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EXAMINATION OF SPATIAL BEHAVIOUR IN SCHOOL BUILDING WITH ATRIUMS THROUGH SPACE SYNTAX METHOD

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ABSTRACT

The child's environment consists of basic spatial units such as home, street and school. The most important part of the child's development process is the education process and the school spaces where the child receives education. School is a spatial system that regulates social relations and behavioral patterns and acts according to certain norms, roles and programs. The spatial characteristics of the school help to understand how children's developmental needs and behaviors are affected. In this direction, the aim of the study is to examine the effects of "atriums" on student behavior in school buildings with atrium. The main research question of the study questions the effect of the atrium on students' social interactions. Two different methods were used in the study: observation and space syntax analysis. In this context, spatial and social behavior data obtained from observation and syntactic data obtained from space syntax analysis were comparatively examined in the circulation areas around and outside the atrium. As a result, it was determined that atriums increased social interactions among students.

Keywords: Atrium, School, Behaviour, Student, Social Interaction, Space Syntax.

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1. Introduction

When looking at the relationship between people and space, it is possible to talk about a two-way interaction. Space configuration is a parameter that reveals the space with its concrete features in the context of this interaction. Hillier (1996), mentioned that space produces social encounters [1]. Spaces can have supportive or hindering features in people's behavior and interactions with each other. In this sense, school buildings consist of a spatial order in which students encounter, recognise or avoid each other, and increase or decrease their social interaction potential. Pollon (2009) stated that time spent at school allows the child to expand their interactions from child-parent and child-sibling relationships to child-teacher and child-friend relationships [2].

In the historical process, the architecture of school buildings has constantly changed depending on the education models of the period and continues to change today. Governments have developed new education models based on their policies, the conditions of the period and technology, and this has led to changes in educational structures. While the plan scheme of school buildings is generally shaped through a main corridor space and circulation core, spatial variations have emerged in terms of scale, function, plan and facade layout, and materials used in new building applications. One of these variations is the addition of an atrium component to the spatial organization

The secondary school level within the scope of the study is a critical stage where interaction between students occurs. In the field study, a secondary school building where children in the 7-12 age group, in which the concrete operations period begins according to Piaget's (2004) cognitive development theory was selected. In the current education system, secondary school level is a transition period between primary and high school in educational terms and includes the 10-14 age range. In this period when a fixed reference system is formed in the development of spatial perception and spatial locations can be perceived, children determine spatial routes in the environment they interact and spatial images of the environment begin to form in their minds. In this system of reference, the imaginary features of space are

based on visual classifications defined as "signs, projections, edges, regions, paths and boundaries" [3].

At this stage, the behaviors and social relationships that children develop during their free time or during their time spent outside the classroom are important in terms of their developmental needs [4]. Many studies have shown that factors such as child development, spatial configuration and free time have an impact on students' behavior, that students tend to spend time with their peers in their free time, and that this is important for their social development and learning performance [4; 5; 6; 7].

In order to draw the boundaries of the study, studies in which space syntax method was included in schools were also examined. Regarding the application of the method in the literature; it has been seen that studied in spatial and social organization issues [6; 7; 8; 9; 10] and academic performance issues [6; 11]. In addition, it has been determined that the majority of studies on buildings with atrium focus on environmental effects such as light, ventilation, heating, fire performance, etc. Apart from this, it has been observed that academic performance has been studied in school buildings [12], and the relationship between atrium and behavior has been discussed in other building types [9; 13; 14; 15; 16; 17].

Atrium, which is included in the scope of spatial void in literature, is the space used by covering the courtyards in order to protect them from natural conditions. Marriage (2012) stated that the atrium is an important factor in the physical and social encounters of users within the building [18]. According to Canter (1974), areas such as corridors and atriums that provide visual access in the plan layout facilitate perceptual access and provide greater perceptual access to the entire space [19].

In this context, since it is necessary to investigate the effects of the "void" factor on behavior in school buildings where the atrium is defined in the plan scheme, the aim of the study was determined as examining the spatial and social behaviors of students in a secondary school building with atrium through space syntax analysis. For this purpose, behavioral data and space syntax data were comparatively examined over the circulation areas around and outside the atrium. At the same time, preferred spatial and social behavior data were examined through the concept of social interaction within the scope of environmental and behavioral theories.

In summary, the comparison of the syntactic data, which are independent variables related to the space, and the behavioral data related to the students created a discussion environment regarding the spatial configuration of the school with atrium.

2. Theoretical Review

2.1. The Relationship Between Space and Behavior

Physical space and behavior are the two main components of the environment. The basic method of understanding the relationship between physical space and the individual can be obtained by examining the social organisation of the environment in question. According to Studer (1970), the physical environment created by an individual is a social system that defines individuals' behavior and their relationships with other social environments [20]. As for Gibson (1986) examined the characteristics of the environment and how it can contribute to interaction. What allows an individual to interact with their environment are the qualities of the physical environment that can cause behavior [21]. In this context, different environmental patterns support different behaviors; in other words, they support some behaviors while restricting others. Hillier (1996) also states that spatial configuration creates possible encounter and co-presence interactions [1].

In this sense, school structures consist of a spatial order where students meet, become aware of or avoid each other, and increase or decrease their social interaction potentials [1].

Many studies in the literature have shown that social interactions, peer relations and friendships are important factors in the development of children and especially young adolescents [4; 5; 22]. According to Young (1997), primary school students like plays that involve physical movement, while older children like to spend time and chat with their friends [23]. Clark and Uzzell (2002) investigated the spatial preferences of young adolescents in terms of privacy and social interaction, and their study concluded that school environments support both social interaction and withdrawal behavior in this age group [24].

In summary; the organization of social interactions in school environments can be evaluated in many different dimensions from a social and spatial perspective. For example, gender and age group differences are factors that affect social interaction arrangements. In terms of spatial factors, circulation areas (corridors, activity areas, entrances), classrooms, stairs and other spaces (wet areas, libraries, etc.), gardens as outdoor spaces or indoor and outdoor seating elements can appear as components that manage or limit social interaction opportunities, depending on their location within the plan. In addition, the time factor is another element that directs social interactions in schools. In this context, the secondary school structures included in the study constitute a field study where very rich data can be obtained in the context of social interaction, which is a requirement of children's developmental needs.

2.2. Spatial Voids and Atrium as a Component of Spatial Organization

The two main elements that constitute of spatial organization physically are spatial occupancies and voids. Spatial occupations define spaces with various functions, shaped in line with architectural programs and needs. In the definitions in the literature, void is stated as an element that makes space a space or creates space [25; 26]. While creating the space, the effect of emptiness can be put forward by designers with different arguments. Spatial voids are common areas in forms of courtyards, atriums, gallery spaces, terraces, balconies, etc. that serve a function such as circulation, passage, entrance, gathering or activity, and where the circulation core may also be located [27]. These spaces find a place for themselves in functional spatial organizations according to the function of the building.

Saxon (1983) analysed atriums and stated that the visual relationship and transitions established by the atrium enable the upper levels to be an extension of the ground floor. The atrium is a part of the spatial order and spatial relations as well as providing a field of vision. The physical components such as walls, columns, doors, railings, stairs, etc. planned around the atrium direct the user movements. Saxon (1983) suggests four main functions in atriums: cultural, economic, housing and settlement. When examined in terms of cultural function; in relation to human behavior, the atrium supports social activities such as watching someone, walking around, and chatting. He also defines atriums in school buildings as spaces that serve the purpose of gathering and circulation and functionally where students watch each other and support social activities [28].

Hillier (1996) mentioned that space produces social encounters. A space supports encounters between users through increased activity and a fluid circulation network. Atriums and their surroundings are also important areas that support social encounters in this sense [1].

When school environments are considered within the scope of the study; school building designs include social areas as well as learning environments. The learning process is also seen as a social process in which students actively participate and seek discussion and conversation with their peers. In this context, when associated with Saxon's (1983) definitions, atriums are spaces in educational buildings that serve the purpose of gathering and circulation, where students watch each other from a functional perspective and support social activities.

2.3. Space Syntax Aanalyses

Space syntax is one of the most influential scientific movements in the fields of architecture and urban design, as a set of techniques used to examine the spatial patterns of buildings and cities and a chain of theories that unite space and society [29]. This method,

which is based on behavior, social relations and spatial theory, generates data about buildings, cities and their spatial organization [1].

Space syntax theory was first developed by the research group led by Bill Hillier and Julianne Hanson at the Bartlett School, University College London and was put forward in their book titled "The Social Logic of Space", which they wrote about the characteristics of space and social relations. The theory of space syntax, described in the book “The Social Logic of Space” published in 1984, is based on the idea that the social structure that creates space can be inferred from the physical structure of space and that organizing spaces is actually about organizing behavioral relationships. With this theory, it is suggested that the social meanings of places can be best expressed through spatial relations [29].

According to Peponis, the space syntax method is a space reading method that creates evidence-based analyses in defining and expressing the relationships between spaces [30]. Spatial syntax is a method that reveals the relationship between the physical components of a space, such as surfaces, edges and paths that a person perceives as he/she moves in the space, and the relationship between the space as a whole and each other. The spatial syntax method, mathematically examines the extent to which spaces are visually perceived, their depth, their integration with each other, and their interconnectedness.

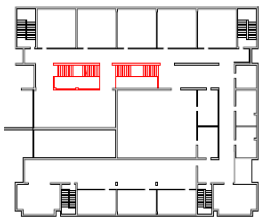
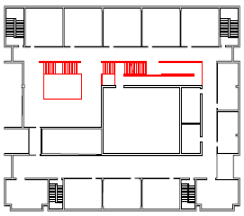
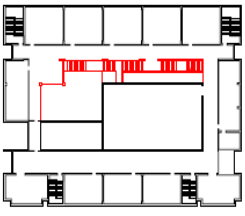
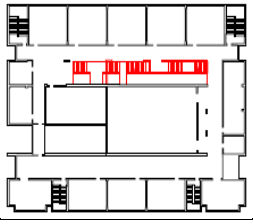
In space syntax theory, while the relationship between behavior and space is examined, the concept of movement is the determining factor in the context of users' interactions with each other and with the space. Norberg-Schulz (1965) argues that humans are at the center of space and that human movements affect orientations within space, and defines space with the components of void, boundary, movement and light [31]. Peponis (2001) stated that there are two important points on which space syntax is based; the first is human movements, and the second is the relational network established by the space [30]. In this context, the space syntax analysis method is considered important in the study to examine whether the "atrium" is a factor affecting student movement in a school structure with an atrium spatial structure. The syntactic parameters to be considered within the scope of the study are; isovist area, isovist perimeter, integration and connectivity values. These syntactic values will be used to determine the characteristic features of the space that are predicted to affect the levels of social interaction in spatial layout with atrium, such as visibility relations, mobility, depth/shallowness and accessibility.

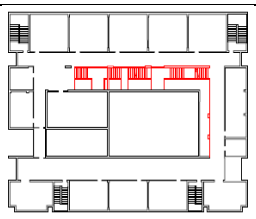
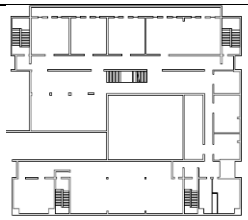
3. Material and Method

In recent years, school buildings that have been renovated due to earthquakes in our country, especially in Istanbul, are differentiated by the designs of out-of-class areas where students can socialize. These differentiations are especially seen in the new school buildings designed within the scope of ISMEP (Istanbul Seismic Risk Reduction and Emergency Preparedness Project) that include atriums in their spatial layout.

The school building considered within the scope of the study was chosen among the school buildings designed by Uygur Architecture, which were decided to be demolished and rebuilt within the scope of ISMEP (Istanbul Seismic Risk Mitigation and Emergency Preparedness Project). The Hacı Ethem Üktem Secondary School (2013) building included in the field study consists of a basement + ground floor + 4 normal floors, and the entrance, activity and corridor areas and classroom units are located around the atrium. In the interior has atrium spaces that are connected to the circulation areas on five floors, including the circulation core, as well as a garden and an open courtyard with an open sports field on two floors. From the atrium and its surroundings; visual relationships between floors can be established horizontally and vertically, and circulation and activities in the stairs and circulation areas can be monitored.

Table 1: Floor Plan Diagrams of Atriums in the Haci Ethem Uktem Secondary School (HEUO) Building

	
Ground Plan	1.Floor Plan
	
2. Floor Plan	3. Floor Plan

	
4. Floor Plan	Basement Floor Plan

Eeach part was divided into certain spatial locations and observation studies were carried out based on these locations. The areas around the atrium consist of locations where the circulation areas can establish a physical and visual relationship with the space, while the areas outside the atrium consist of locations where the circulation areas cannot establish a direct physical and visual relationship with the space.

The elements of these positional plan schemes are; the entrance area, corridors, the activity area associated with the corridor, and intermediate locations (in front of the window, niche, landing, passage and fire escape hall). In addition, since it was seen that the basement floor was used except for special occasions anda the gym was mostly used for lessons, this floor and this space were excluded from the evaluation.

In the field study, observation technique was used in order to examine the behaviours of the students in the space and their interactions with each other. Lang (1974) stated that the most productive technique for obtaining information about how people behave in the environment and how they experience it is the observation technique [32]. This technique involves recording the behaviour of users in the study area and converting it into data.

The observation, which constitutes the first stage of the analysis method, was carried out during a total of 8 break periods of 10 minutes each before and after noon for two school days on each floor during the second semester in the spring season (Table 2). In this context, the observation study was carried out in a total of 10 days on 5 floors in Haci Ethem Uktem Secondary School (HEUO) building by taking photographs together with the researcher (author) and three assistant architect observers. During the observation period, the behaviours and locations preferred by the students were recorded on the control sheet prepared beforehand together with their durations. In this way, behavioural data were obtained separately over the determined locations. Within each location;

- the spatial behaviour of the students was classified according to modes such as waiting/watching the surroundings, walking, and social interaction based on playing and chatting (sitting, standing),

- the social behaviours of the students were classified as individuality (Mode 1), group of 2 (Mode 2) relationships and forming a group of 3 or more people (Mode 3).

Table 2: Observation Technique Data Collection Period Chart

Observation Period		
2 Days		
Weekday	Before noon	After noon
Day 1	2 free times (20 minutes)	2 free times (20 minutes)
Day 2	2 free times (20 minutes)	2 free times (20 minutes)

In the second stage, the space syntax method was used, which allows analysis between different plan schemes. Using Syntax 2D software, the isovist area, isovist perimeter, integration, and connectivity values of the locations detected during the observation were obtained and these values were classified into two parts: around and outside the atrium and tabulated.

The evaluation and interpretation of the results obtained from all stages were carried out comparatively on the areas around and outside the atrium. Detailing spatial and social behaviors is important within the scope of the study in order to examine whether the atrium component in the selected school building affects social interactions.

3.1. Observation Study

When looking at the Haci Ethem Uktem Secondary School (HEUO) building, has a plan scheme in which the atrium is located in the center (corridors and other areas are arranged around the atrium); as a result of the observation analysis, it was found that 70.6% of the students preferred the atrium area and 29.3% preferred areas outside the atrium. When spatial behavior data are evaluated; while it was observed that the highest usage frequency around the atrium is to chatting behavior with a rate of 30.7%, %, it was also observed that the highest frequency outside the atrium is to stopping/watching behavior with a rate of 11.6%. It was found that the general frequency of use was higher around the atrium in all behavior types throughout the school (Table 3).

Table 3: Total Obtained Spatial Behavior Distribution Chart in Hacı Ethem Uktem Secondary School (HEUO) Building

HEUO	Whole School	%	Areas around the atrium	%	Areas outside the atrium	%
Waiting/watching	200	27,8	116	16,1	84	11,6
Chatting	301	41,9	221	30,7	80	11,1
Chatting while standing	242	33,7	182	25,3	60	8,3
Chatting while sitting	59	8,2	39	5,4	20	2,7
Walking	110	15,3	78	10,8	32	4,4
Playing	107	14,9	92	12,8	15	2
	718	100	507	70,6	211	29,3

When social behavior modes were evaluated, it was emerged that the highest behavioral mode of the students was 29.7% group of 2 (Mode 2) around the atrium and 21.8% individual behavior (Mode 1) in areas outside the atrium (Table 4).

Table 4: Total obtained social behavior distribution chart in Hacı Ethem Uktem Secondary School (HEUO) Building

HEUO	Whole School	%	Areas around the atrium	%	Areas outside the atrium	%
Mode 1	210	48,8	116	26,9	94	21,8
Mode 2	172	40	128	29,7	44	10,2
Mode 3	48	11,1	34	7,9	14	3,2

When we look at the percentage distribution graphs of spatial behavior data, it is seen that the most obvious behavior observed around the atrium is chatting behavior. Based on the observations, it was determined that the students were chatting in the atrium in a close friendship mode (Mode 2). When looking at the location maps; it is seen that there are the

entrance area and staircase surroundings (Z1a, Z1b, Z1c), corridor areas (Z1d, Z1e, K1d, K1e, K1f, K2d, K2de, K2f, K3d, K3de, K3f, K4d, K4de, K4f, K4g), activity areas (K1a, K1b, K1c, K2a, K2b, K3b, K4b) and landing locations (K2e, K3e) around the atrium.

In areas outside the atrium, students were generally observed standing in front of classroom doors (K1h, K2h, K3h, K4h) and windows in the corridors, and in the fire escape halls (ym) to watching the surroundings or chatting for short periods of time. It was determined that the behavior that occurred at the lowest rate outside the atrium was playing behavior.

Figure 1: Locations of Z1a (entrance area), Z1b, Z1c (staircase surroundings)

Figure 2: Locations of 1. Floor K1a, K1b (activity area)

Figure 3: Locations of 2. Floor K2a, 3.Floor K3b (activity area)

It is observed that students' social behaviors as well as their spatial behaviors differ. It was observed that the most dominant social behavior around the atrium was the close friendship mode (Mode 2), while in areas outside the atrium, the most dominant social behavior was individuality (Mode 1).

From all the data obtained, it was determined that the areas around the atrium were used effectively in terms of spatial and social behaviors. In this context, it is possible to say that the atrium in the Hacı Ethem Üktem Secondary School (HEÜO) building increases the social interaction levels of the students.

Table 5: Positional Plan Diagrams of Hacı Ethem Uktem Secondary School (HEUO) Building

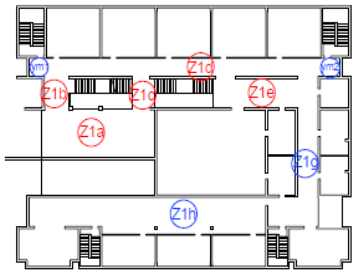
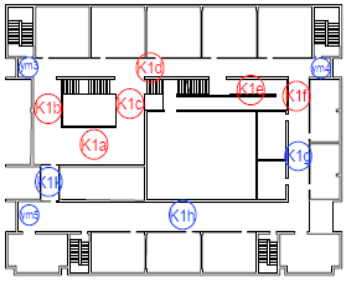
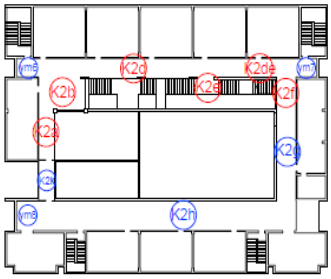
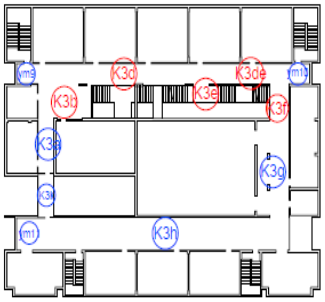
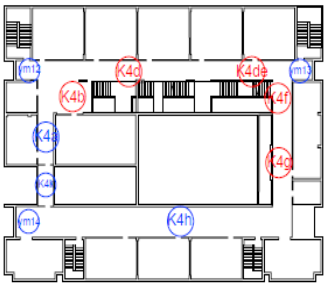
	**Ground Floor**
	Areas around the atrium
	Z1a (entrance), Z1b, Z1c (around the stairs), Z1d (classroom corridor), Z1e (entrance of sports hall)
	Areas outside the atrium
	Z1g (corridors), Z1h (classroom corridor)
	ym1, ym2 (fire escape hall)
	**1st Floor**
	Areas around the atrium
	K1a, K1b, K1c (activity area), K1d (classroom corridor), K1e (corridor), K1f (corridor)
	Areas outside the atrium
	K1g (corridor), K1h (classroom corridor)
	K1k (pass), ym3, ym4, ym5 (fire escape hall)

Table 6: Positional Plan Diagrams of Hacı Ethem Uktem Secondary School (HEUO) Building

	**2st Floor**
	Areas around the atrium
	K2a, K2b (activity area), K2d, K2de (classroom corridor), K2f (corridor), K2e (landing)
	Areas outside the atrium
	K2g (corridor), K2h (classroom corridor)
	K2k (pass), ym6, ym7, ym8 (fire escape hall)
	**3st Floor**
	Areas around the atrium
	K3b (activity area), K3d, K3de (classroom corridor), K3f (corridor), K3e (sahanlık)
	Areas outside the atrium
	K3a (corridor), K3g (corridor), K3h (classroom corridor)
	K3k (pass), ym9, ym10, ym11 (fire escape hall)
	**4st Floor**
	Areas around the atrium
	K4b (activity area), K4d, K4de (classroom corridor), K4f (corridor), K4g (corridor)
	Areas outside the atrium
	K3a (corridor), K4h (classroom corridor)
	K4k (pass), ym12, ym13,ym14 (fire escape hall)

	Waiting/watching		Chatting
	Playing		Walking

3.2. Space Syntax Study

In determining the relationship between the physical and social structure of the space, the spatial syntax method is used, and concepts such as isovist area and isovst area perimeter, integration, connectivity, depth, and centrality are analyzed through the numerical and graphical values obtained for the space.

The syntactic parameters to be considered within the scope of the research are isovist area, isovist perimeter, integration and connectivity values. These syntactic values will be used to identify the characteristic features of the space that are predicted to affect the levels of social interaction in the space, such as visibility relations, mobility, depth/shallowness, and accessibility.

In the school building where the field study was carried out, spatial syntax graphics of the floor plans were prepared using the Sytax 2D software. As mentioned in the previous section, spatial plan schemes were created around and outside the atrium on each floor. In the process of obtaining syntactic data; firstly, floor plans were divided into grids, and the syntactic values of each grid within the determined spatial locations were averaged and the syntactic values of the locations were calculated separately. By averaging these values, average syntactic values for the areas around and outside the atrium were obtained.

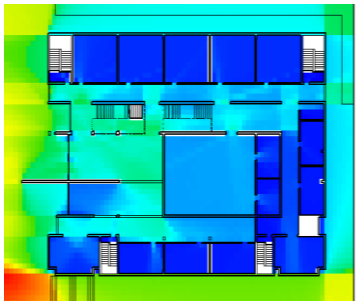
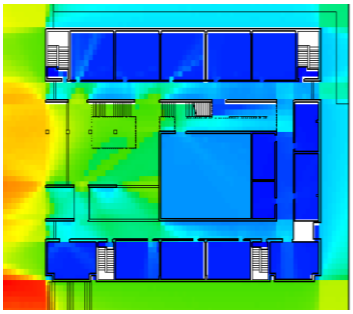
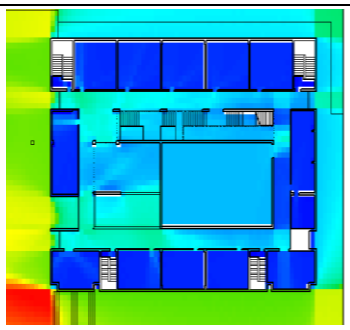
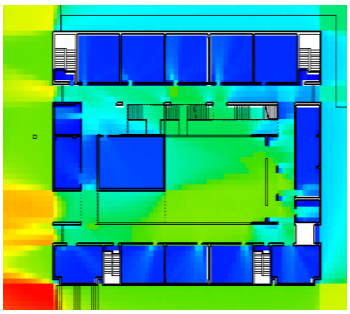
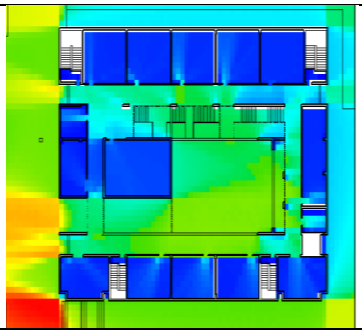
3.2.1. Haci Ethem Uktem Secondary School (HEUO) Building's Isovist Area Features

Since the field of view graphic is based on the visibility of the spatial components, it can be said that the most effective physical structural component in the selected school buildings is the atrium, which provides visibility. In the current situation, the atrium is separated from the circulation areas by a limiting structural element (dividing iron railing). This limitation physically divides the spaces, but its relationship with many spaces and floors continues visually.

In the isovist graphs; it can be read that the areas seen in red have high isovist area values, while the blue areas have lower visibility values. In this context, it is seen that the locations with the highest isovist area values are the locations related to the atrium and its surroundings, which are also prominent in the observation analyses, and the isovist area values decrease as one moves away from the atrium surroundings (Table 6).

It is seen that the locations with the highest isovist area values are activity areas (K1a, K1b, K1c, K2a, K2b, K3b, K4b), classroom corridors (K1d, K2d, K3d, K4d) and the landing on the 3rd floor (K3e). It has been observed that students prefer to chat and playing in groups and stay in these areas for long periods of time. Areas outside the atrium show lower values in terms of the isovist area value. It was observed that the classroom corridors (K3h, K4h) and fire escape entrance halls (ym1, ym3, ym11, ym14) have higher isovist area values. During the observations, it was observed that the students stood alone in these positions and watched the surroundings or had short conversations in a friendship mode.

Table 7: The isovist area graphs of the floor plans of the Haci Ethem Uktem Secondary School (HEUO) Building

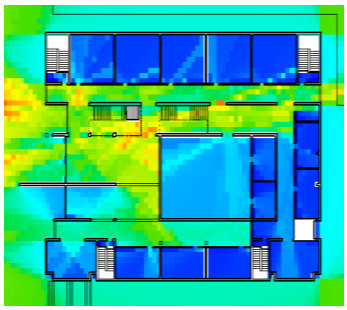
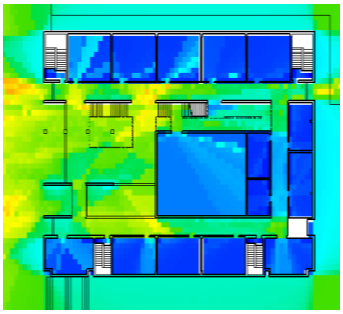
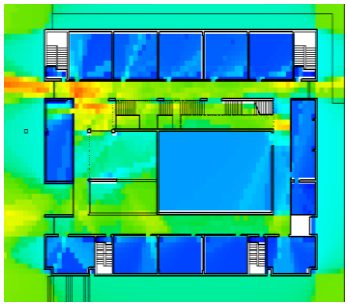
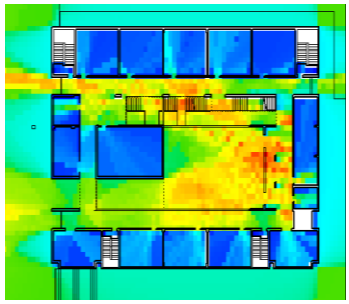
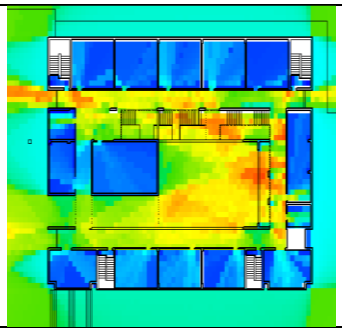
HEUO	
	
Ground Floor	1st Floor
	
2st Floor	3st Floor
	
4st Floor	

3.2.2. Haci Ethem Uktem Secondary School (HEUO) Building's Isovist Perimeter Features

Although graphical features with similar qualities to the isovist area are exhibited, the isovist perimeter shows us the length of the walls of the visible areas (Sarıberberoglu, 2018). When the isovist perimeter graphs are examined, the isovist perimeter value is higher in the areas around the atrium due to the longer perimeter length (Table 7). In this context, a high value of the isovist perimeter value means that visibility in the space is also high.

It is possible to say that isovist perimeter data increases, students' socialization potential increases and they spend more time in the area they are in. During the observations, it was observed that students mostly engaged in group of 2 relationships or group chatting or playing around the atrium. In the isovist perimeter graphs, areas outside the atrium show lower values in terms of isovist perimeter value.

Table 8: The isovist perimeter graphs of the floor plans of the Haci Ethem Uktem Secondary School (HEUO) Building

HEUO	
	
Ground Floor	1st Floor
	
2st Floor	3st Floor
	
4st Floor	

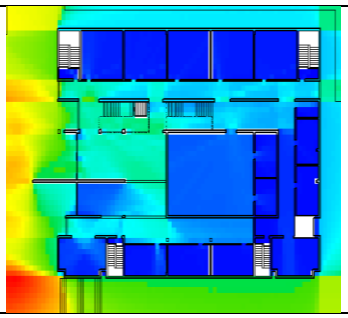
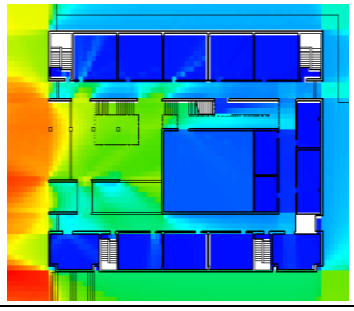
3.2.3. Haci Ethem Uktem Secondary School (HEUO) Building's Integration Features

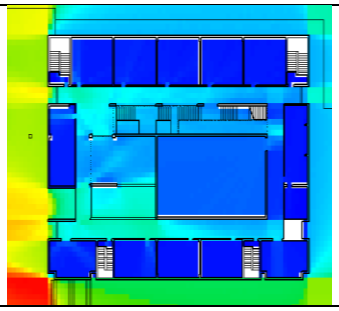
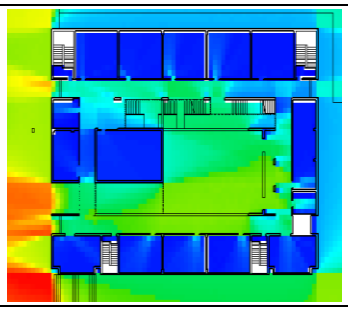
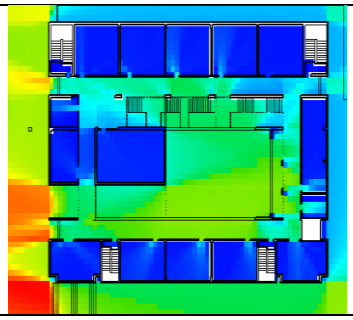
The integration value is important in determining social interaction as it affects the movement within the space and the level of encounter between individuals. This value expresses the depth/shallowness value of a space in relation to other spaces in the plan scheme. Shallow spaces with low depth and easy access increase the likelihood of individuals engaging in social interaction.

When the integration graphs are examined, it is seen that the locations with the highest integration values are the locations related to the atrium and its surroundings, and the values decrease as move away from the atrium surroundings (Table 8). This shows that the atrium is effective in increasing the integration values. When floor plans are evaluated as shallow (integrated) and deep spaces, the shallowest space components stand out as the areas around the atrium, while the deepest spaces stand out as the locations outside the atrium.

It is observed that the integration values are high in the activity areas around the stairs (Z1b) and atrium on the ground floor (K1a, K1b, K1c, K2a, K2b, K3b, K4b). In the observations, it was observed that students preferred the areas around atrium, which is described as shallow and has a high integration value. Areas outside the atrium show lower values in terms of integration value. It is observed that the integration values increase in the classroom corridors (K1h, K3h, K4h) and fire escape entrance halls. During the observations, it was observed that they stood alone in these locations and watched the surroundings or had a short chat in group of 2 relationships.

Table 9: The integration graphs of the floor plans of the Haci Ethem Uktem Secondary School (HEUO) Building

HEUO	
	
Ground Floor	1st Floor

	
2st Floor	3st Floor
	
4st Floor	

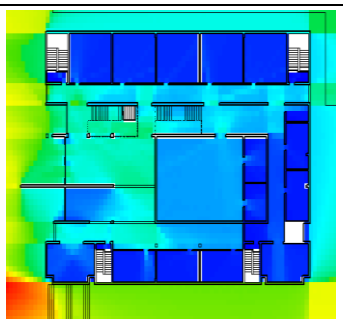
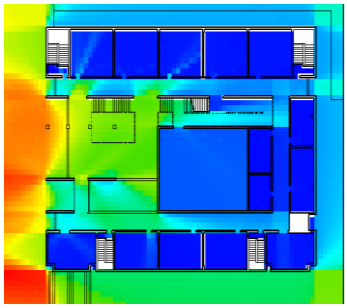
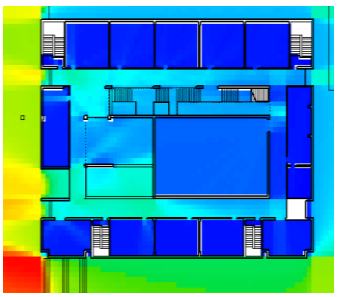
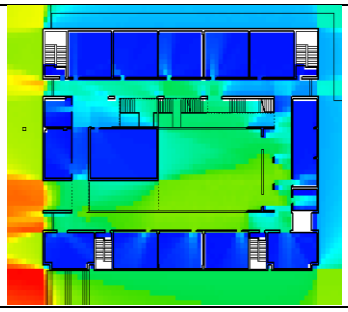
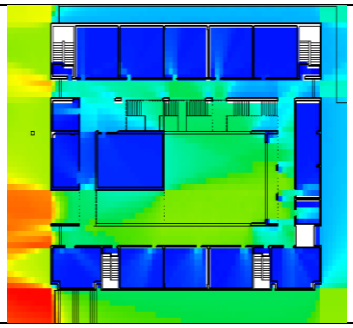
3.2.4. Haci Ethem Uktem Secondary School (HEUO) Building's Connectivity Features

The connectivity is the value that highlights the connection value of a space with other spaces. A situation similar to the distribution of integration values is observed in the connectivity graphs obtained from the floor plans.

When the connectivity graphs are examined, it is seen that the connectivity values increase at the points where the space is connected to the classroom corridors (K2d, K3d, K4d) and activity areas (K1b, K1c, K2b) and at the landing (K3e) location in the HEUO building. In the observations, it was observed that students preferred to chat in pairs or in groups, play or walk around, and stay in these areas for long periods of time in these locations associated with the atrium. Areas outside the atrium show lower values in terms of connectivity. It is observed that connectivity increases in the classroom corridors (K1h, K2h, K3h, K4h) and fire escape entrance halls. During the observations, it was observed that students came together in these locations for short periods of time (Table 9).

When the connectivity graphs are considered holistically, it is seen that the prominent locations in terms of connectivity are related to the atrium that direct entry-exit interactions, encounters between students and mobility. The high connectivity values around the atrium cause these areas to be used with high interaction by students.

Table 10: The connectivity graphs of the floor plans of the Haci Ethem Uktem Secondary School (HEUO) Building

HEUO	
	
Ground Floor	1st Floor
	
2st Floor	3st Floor
	
4st Floor	

4. Conclusion

In this study, the spatial and social behaviors of students in a secondary school building with an atrium were analyzed by observation and space syntax analysis methods. The behavioral data and space syntax data obtained in the study were comparatively examined over the circulation areas around and outside the atrium. At the same time, the preferred spatial and social behavior data were evaluated through the concept of social interaction within the scope of environmental and behavioral theories. In this context, the comparison of the syntactic data which are independent variables related to the space, and the behavioral data related to the

students created a discussion environment regarding the spatial configuration of the school with atrium. In this sense, the study is important in terms of determining the behavioral effects of the spatial layout with atrium on the students.

As a result of the observation study, the atrium emerged as the physical structure component that affects and directs the students' behavior, desires and needs. From the data obtained, it was observed that the atrium and its surroundings were used effectively in terms of spatial and social behaviors, and that these areas were the areas with the highest frequency of use, where students could see each other, contact and chat. When behavioral data regarding areas outside the atrium were examined, it was observed that usage frequencies decreased as they moved away from the atrium and its surroundings, students avoided social interactions, and tended towards more individual behaviors.

In spatial syntax analysis studies, the locations determined by observation analysis around and outside the atrium were taken as basis and the values of the isovist area, isovist perimeter, integration and connectivity of these locations were obtained and recorded in the control sheets. As a result of the analysis, it is seen that all spatial syntax values increase in the areas around the atrium.

Table 11: Comparison of average spatial arrangement values in areas around and outside the atrium of Haci Ethem Uktem Secondary School (HEUO) Building

HEUO	Isovist Area	Isovist Perimeter	Integration	Connectivity
Areas around the atrium	3855150.63	27324.13	1731718.32	677.59
Areas outside the atrium	3508013.73	22539.6	1625333.48	631.48

The isovist area value represents the visible areas on the plan scheme. Since the atrium allows visual relationships between floors and spaces, it creates visible areas in the interior. In the Hacı Ethem Uktem Secondary School (HEUO) building, the arrangement of corridors and other areas around the atrium increases the width of the field of view by ensuring that the visible areas are distributed throughout the entire floor in the interior. In this context, the highest field of isovist area values also occur in the locations around the atrium.

When the isovist perimeter values are examined, it is seen that the highest values are around the atrium. Because the surface lengths of the areas around the atrium are longer, the isovist perimeter value was higher in these areas. When the integration value is examined,

atriums have emerged as areas with high integration, as the integration value directly affects the mobility and encounter levels within the space. When evaluated in terms of connectivity, providing access to many spaces around the atrium increases the connectivity value and increases the level of interaction in these areas.

When all the data obtained as a result of the observation study and space syntax analysis studies are examined; it is possible to say that it provides students with a wide viewing angle in the interior, makes spatial relationships and access between spaces visible, and the visible areas emerging around the atrium act as a meeting point, increasing the potential for social interaction.

Considering the physical and psychosocial needs of children in this age period, it was determined in the study that interactions and needs regarding student behavior differed in the areas around and outside the atrium. Active interactions such as coming together in pairs or groups, playing and chatting were observed around the atrium, where student mobility was high. It can also be said that the high level of visibility in these areas has an impact on the length of time students spend.

In areas away from the atrium, it was observed that students moved individually and personal distances were created among themselves. In line with this data, it is seen that in a spatial order where visual interaction is disconnected, the relationships that students establish with the space and with each other are restricted, and the atrium determines the levels of social relationships between students.

With this study, social interaction emerged as one of the basic needs of students in school buildings. Considering the importance of visual contact for social interaction, solutions that do not limit the visual area are important for the social interaction opportunities of spaces. In addition, the design of the atrium component and its spatial relationship with the circulation areas is also an important design input in the planning of school buildings with atriums, a result that emerged within the scope of the study.

The results obtained in the study are important in that they provide clues that areas where students can interact in school buildings should be supported by designs that allow for visual interaction, such as atriums. Determining the level of relationship between the atrium and social interaction will guide the examination of the designs of existing school buildings and the designs of future school buildings. In addition, it is thought that the study will contribute to the literature in the context of environmental behavior studies through the relationship model established between spatial configuration with atrium and behavior

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