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# Understanding the Role of Spatial Configuration on Social Behavior in Educational Buildings

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## Abstract

Educational buildings, which appear as a design problem when viewed through the historical process, appear as a whole of structures consisting of educational units of different functions and sizes, shaped through a main corridor space and attached to this main space. On the other hand, when educational buildings are considered through their plan schemes or spatial layouts, it is possible to say that they positively or negatively affect different but interrelated parameters such as students' potential to come together, their motivation in crowds, and their involvement with each other in social relations. In the space syntax theory, buildings are separated from each other in terms of programming; that behavior is shaped and determined by the configuration (strong programming) or possible new forms of behavioral patterns occurring against the layout (weak programming). This study uses a comparative methodology to investigate the effect of the spatial layout of educational buildings on how social interaction is generated and motivated in the relations of 'syntactic programs' in school settings. The study focuses on recess time behavior in relation to the spatial layout and uses behavior maps and space syntax methods to examine the effects of the spatial setups programming parameters in educational buildings. Results show that if an educational building has a flexible structure (weak programming) with its spatial organization, socialization is oriented naturally by the layout with enriched behavioral patterns. However, when the design starts to behave strongly programmed, social behavior becomes monotonous and prevented. As a result, this study shows the importance of understanding social logic in the architectural design of educational buildings in structuring social relationships. Revealing the relationships between these concepts is thought to guide the evaluation of the design criteria of educational buildings and the contents presented for new designs.

***Keywords:***
*Architectural programming, Educational buildings, Spatial configuration, Spatial behavior, Space syntax.*

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## INTRODUCTION

The communication between the physical environment and the child occurs through symbolic messages. Proshansky and Wolfe (1974) state that adults' intentions or values about that environment transform the setting over which they have control in a pragmatic role. The overall setting is designed and controlled by adults in educational facilities, but in several academic research studies, the child's point of view has recently started to be considered. In many research studies, the child and environment are considered through learning. Studies state that the learning process does not simply occur within the physical setting; it is affected by the relationship between the setting and the nature of behavior (Backman et al., 2012; Woolner et al., 2012; Coelho et al., 2022). Education becomes effective and meaningful when children connect with the place, interact socially, and gain identity. Therefore, it is necessary to consider the structure of school environments as places where real life happens for students instead of dull places where they are informed about specific educational programs.

Besides being a learning facility, school environments allow children to expand their social ties with others, encouraging them to make connections between themselves and develop a sense of group and individual attachments to the social environment to become connected (Kohlberg, 1971); cited in (Cotterell, 1996). The school is considered a behavior setting, influences the students, and motivates them to achieve new things. It is also a setting where the environment is integrated into the relationships between the learning and social development of the child (Lippman, 2010).



On the other hand, the social structure of space is a dimension that can be understood through the physical setting of the space (Hillier & Hanson, 1989). Hillier (2007) states that physical configurations of forms and elements represent the social organization as we see in everyday life construct the social organization of everyday life. Furthermore, it is possible to understand the effect of spatial form by making configuration-based measurements of social and behavioral patterns with the space syntax method.

In this context, recess time is essential for examining the child's behavior to understand the social structure in educational buildings. Recess is a period when students behave accordingly free rather than the class. Therefore, recess is the time for unstructured and undirected behavior in school environments. Rhea (2016) states that the definition of recess is abstract, like the play itself, and essential for the child to experience whatever they want to refocus. It could be role play, physical activity, sitting and reading, socializing, imagining, or reflecting. Recess can potentially affect the whole child—offering academic, cognitive, emotional, physical, and social benefits— (Ramstetter et al., 2010). In several studies focusing on recess time behavior (Lever, 1976; Finnan, 1982; Harper & Sanders, 1975; Pellegrini, 1992), the physical environment and behavior are related to each other, and recess time

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significantly affects overcoming the difficulties of stages in child development through social interactions.

Within this framework, this study aims to examine the relationships between socialization and spatial order in recess time behavior. The main question of this study is how space is structured and how it affects students' social behavior. In the first part of the study, the theories of behavior and spatial order are discussed within the framework of school environments. Then, the field study, findings, and general evaluations are presented.

## SCHOOL ENVIRONMENT AS SOCIAL SETTING

Educational buildings, the most basic public spaces where children interact, are emerging as an area of ecological psychology because of their behavioral environments and perceptual infrastructures. Rather than defining the physical environment in a school setting as where students are exposed to a particular education system, it is necessary to think of it as where real life occurs. School settings are physical environments where children can expand their social ties with others, thereby interacting with peers, older and adults, to connect and identify with society.

There is an unlimited number of school settings (configurations) that specify only the design features of school environments without considering social phenomena such as the activities of students and teachers and their organization in school environments. Based on the classifications created by Brubaker (1998) and Perkins (2001), it is possible to categorize school structures according to different educational philosophies that have developed over time (Figure 1). However, Perkins' classification does not reflect what kinds of visual and physical connections are provided between individual areas and what types of activity and movement patterns can be produced.



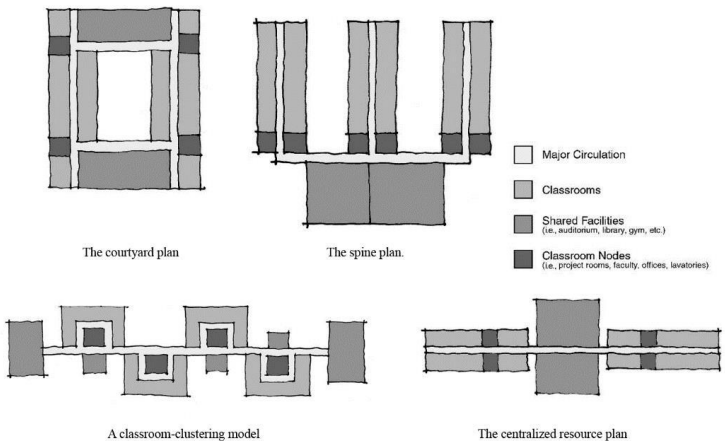


**Figure 1.** Examples from Perkins' classification of school building layouts (Perkins, 2001).

According to Peponis and Wineman (2002), to look at the relationship between space and behavior, it is necessary to understand

the relationship between built spaces and their social functions, as well as the boundaries, connections, and divisions created in spaces.

Bell et al. (2001) divide the spaces where we live, learn, and play into primary and secondary spaces. Primary spaces constitute primary purpose-oriented environments that allow people to meet regularly and where personal relationships can be developed, while secondary spaces are generally temporary and anonymous environments for relationships (Lippman, 2010).

As individuals interact in primary environments, bonds are formed between each other. It is more accurate to define these spaces as the environment (milieu) in which the person becomes individualized rather than simply calling them home or the immediate environment. Instead of rules to be followed, learning takes place in these places through observation and internalization. While secondary environments can be flexible, malleable, and integrated like primary environments, they are essentially more defined areas. Lippman (2010) emphasizes that although school environments, which can be considered secondary spaces, are environments where different individuals come together, various activities are carried out, and different skills are acquired, designs made to control undesirable student behaviors come to the fore in these spaces, and that the educator's and administrator's He argues that there is a system in which he acts as an authority and rules are imposed.



In educational areas consisting of corridor systems, which are generally double-sided classrooms, the general school design is carried out through specific arrangements to accommodate the student population of the building. Lippman (2010) defines corridors as "active" areas for activities, while classrooms are "passive" areas. While corridors are designed to enable users to go from one educational location to another as quickly as possible, they are areas where other behaviors are exhibited (such as waiting to enter the classroom, working, reading, and reaching personal lockers). While order appears through the teacher in classrooms that support passive interaction, both corridors (active areas) and classrooms (passive areas) need to be re-evaluated for children's educational practices and allow interactions at different levels, including individual, one-on-one, small groups, and large groups (Lippman, 2010).

Gür and Düzenli (2004) define free time (recess) as the education that takes place in the hours allocated for the student to relax mentally and physically through entertainment and recreation between scheduled lessons. Kıncal and Genç (2002) state in their study that the concept of recess (free time) is an essential part of education/training in terms of time and space and that in these free times, students can meet their basic needs as well as play games and play games. In their study, Polat and Ünişen (2014) emphasize that recess spaces are attractive environments where individuals of the same age and cognitive level, who cannot come together in any environment other than school, can

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leave the classrooms, which are synthetic learning environments and have real-life experiences - socialize and gain experiences about social life.

Therefore, the school setting encourages the establishment of bonds between students and the development of group consciousness, so a connection occurs between the individual and the social environment (Kohlberg, 1971); cited in (Cotterell, 1996). Saeki (1995) states that learning happens in an environment structured by the dialogue between the child and the adult. Physical space can be supportive or discouraging for social interaction for children in terms of their relations with each other and their teachers (Itoh, 2001). Tarçın Turgay and Ünlü (2017) also emphasize that the functional and syntactic qualities of the space in educational buildings are effective on the levels of social attachment established with that space. Children should engage in rich social interactions for effective and meaningful education, establish a connection with the place, and gain an identity. In this context, it is possible to investigate the space with the concept of psycho-social territory and to examine the forms of behavior that individuals have developed to create, protect, and even defend their fields.

**UNDERSTANDING THE SOCIAL BEHAVIOR**

Gibson (1986) emphasizes a strong relationship between environment and individual experience, and it is impossible to examine the interaction process without focusing on the lived and experienced environment. Barker (1968) also describes the environment as a natural medium in which artificial or virtual environments are created daily and can be interpreted as multidimensional regarding socio-physical relations between man and the environment. Proshansky et al. (1983) point out that our physical surroundings are not just physical but also social as we configure them, so understanding the physical universe's behavioral effects is a great extent through understanding the social relations of that physical environment.



According to Ünlü (1998), spatial behavior is a critical point in environment-behavior studies and consists of the interaction where different dynamics are effective. The behaviors that stand out in the space are mutually related to where the behavior occurs. Also, Barker (1968) states that spatial behavior is the identity consisting of pieces of thought related to the social and cultural position, including the interaction of mental perception and all the temporal, social, and physical dimensions.

Behavior is also shaped by the content of that space when it provides enough visual and physical spaces for the individuals with the order that the space creates. Lawson's (2007) Language of Space emphasizes the spatial distances people make and how spaces generally tell people how to behave. The physical space modifies our behavior, constructs our relations with each other, and causes us to exhibit the behaviors appropriate to that space in the spatial arrangement. As the central

element of the fundamental and universal form of communication, space could bring people together and separate them.

Behavior setting theory focuses on the fact that people's behavior cannot be handled independently of the environment and the factors in the environment (Barker, 1968). It is a homeostatic equilibrium involving all living or non-living beings and their chain of relationships. Bechtel (2000) quotes Barker's original definition, "A behavior setting has been defined as a standing pattern of behavior and a part of a milieu which are synapomorphic and in which the milieu is circumjacent to the behavior." (Barker & Wright, 1955, p.45). Moreover, Skinner's quote (1972, p.185), "People are extraordinarily different in different places, and possibly just because of the places." explains the argument that behavior is shaped by the environment.

In the most basic case, behavior studies start with the individual, and the individual is surrounded by an invisible border around his own body (Sommer, 1969). Hall (1966) identifies this boundary as an irregularly shaped soap foam that is a proper mechanism between individuals. This boundary is also defined as the personal area, determines the spatial limits of the person, and provides compatibility with the person's behavior and space. Hall (1966) emphasizes that people interact with each other within four different distances, including intimate, personal, social, and public, and suggests that living things exhibit various forms of behavior within different social groups (Figure 2).



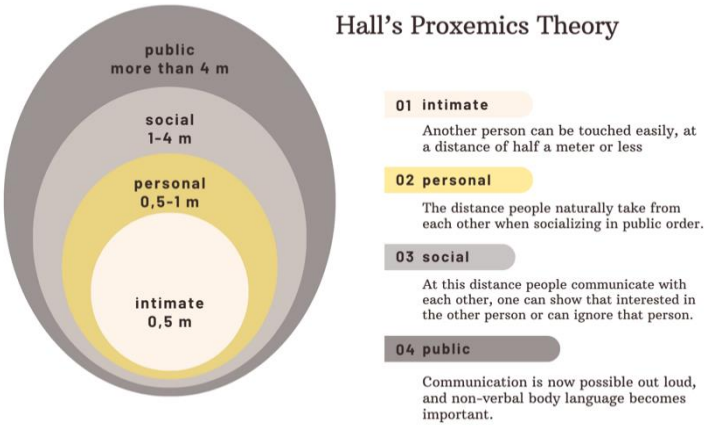


**Figure 2.** Hall's (1966) proxemics zones

Hall (1966) created the concept of space, stating that each culture or arrangement has its own rules. His observations about human interactions define these as proxemics and are directly related to the social meanings and the design and use of the spatial order. There are several studies that are using proxemics to understand the behavior in an environment. Marquardt and Greenberg (2012) use this theory to examine Informing the Design of Proxemic Interactions on how devices could have knowledge of nearby people and other devices and exemplify how it might exploit that knowledge to design interaction techniques. Was (2010) uses proxemic theories on crowd dynamics modeling to understand the motion mechanism in pedestrian dynamics. Aliakbari et

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al. (2011) searched the proxemic behavior of Iranian professors and university students on the effects of gender and status. They stated that status-organized behavior and physical distance of the lower-status individuals differed significantly. Raje and Ojha (2022) use Hall's proxemics theory to understand the natural relationships and the prospects it creates for 'quality' play that can accommodate a child's needs and behavior. Do et al. (2019) explore different behaviors of residents in an open space in Da Nang (Vietnam), which can support the future development and improvement of local open spaces by the proxemics theory. Gao (2020) uses the proxemics theory to focus on the impact of landscape design elements and features on crime prevention in commercial districts. Eyüboğlu and Zorlu (2021) search for the role and importance of personal space and territoriality in spatial behavior and user preferences in Library spaces using Hall's proxemics theory.

**SYNTACTIC STRUCTURE OF SPATIAL CONFIGURATION**

According to Hillier and Hanson (1989), the space is created by a social structure. Therefore, it is a dimension that can be understood through the physical setting of the space. Moreover, the physical setting is a social dimension that affects the different factors that make up that space, regardless of the scale. According to Hillier (2007), spatial configuration can be considered the primary producer of movement patterns in buildings consisting of spaces where individuals move, come together, and become aware of each other.



Space Syntax is a theory and methodology that made it possible to perform configuration-based measurements of social and behavioral patterns to understand the social logic of space. The book Social Logic of Space explains the theory as the relationship between external factors that generate the forms and the social structure. Syntax is the rule necessary to produce various spatial arrangements and combinations (Hillier & Hanson, 1989).

The spatial dimension of the organization in a building is called a program. The essential element in any program is the interfaces that buildings exist or construct (Hillier, 2007). The main point of the programming concept is based on the interaction in the building of two different groups of people -visitors and inhabitants. While visitors are in a temporary out-of-control interaction, inhabitants are the dominating group for the entire spatial configuration of the building (Sailer et al., 2013). Inhabitants are the ones who have control over the space, while the visitors lack it. Identities of visitors are collective, temporary, and subordinated, such as students and patients, while inhabitants dominate the space as teachers, doctors, etc. This categorization of the interface is taken as the program of a building in terms of strong or weak. The idea of the organization of the spatial dimension must be realized in the spatial form of the building (Hillier, 2007).

In a building defined as strong programming, the interaction of different groups of people is under very tight rules, and the use of space

is shaped by the program rather than the plan diagram. When the program constructs the movement, spatial configuration only allows primary and necessary movements. On the other hand, if the program becomes weaker, the structure of the layout starts to allow random interactions. Furthermore, movement is defined less by the program and more by the structure of the layout (Hillier, 2007). In addition to this, in various studies, it has been found that in the buildings defined as weak programming, random interactions occur without related to the program (Grajewski et al., 1992; Hillier & Grajewski, 1990; Penn et al., 1999); cited in (Sailer et al., 2013). By another definition, the program of a building specifies the spatial dimension of the organization in the building (Sailer et al., 2013). Sailer et al. (2013) defined strong and weak programming in their study as the criteria considered to be a building for strong or weak programming in theory (Table 1).

**Table 1.** Criteria for strong and weak programmed buildings are derived from the literature (Sailer et al., 2013)

| | STRONG PROGRAMMING | WEAK PROGRAMMING |
|---|---|---|
| **THEORY ORIGIN (Hillier, Hanson ,Peponis, Penn)** | 1. More complex and segregated layout<br>2. Low ratio of bounded spaces to convex space<br>3. Low ratio of axial lines to convex spaces<br>4. Smaller buildings<br>5. Strong control of inhabitant -visitor interface:<br>5.1 Separate non-interchangeable entrances<br>5.2 Easily controlled spaces for visitors, shallow in the building -close proximity to visitors<br>5.3 Independent routes<br>6. Strong control of inhabitant - inhabitant interface:<br>6.1 Strong division of categories of users by division of spaces used<br>7. Preserved professional status with more segregated spaces<br>8. Activities follow programme<br>9. Correspondence model<br>examples of building types: courts, prisons, hospitals, airports | 1. Simpler and more integrated layout<br>2. High ratio of bounded spaces to convex space<br>3. High ratio of axial lines to convex spaces<br>4. Larger buildings<br>5. No control of inhabitant – visitor interface:<br>5.1 Same entrances for inhabitants and visitors<br>5.2 No control over visitors<br>5.3 Shared routes<br>6. No control of inhabitant – inhabitant interface:<br>6.1 No division of spaces, therefore categories of users are mixed<br>7. No status expressed with spatial properties<br>8. Activities follow configuration<br>9.Non-correspondence model<br>examples of building types: offices, museums, galleries |
| **CONTRIBUTIONS (Sailer, Koch/Steen, Heoetal, Lu et.al, Cai/Zimring)** | 10. Attractors placed in segregated areas without configurational logic (Sailer, 2010)<br>11. Time restrictions of space usage (Sailer, 2010)<br>12. Activities follow programme: no influence of a spatial factor on different roles and tasks<br>13. Spatial practices (tasks and roles) are realised in space and time (duration) similarly (Koch & Steen, 2012) | 10. Attractors placed in integrated areas according to configurational logic (Sailer, 2010)<br>11. No time restrictions of space usage (Sailer, 2010)<br>12. Activities follow configuration: different spatial factors influence different roles and tasks<br>12.1 Targeted visibility (Lu, et al., 2009)<br>12.2 Visual connectivity / generic visibility<br>(Lu, et al., 2009)<br>12.3 Axial integration (Heo et al.,2009)<br>12.4 Distance (Heo et al., 2009)<br>13. Spatial practice (tasks and roles) are realised in space and time (duration) differently (Koch & Steen, 2012) |

In traditional space syntax theory, it is suggested that high integration areas exist with a high flow of motion, defined as natural



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movement. On the other hand, when strong and weak programming is added to the design, it is expected that the natural movements in which random choices are made, and morphogenetic behavior occur only in weak programming (Sailer, 2015).

Hillier (2007) emphasizes that the spatial configuration can be regarded as the primary producer of motion patterns where the individuals move, come together, and are aware of each other. Space Syntax analysis gives us numerically spatial schemes that describe social functions, cultural differences, and behavior change patterns. Space is considered an environment consisting of a combination of different convex parts. The forms of interaction in the environment are defined as concepts of isovist area, isovist perimeter, circularity, integration, depth, connectivity, inclusivity, etc. The syntactic parametric expressions of spatial relationships (integration, connectivity, etc.) strongly reference using spaces and forming interactional patterns between individuals (Haq & Zimring, 2003). Each unit receives a numerical value so spaces can be represented graphically, allowing comparison through configuration values to correlate with spatial data.

## METHODOLOGY

The study is conducted on two different school buildings in Bolu, Turkey. A comparative method is used to examine the effects of the syntactic contents of spatial programming on social behavior. Hall's (1966) proxemics theory is used to categorize the students' social behavior, and spatial data is obtained using Syntax 2D software (developed by the University of Michigan). Numerical values of each space are obtained from the grids where the recess areas' center points and used to calculate the space's mean value. The obtained data is compared with simple regression analysis. The process followed for the study is explained step by step in detail in further sections.



### Case Study Environment

The research is carried out in 50. Yıl İzzet Baysal Middle School and Merkez Şehit Ozan Özen Middle School, which have different plan typologies and space layouts, are located in the Merkez district of Bolu province, Turkey. The plan layouts of selected buildings are produced by the studies from the Ministry of National Education's cooperation with universities between 1998 and 2000 in Turkey. Plan schemes that are still up to date to provide an area for discussion on the essential design criteria of educational buildings.

In the scope of this study, buildings are referred to as Type-1 and Type-2 buildings. Each building has the same logic for maintaining educational areas (classrooms) at first but differs in architectural layout decisions (Figure 3).

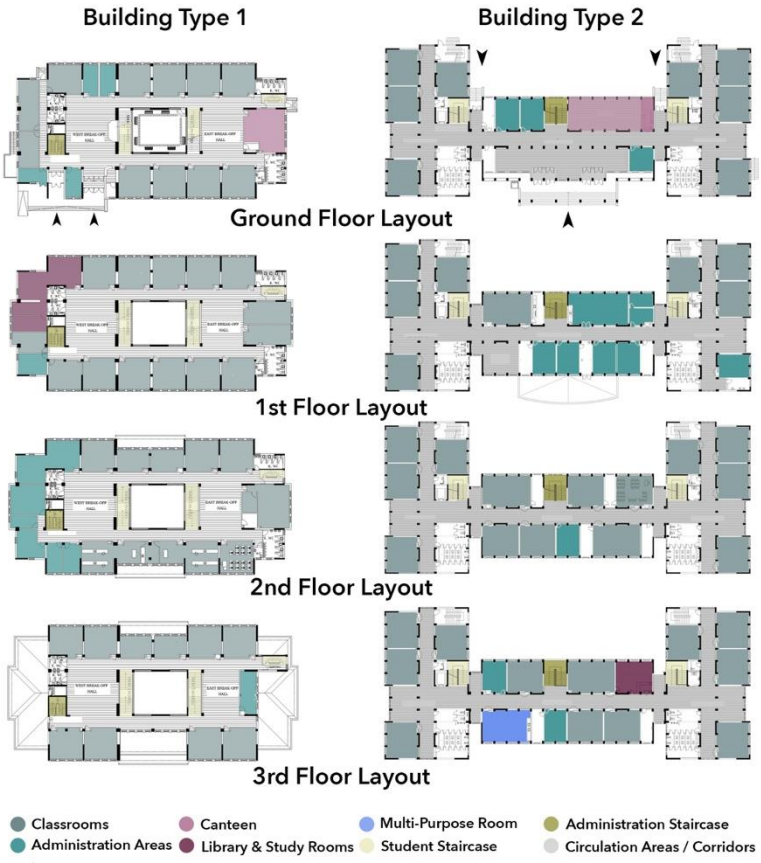


**Figure 3.** Layout and floor plans of the case study buildings



The building has a Courtyard plan layout (50. Yıl İzzet Baysal Middle School), defined as a Type-1 education building. It consists of a basement, ground floor, and three floors, with a total of 40 classrooms, eight administrative rooms, and a capacity of approximately 1200 students; it includes primary branch classrooms, science laboratories, music and painting workshops, a library, administrative units, and a canteen area. Entrances to the building are provided through two separate doors, administrative and student, and vertical circulation within the building is separated into student and administration stairs. In the building, which has two separate square-shaped break halls on each floor, east and west, access to the break halls is provided through the passage corridors located in the north and south. Following the architectural program of the building, it consists of classroom volumes, administrative units, food and beverage areas, and technical volumes, and the students' extracurricular lives are shaped through two separate break halls surrounded by these areas. While the break halls in the western part of the building are primarily associated with administrative spaces.

The plan diagram of the other building (Merkez Şehit Ozan Özen Middle School), defined as a Type-2 education building, is located in the city center, and consists of a basement, ground + 3 floors on a symmetrical H-type plan scheme (Figure 4). The building has a total capacity of 32 classrooms and 13 administrative rooms with a capacity of approximately 600 students. Located a little outside the main city

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center, the school has a ceremony area and open playgrounds in its garden. The building program includes multi-purpose halls, dining halls, classrooms, and administrative units. The general design of the building consists of classroom units located on both sides of a central corridor. Break halls have been left at the intersections of classroom corridors, causing the spaces to be perceived through a long corridor.

In other words, Type-1 building is relatively small and segregated, while Type-2 is more integrated by the main corridor. The spatial layout in Type-1 is shaped around an inner courtyard in the middle, which divides the floor plan into two and creates two break halls that are visually separated. This building has separate administrative rooms and classrooms, with distinctive entrances for students and teachers. The spatial layout in Type-2 is shaped over the main corridor with one main entrance to the building, administrative spaces are located at the center of the building, and classrooms are located mainly around the main corridors.

The buildings selected in the study are considered regarding the spatial differences between the non-classroom circulation areas. Therefore, the relationship between behavior and design could be revealed regarding strong or weak programming. Classification is shown in detail in the above table (Table 2).

**Table 2.** Evaluation of schools in terms of strong and weak programming criteria

| **Type-1 Educational Building** | **Type-2 Educational Building** |
|---|---|
| 1. More complicated and separated layout - two separate halls | 1. Simple and more integrated layout - placement on a straight corridor |
| 2. Small building | 2. Big building |
| 3. Strong control of users. | 3.No control of the movement of users by the administration |
| 3.1. Separate building entries | 3.1. Everyone uses the same entry to the building. No control over the students' movements |
| 3.2. The area where the students are located is easily controlled, and the students are close to each other. | 3.2. Shared routes, no division or identification over the areas. |
| 3.3. Independent routes, teachers and students using different staircases. | |
| 3.4. identified spaces, parent lounge area, and chess play area. | |
| 4. Activities following the program; no influence of a spatial factor on different roles and tasks. | 4. Activities follow configuration; different spatial factors influence different roles |
| 5. No visual connectivity, unable to perceive layout at once. | 5. Targeted visibility, distance, and visual connectivity. |



### Data Process

The data collection process is based on a two-stepped methodological structure, which belongs to the students (behavioral data) and the other belongs to the space (spatial data). First, to measure spatial behavior and syntactic relations, floor plans are divided into regions according to functional relations upon the layout (Figure 4). Every floor is categorized upon circulation and recess halls' locations and coded as (F1a, F1b. etc.). Besides the syntactical data, photoshoots and behavior observations at recess are also based on these regions. The basement floors are excluded from the evaluation because of the limited access on special occasions.

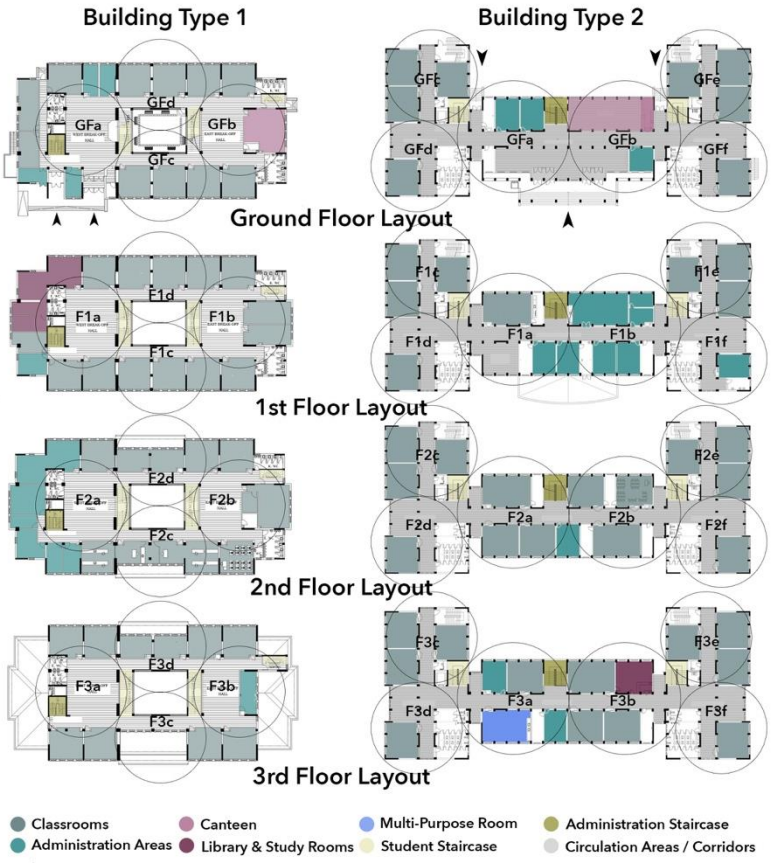


**Figure 4.** Areas where behavior is observed on building floor plans.



## Behavioral Data

Student behavior is categorized into three different social settings: individual behavior, intimate distance, and group interaction, as projected from Hall's (1966) proxemics theory. Individual behavior (mode-1) is taken for intimate/close distance, intimate interaction (mode-2) is for friendship for two individuals in the range of social distance, and group interaction (mode-3) is for public distance and beyond (Figure 5).

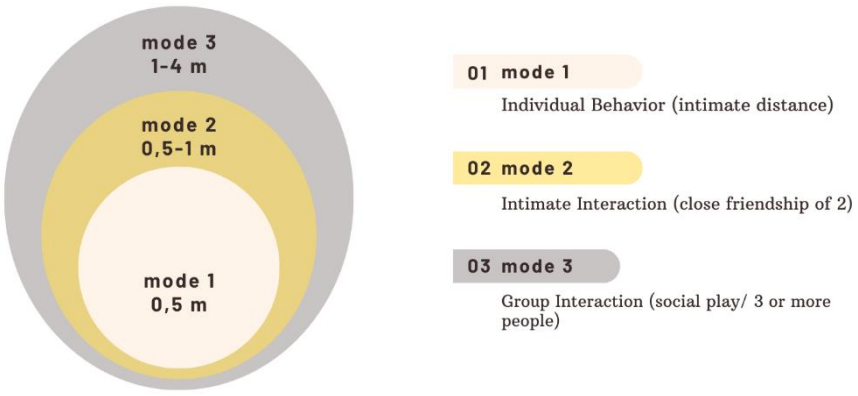


**Figure 5.** Students' behaviour categorization projection from Hall's (1966) proxemics theory.

Behavioral maps are drawn out to enable the socia behavioral parameters of the students in the non-class time (recess time) in the spatial order in the educational buildings during the three school days. In order to obtain behavior map data, photographs, and observations

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are taken on the floors during the first 15-minute break in the morning and afternoon during the three class days allowed by the school administration. Obtained behavioral data are processed by entering the '1' numerical value per category of individual behavior, intimate interaction (close friendship), and group interaction (active/social play) within the regions determined for every 15 minutes, as described in the previous methodology section. The sum of the children in that region is evaluated as the spatial behavior value of that region.

**Spatial Data**

Space syntax analysis evaluates space as an environment consisting of a combination of different convex space parts on the plane. The relationship forms within this environment are defined through concepts such as isovist area, circularity, compactness, integration, depth, connectivity, and inclusivity (Batty, 2001). Each unit receives a digital numerical value, allowing spaces to be represented graphically and configuration values to be compared statistically with other spatial data.

For the spatial data, isovist area, isovist perimeter, integration, and connectivity values of the regions obtained with Syntax 2D software over the floor plans of the previous two buildings.

First of all, it is essential to explain what the isovist is. Isovist is the data that enables the understanding of the space from the inside. It enables us to understand how the individual perceives the space, what kind of visual interaction he has with the space, and how the visual perception of the individual changes at each step (Benedikt, 1979). The isovist analysis is based on the point of view that gives the numerical equivalent of the relationship between the location and other spatial units within a physically unrestricted field of view. Due to their general architectural programs, educational buildings have a layout consisting of the main corridor and different classroom units attached to it. Therefore, curricular areas are the most determined places for examining space and human relations.



Since the isovist graphs are based on the visibility of the spatial components of the planning scheme, it is possible to compare the syntactic data of the points where the behavioral movement is detected on the corridor space via behavior maps of those regions. However, the effect of the space on visual perception also varies with different parameters—the expansion and contraction of circulation areas and the creation of gathering areas. Furthermore, different widths of corridors have different isovist values and significantly relate to variations in environmental and behavioral models. Therefore, it is assumed that there is a significant relationship between the isovist values of the corridor. Extension spaces and density of the student's behavior patterns relate to the relationship between behavior and visibility.

Isovist area is one of the spatial data subheadings, defining the area's visual and perceptual dominance when a person stands still and turns

360 degrees with the sense of sight. At the same time, the isovist perimeter is the calculated data calculated by the perimeter of the polygon in two dimensions determined by the relevant isomorphic field instead of the area value of the 360-degree field of view at a single point (Şalgamcıoğlu, 2013).

The other is the integration value of the space, which expresses the depth/shallow value of the space depending on other spaces. In other words, integration expresses how many spaces are distant from a particular space (Hiller et al., 1984). It is expected to be the most integrated/integrated space in the entire layout, considering the relation of corridor areas designed in educational buildings with other spaces. Therefore, it is essential to analyze whether there is a significant relationship between the regions where the frequency of behavior on the corridor space intensifies/ decreases and the integration values of these regions. This relation gains importance over whether the shallow and deep areas on the plan match the content of the behavior. Also, it is expected that comparing the total values of the behavior patterns obtained from the behavior maps and the integration values will give clues about which behavior patterns the layout motivates.

The connectivity value obtained from space is a value that changes according to the relationship between that space and other spaces close to it. In other words, the higher the number of neighbor spaces, the higher the connectivity value of that space. In this context, the places with the highest connectivity value in educational buildings are undoubtedly corridor areas. The width and narrowness of the corridors and spaces opened to corridor areas can be associated with the usage contents of the corridor areas in the education building.



In the scope of this study, simple regression (R) analyses are used to determine whether there is a significant relationship between the frequency of spatial and social behaviors obtained from these regions, and the findings are explained in a further section.

**DATA & FINDINGS**

When the behavioral data is analyzed through social interaction, in the Type-1 building, 53.74% of the students showed individual behavior (mode-1), 32.67% of mode-2 (intimate interaction -close friendship), and 13.59% of the students showed mode-3 (group interaction -playing active games) in curricular areas. On the other hand, in Type-2, it is seen that the social behavior is distributed in a balanced manner. At the same time, 32.45% of students showed individual behavior, 34.08% showed close friendship relationships, and 33.47% showed group behavior (Figure 6).

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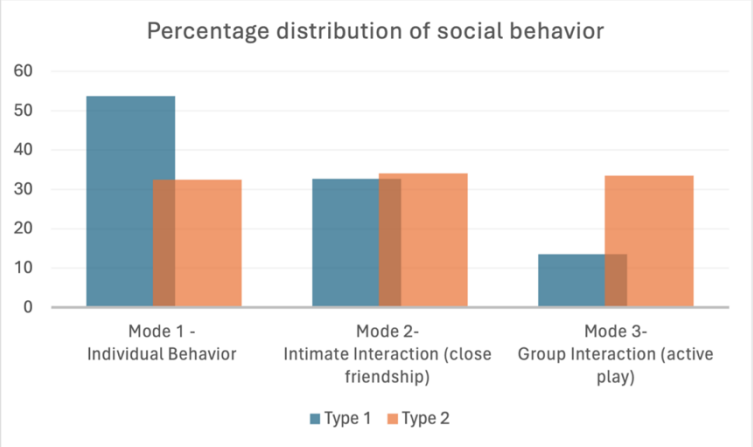


**Figure 6.** Distribution of modes of social behavior

In the context of these data, it is seen that the students' social behaviors differ in these two different school settings. While the most dominant social behavior observed in Type-1 building is individuality, there is a balanced social interaction distribution in Type-2 building.

In the Type-1 building, with distinct and disconnected recess halls, social behavior is observed mainly individually, while short-term games occur and dissolve in minutes. According to the observations during behavior mapping, students tend to behave isolated from each other while playing temporary games, and these areas mainly serve to pass by or use personal student lockers. It is mainly observed that students tend to stay in classrooms or go directly outside rather than staying in the halls. It is possible to say that lack of visual contact in layout causes limited social interaction in this spatial behavior. Therefore, this can be a reason for students to prefer staying in the classrooms or going outside rather than staying in the halls. Also, in the Type-1 building, it is observed that the students are standing alone and in a distance in front of the classroom doors, trying to participate in the games set in the middle area by watching or cheering. No reachable window openings to the outside due to the inner courtyard is another spatial fact in this building.

On the other hand, students in the Type-2 education building use the halls and circulation areas intensely for playing and socializing and for walking by. Children tend to play group games across the floors, not only in the corridors but also in intimate friendships in the non-class areas of the layout of this building. It is also determined that the social interaction observed in these areas can spread to the entire floor area from time to time.

Besides behavior mapping data, syntactic values are obtained from the center points of the areas based on the regions (F1a, F1b. etc.) determined for the behavior maps on the floor area of both education buildings. Then, an average sequential value is obtained for each floor area, and the general syntactic value of the building is tried to be obtained from these values.

Syntactic values of these two buildings differ in isovist area, isovist perimeter, integration, and connectivity. Type-1 building has lower

syntactic values than Type-2 building, considering the average syntactic values obtained from the areas in both layouts. This situation can be interpreted as the plan layout created in the form of H over the linear corridor scheme having high values against a planning scheme that can be considered compact with its inner courtyard as a square. Therefore, it is seen that the spatial mobility formed in the plan layout influences the spatial syntax values (Table 3).

**Table 3.** Distribution of the syntactic data

| Syntactic Values of the Buildings | Building Type-1 | Building Type-2 |
|---|---|---|
| Isovist Area | 1339,798 | 2531,535 |
| Isovist Perimeter | 10,959 | 20,603 |
| Integration | 794,481 | 2271,485 |
| Connectivity | 523 | 965,25 |

The syntactic graphs obtained from the buildings' ground floor plans show that main social spaces exist, such as the canteen area and main entrance halls. The diagrams' warm (red) color indicates the highest degree of searched value on the layout, while the cold (blue) indicates the lower. It can be seen that the higher values of syntactic relations occur in administrative areas in Type-1, while recess halls have a higher value in Type-2 (Figure 7). Similar graphs area obtained from the other floor levels of the buildings.



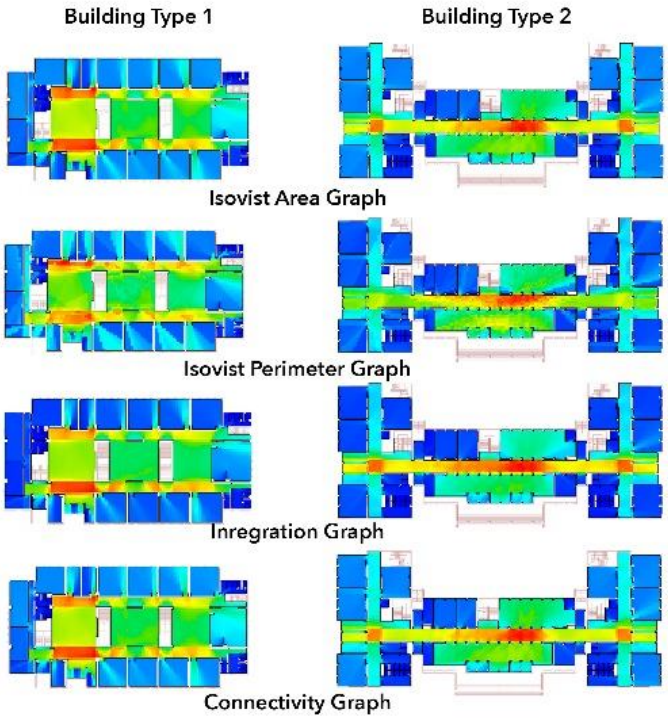


**Figure 7.** Syntactical Graphs of buildings.

It is seen that the width of the sight in the floor area in the Type-2 building, which has a linear plan scheme, is also reflected in the syntactic values. One reason for the low isovist area value in the Type-1

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building is the inner garden in the middle area, which negatively affects the interaction of the break halls by cutting off the visual interaction. On the other hand, the isovist perimeter value of the Type-1 building decreases while the square-shaped break halls and the surface lengths of the space decrease. In contrast, this value increases in Type-2 building with the window fronts and recessed and protruding areas created on the corridors.

Considering the integration values, the long corridor area in the Type-2 education building is the most significant factor in increasing the building's value. This increase is because all space units in the floor area are directly related to that area. In addition, separating the break halls in the Type-1 building also reduces the integration value of the entire floor area.

In connectivity values, it is seen that the values of the Type-2 education building are higher than the Type-1 building. This data shows the effect of the corridor areas on the connectivity value, which forms the basis of the space setup. The connectivity value is high in the corridor layout of the building, where all units can interact with its linear scheme. In contrast, the connectivity value is low in the layout connecting to the short, narrow corridors and vast break halls.

After obtaining the behavioral and syntactic data, simple regression (R) analyses are established between the behavioral data and the syntactic values obtained from the same areas. In the evaluation of the results of the correlation, the "r" value being between +1 and -1 determines the direct or inverse relationship by being positive or negative, and the "p" value less than 0.05 defines the significant relationship between the data.



When we look at the relationship between social behavior and space, we see that only individual behavior is associated with the space with values of isovist area and integration in the Type-1 education building. On the other hand, close friendships and group behaviors significantly correlate with the syntactic values of isovist perimeter, isovist area, and connectivity in the Type-2 education building (Figure 8).

In Type-1 building, the isovist area values ($r2= 0.484^*$; $p=0.049<0.05$) and integration values ($r2=0.495^*$; $p=0.044<0.05$) have significant relation with the individual behavior model while other social behavioral modes (friendship and active play) do not relate with the layout.

On the other hand, individual behavior defined as Mode-1 is unrelated to the syntactic values in Type-2 education building. It is seen that there is a significant relationship with the isovist perimeter ($r2=0.419^*$; $p=0.042<0.05$) between the close friendship relations exhibited by the students. Also, group behavior (active play) and the area of isovist area ($r2=0.685^*$; $p=0.000<0.05$), isovist perimeter ($r2=0.644^*$; $p=0.001<0.05$) and connectivity ($r2=0.707^*$; $p=0.000<0.05$) values are found to be correlated in this building.

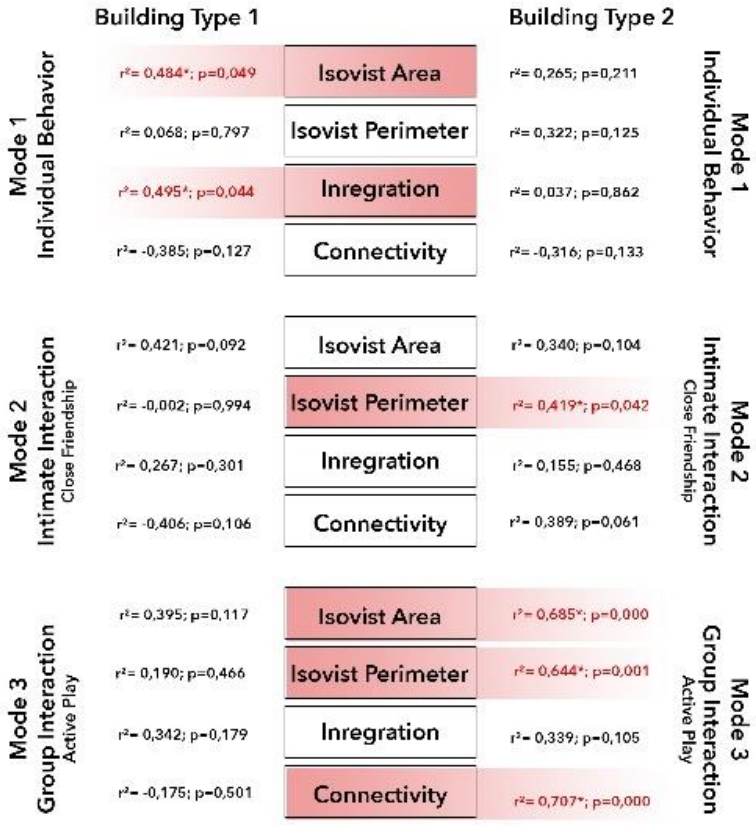


**Figure 8.** Syntactic and behavioral correlations



## EVALUATION

When looking at the correlational relations between social behavior and space, only individual behavior is associated with the layout in the Type-1 educational building. Throughout the spatial behavior analysis process, it is observed that students created singular, distanced, defined personal space in front of the classroom doors in the Type-1 building. Based on the data, it is possible to say that only individual behavior defined as Mode-1 is motivated by the spatial layout in the Type-1 educational building. Avoiding interaction with each other and using these areas by keeping a distance between themselves can indicate that the spatial order in this building has a feature with low social interaction.

On the other hand, intimate interaction (friendship of two) and group behaviors show a significant relationship with the Type-2 building's syntactic values. According to the behavior data, students' effective use of corridors and break halls and the formation of groups of two or more friends resulted in meaningful results with the syntactic values of the space. It is possible to say that as the level of visibility and connectivity of the space increases, students can see each other, interact, and, if necessary, establish social spaces between groups. Thus, such a spatial setup allows students to engage in social interaction.

The study's findings show a significant relationship between architectural design and behavior, and spatial programming directly relates to social life. The significant correlations between syntactical and

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behavioral data indicate that when visibility and accessibility richen in a school layout, group activities such as group plays occur effortlessly.

In other words, when halls and divisions separate the layout, children tend to act alone; the socialization of students weakens, and they prefer to be alone during recess periods. As the syntactic features of the space increase, the behavioral patterns and the social interaction that takes place in these areas are enriched. This situation can be evaluated as the combination of programming content and syntactic values in the spatial setups of these educational buildings will support social interaction.

According to the space syntax, when a building's programming is weak, natural movement occurs. This study shows that if the layout is divided visually and functionally in educational buildings, it affects students' natural movement during recess.

When layout becomes rigid, and students avoid interacting with each other in such a layout. In such setting students interact with the social areas within the school building for a short time, and after meeting their basic needs, they return to their classes or directly use the garden area. This is an indication that as the spatial design becomes more rigid, students become individualized and retreat to their classrooms, or they cannot establish a relationship with the general setup by directly interacting with open spaces. Students tend to prefer to be in places where they can see each other without any spatial obstacles. They seek visual flexibility in layout.



## CONCLUSION

The environment is a holistic concept that can be understood by physical characteristics, whereas social life is experienced in the context of environmental and behavioral theories. On the other hand, educational buildings, which have become an extension of the students' everyday experiences, can be accepted as designed configurations with their spatial identities. Therefore, the spatial order in educational buildings influences students' behavior, and behavioral maps become valuable tools in the analysis of the contents of design parameters.

There are several studies investigate social interaction in the setting and its relationship with spatial configuration (Ünlü et al., 2001; Ridwana et al., 2018; Golshan et al., 2021; Aelbrecht, 2016; Wu et al., 2017). This study proposes a new method for spatial behavior studies in educational buildings by categorizing social behavior in proxemics theory. Understanding the interaction between the physical layout of the spaces and the student's behavior in high-interactive and low-interactive space concepts is essential in the design parameters of educational buildings.

The study's results are significant in that they show that as the architectural layout in educational buildings becomes flexible, the social relationships between spaces can also be enriched. They also contain clues that the educational environments in which students are happy to

live should be supported with more flexible designs that allow visual interaction. Therefore, flexible programming is needed in educational buildings to integrate with the space. Revealing the relationships between socialization and spatial order is thought to guide the evaluation of the design criteria of educational buildings and the contents presented for new designs.

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