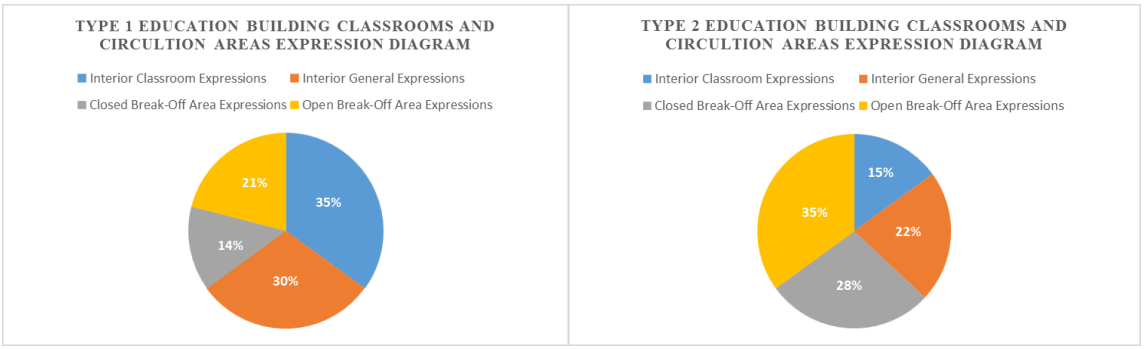

Figure 3: Closed spaces/circulation areas distribution charts from "Type 1" and "Type 2" building students

According to these findings, students who have visual limitations by the spatial order often have reflected Open Break-off areas and classroom settings in their cognitive maps. On the other hand where there is a visual openness in the layout, students draw Corridors and Closed (inner) Break-off areas into their schema. In the separate order building, the contents of the corridor expressions in this school are interesting as well as the classroom expressions which are concentrated in the drawings. It has been seen that staircase expressions associated with corridor locations in maps are often defining the difficulties of ascending and descending stairs, and teacher images that warning students for possible danger hazard in the event of a fall. At the same time, there is a constant check figure in the break-off halls presentations.

These findings can also be interpreted as the fact that the break-off halls, which are visually separated from one another, need more control for the teachers which in turn leads to a feeling of being restricted by the students and therefore students prefer to stay in their classroom or directly go out to the open break-off area. In addition to that in "Type 2" building, where has the visible layout; friendships and playful expressions are noteworthy when the spatial units, social expressions, and general cognitive expressions are examined. In the linear plan building, students mostly draw joyful expressions and movement patterns on their drawings. Students highly identified their building through its corridors, canteen area with social expressions.

And as a final search the effect of spatial order in socialization parameters, individual and friendship expression on the maps were examined. It was found that in "Type 1" building, there were 114 social expression values identified with 69 value and 60% individual expression while there were 45 value and 40% friendship data. In "Type 2" building, there were 104 social expression values identified with 76 value and 73% of friendship expression were obtained while there are 28 value and 27% individual expressions (Figure 4).

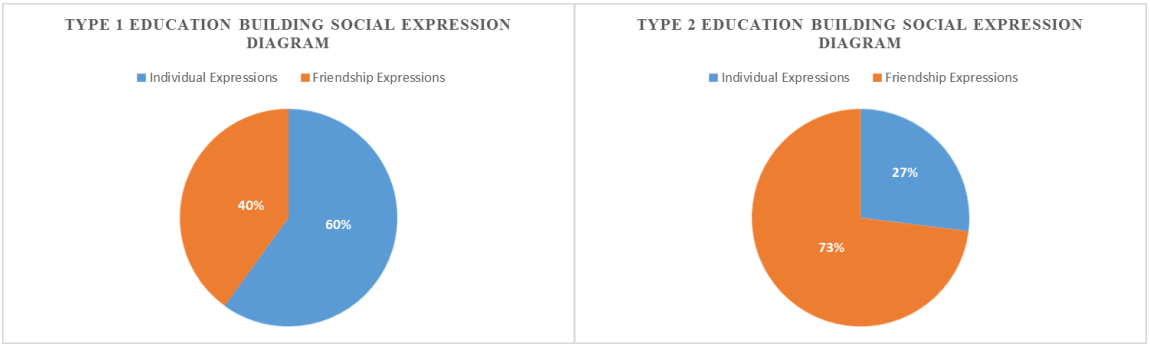

Figure 4. Social expression distribution graphs obtained from "Type 1" and "Type 2" building students

When the social data obtained from the students are examined, it is seen that the emphasis of individuality in the maps of the students of the "Type 1" building is high, while the friendship and the socialization emphasis are intensively obtained from the maps of the students of the "Type 2" building. While Students in "Type 1" building draw themselves alone in their classroom areas, "Type 2" school building students draw corridors and canteen areas with friendship expressions. According to these findings, students who have visually distrupted by the spatial order often have reflected individual expressions and classroom areas on their cognitive maps. And where there is visuality in spatial order children draw colorful plays and gatherness of crowds in their drwaings.

This data shows that socialization parameters change according to the spatial order and children have difficulties for socializing when the space has limitations of visualization. With a linear and comprehendable layout students can easily interact with each other and they can transfer to this to their cognitive shemas.

DISCUSSION

Within the scope of the study, two educational buildings were taken into account in the context of spatial differences through their layouts in order to be able to reveal the different effects of the spatial arrangements on the spatial perceptions of the students. Considering the cognitive maps obtained from the students, it has been found that semantic relations are consistently relevant with the spatial order in both buildings. And the perceptual effects of the spatial order on the students can be read on the non-classroom and closed break expressions of the students in both schools.

It has been observed that the students in the "Type 1" educational building with separate break-off halls, have interacted with their classrooms or directly with the open break-off area instead of being cognitively involved in the general spatial order of the building. Students also draw only themselves alone or blank class descriptions in classroom expressions. This outcome shows that the departed spatial arrangement pushes students into their classrooms and enables them to interact with the general fiction.

These reflections of spatial disconnection in the cognitive maps in the "Type 1" building can be regarded as a sign that these students do not develop a complementary sense of place against their educational buildings. The individual expressions are mostly defined in the classroom areas can be taken as a sign for the students have established a place attachment with their classrooms but they can not carry it to the whole building. In this school, canteen area, which should be defined as a sociopetal place where social interaction is high, is intensively defined by individual drawings or empty spatial expressions also. The fact that the canteen area's lack of daylight and its location can be the main reason of why the students do not prefer to use this area outside of basic food needs and therefore can not socialize in that space. At the same time, it is possible to say that the students prefer to spend their break-off time in the open air break-off area or in their classrooms instead of being in the building due to the spatial order's characteristics.

On the other hand, when the contents of the spatial expressions obtained from the "Type 2" educational building where have a linear layout plan are examined, it is seen that the classrooms, the canteen, the corridor and the break-off areas reflected the maps proportionally with each other. It is possible to say that students are able to develop a sense of space against their buildings in general, in view of the balanced distribution seen in students' maps. The vast majority of spatial expressions in the cognitive maps of "Type 2" educational students also form content about friendship and social interaction. The hallway expressions in the drawings, walking with friends and watching through the windows of corridor drawings are also noticeable. The fact that corridors' receiving daylight, the break-off holes can be perceived through the light and the main corridor can be interpreted as a social and free interaction of the students with the school buildings. It is possible to state that hallways and open break-off area facing windows on those break-off halls are also an important factor in students choosing these places. The canteen expressions in the drawings also contain expressions indicating that they use this area not only for eating but also for socializing purposes. The fact that the location of the canteen is located at a central point on the ground floor allows students to interact with each other visually.

The content of the cognitive maps of "Type 2" educational building students can be considered as a sign that students can establish a holistic relationship with the spatial order and develop a defined sense of space against school buildings. In this context, it can be said that students can establish a social attachment with school buildings as well as a spatial attachment.

CONCLUSION

In this research, it has been found that when the school design is not visually and physically broken students are able to interact with each other and with the space and the level of social interaction in such a space is also increased. At this point, the study contains striking findings of the basic design parameters of educational buildings. If the spatial order disintegrated and broken out, it was seen that the students could not perceive the school building as a whole and they were drawn to the classrooms which are the most basic unit. In other words, when the spatial order is not supported by the students' sense of space, the building becomes only a structure consisting of classrooms and just plain outdoor areas. And when the spatial order supports to develop the senses of space it turns out that the students are able to perceive and use the school buildings as a whole and interact with each other in this arrangement.

As Ünlü et al. (2001), have stated in their study that, the social interaction is an outcome based on visual occurrencesderived from the spatial configuration. They indicated that

behavior occurs due to visual stimulation and people interacts wit each other in the settings based on occurences and spatial configuration.

In this respect, it can be said that the visual interaction between the people that space allows in the design of education buildings is an important clue to be considered. This is because, when the visual interaction is limited via the spatial order, social interactions of students are also affected. With the high level of visuality in the spatial order, students can perform physical and cognitive interactions with the whole building.

As visual interaction increases, spatial fiction becomes a sociopetal environment where social interaction also rises. When this level is lowered, social interaction also falls down and a sociofugal educational environment is formed. In regard to these results, it is seen that the content of the spatial order in the design of the educational buildings influences the cognitive relation that the students establish with space.

In conclusion, this study includes important data in terms of understanding how the cognitive map studies are a useful tool for analyzing perceived the physical form of the space, as well as the meaning of the spaces, through design parameters of educational buildings. Cognitive and spatial comparative testings of more complex educational context typologies are expected to strengthen the validity of the data obtained within this study. And it is also important to note that these studies should be carried out by a higher number of samples for deepening the data set out within the scope of the study.

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