P-ISSN 2664-0422	Pakistan Social Sciences Review	October-Dec 2024, Vol. 8, No. 4
O-ISSN 2664-0430	https://doi.org/10.35484/pssr.2024(8-IV)39	[494-508]

Pakistan Social Sciences Review
www.pssr.org.pk

RESEARCH PAPER

Inquiring about The Relationship between Spatial Design and the student's Behavior in the Department of Architecture Using Space Syntax

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ABSTRACT

The spatial Configuration of any building significantly affects occupants' interaction with one another; correspondingly, the spatial layout of the University's departments impacts students' social behavior. The objective of this research is to explain how spatial design relates to transgression. A review of the literature indicates that University students are prone to transgression, and less controlled areas, as well as highly deep spaces, are among the causes. This article uses Space Syntax as a conceptual framework theory, a tool for comprehending the connection between space and students' community behavior, and examines the Department's spatial layout to highlight the spatial issues. A graph and the DepthmapX applications of the space syntax are used to find the connectivity and controllability of spaces. The investigation reveals that less controlled areas, as well as highly deep spaces in the Department, are prone to transgression. It is recommended to increase the controllability of the deeper spaces to avoid transgression.

KEYWORDS Community Behavior, Controllability, Space Syntax, Spatial Configuration

Introduction

The built environment has a significant impact on people's social Behavior. By default, the space as the principal canvas assumes the role of an instructor. The layout of a space directs its spaces to act in ways that respond to people and the environs (Waqas et al.,2021). Winston Churchill's famous quote from 1943, "We shape our buildings, and then our buildings shape us" (cited in Winslow, 2016), highlights the significance of the built environment to user behavior. Demirbas (2007) outlines this phenomenon in the words that the physical surroundings and environment impact a person's Behavior. The University is a built environment where people live together, offers a cooperative living practice, and serves as both a learning center and a varied social institute. In other words, the learning environment serves as a channel for communication, and information is disseminated through the spaces (Demirbaş, 1997). The Department's spatial planning impacts students' social lives and academic progress (Zaman et al.,2021). Since students spend a substantial amount of their adult lives in universities, the main goal of the campus building is to educate and equip students with the skills they need to meet life's difficulties by encouraging learning and community behaviors. In the context of the educational built environment, space is not only meant to provide a setting for flexible learning but also to facilitate, support, and ignite social communication among the learners (Fouad & Sailer,2017).

The idea of community interaction in a spatial context is very closely tied to the educational process. The integration of community behavior among the students depends critically on the socio-behavioral characteristics of the spatial setting of any space. Actors, environment, synomorphy, and time are the four components of Barker and Gump's thesis (1964) that define the space for an activity's appropriateness (Brown, 2004). Therefore, proper spatial settings will provide an environment in the Department to afford actors/students to interact. Suitable Spaces for Socialization enhance the confidence and self-esteem of the students. Most young students adopt wrong social behaviors to overcome shyness and to look smarter (Cepulkauskaite, 1998). The research conducted by Kauffman and colleagues (1997) and by Çırakoğlu & Işın (2005), revealed that social environment is among the causes of addiction in university students. In addition, the research of Newcomb and colleagues (1986) confirms that lack of social conformity is among the reasons for transgression among university students.

Transgression is the term for breaking laws without permission. It is in our "recalcitrant" nature to not be denied pleasure since people are prone to rebel against social limitations on them (Crawford, 1999). Young people are often more likely to transgress (do something wrong or go against the rules and laws) (Cambridge University Press & Assessment, n.d). The importance of university life for students is that they spend a significant amount of their adult years in the university's physical environment(Yaseen et al,2022). Numerous academic studies have been conducted on students' transgressions during their academic years(Peltzer et al.,2002; Young et al., 2002; Olley, 2008; Deressa & Azazh, 2011; Steyl & Phillips,2011). The built environment and spatial arrangement of the university(Nasar et al., 1993), in addition to sociodemographics, religion, and academic success, are major factors in students' transgression of the rules (Peltzer et al.,2002). If the working and learning settings are supportive, interesting, and provide the required behavioral elements then productivity, and educational quality will rise (Demirbaş, 1997; Sanoff, 1993).

Literature Review

In academic settings, students typically have two sorts of experiences: one that is formal and is defined by educational standards, and another that is spatial and results from encounters that are influenced by the physical arrangement of buildings. As a result of the interaction between education delivery and social cohesiveness, education is a process of socialization that not only shows the education system but also influences how socialization takes place in space (Peatross & Peponis, 1995). Students who are enrolled in University experience independence and freedom from direct family supervision during this time. They also share accommodation with strangers, experience new social groups, and may be exposed to accepted norms valued by the younger generations that differ from parenting practices (Steyl & Phillips,2011). University students go from a restricted life under parental supervision to a more independent life offered by the built and social environment of the University (Olley, 2008). The controllability of spaces is more important on university campuses since people aged 18-29 are more prone to abuse and addiction (Young et al., 2002). This trend of abuse and addiction in university students is more prevalent in developing countries where environments might favor it (Babalola, et al, 2013; Deressa & Azazh, 2011).

Planners and architects are becoming more aware of the intricate and dynamic links between physical space and its social and psychological components (Madanipour, 1996). A great scholarship covers the relationship between the built environment and the fear of inappropriate social conduct and crime (Long & Baran,2006; Pain, 2000: Nasar et al., 1993; Poyner,1983). According to Vrij and Winkel (1991), quiet and isolated places can be dangerous. Similarly, according to Nasar and Fisher (1992), The fear of crime or an actual crime is a severe issue on university campuses. They discuss architectural clues that may influence the fear of crime and found it by several site-specific indications through the study of answers to open-ended questions, featuring alarming visuals for pedestrians due to inadequate lighting, a narrow evasion for the bystander, and cover for the perpetrator

. According to their findings, micro-level spatial configurations may be used to reduce crime on campus. Correspondingly, Oc and Tiesdell (1999) identified easily accessible and proper monitoring among the Key features of making a safe built environment. In addition, Cozens and Sun (2018), in their study about exploring crime prevention at an Australian university campus, found that the unsafe places were often associated with inadequate options for natural surveillance, in addition to diminished "prospect" and elevated "refuge" levels.

According to site audits and survey responses of Cozens and Sun's research, safe areas consistently had higher levels of surveillance and lower levels of shelter and concealment.

Researchers have also attempted to investigate how fear in various situations is affected by apparent social controls or their absence. Visible incivilities and low-level crimes are transgressions due to low social control (Greenberg, 1986; Lewis and Salem, 1986). Similarly, It has been discovered that altering the layout and removing concealments and impediments for better visibility might make a place appear safer. (Appleton, 1975; Nasar and Jones,1992). Lately, Hillier and Hanson (1984) used the space syntax methodology to investigate the connection between the occurrence of criminal occurrences and spatial Configuration. Similarly, Nubani & Wineman (2005) have acknowledged the relationship between space and crime using space syntax.

This study uses space syntax too, to analyze the spatial Configuration of the case study. If space is understood through an analysis of its configurational aspects, a connection might be built between space and the final users of the Design (Karimi, 2012). Therefore, In the academic setting, this study focuses on the relationships between the built environment, spatial structure, and its occupants' community behavior. By bridging knowledge gaps and raising awareness of the relationships among spatial design, the social organization of learning, and community behavior, this research intends to expand knowledge. Keeping this in mind, the objective of this research is to appreciate the relationship between community behaviors and the built environment.

Methodology

The "space syntax" refers to a collection of methods for evaluating the functional consequences of architectural and urban settings (Hillier,2007). It is essentially a creative depiction of human space and its practical results, conceptual knowledge of the space, and how it functions as a component of society (Unlu et al.,2001). In recent years, the Space syntax methodology has grown tremendously. It is used to analyze the areas of transportation, land use, and human interaction with the environment, as well as urban Design for spatial analysis (Penn and Turner, 2004; Karimi, 2012; Dettlaff, 2014). In many dimensions, from buildings and neighborhoods to urban areas and entire regions, space syntax is used by many researchers, academicians, practicing architects, and urban planners. Similarly, space syntactic theory has grown to be a crucial component of education across the globe (Jones,2005).

In this paper, two applications, A graph, and DepthmapX are used to analyze the spatial Configuration of the case study site. While designing, it's critical to consider how the space will be used. Space syntax helps to determine spatial Configuration, which is a relation that takes into account other relations in addition to being a connection. With the help of 'A graph' application of space syntax, two different layouts are possible if we graph the pattern from two places on the same structure. One can be deeper or more integrated, while the other can be shallower or more segregated. Each space can be evaluated critically to determine whether it is integrated or segregated according to the user's needs. It is done by comparing the depth of each space within the various buildings. On an urban scale, it can be of great help to examine the structure regarding its surroundings, and similarly, its interior Design can be examined at a micro level (Karimi, 2012).

The analysis through space syntax allows the analyzer to examine any structure or space's function and integration value (Zaman et al.,2021). This value of integration in turn illustrates the social significance of the space. For illustration, in this research, two different interaction sites are chosen from a typical plan. Both interaction sites are utilized and tested using the depth map X tool, depending on the requirement for interaction and connection. Two types of relationships; deeper and more interwoven and dispersed and isolated, are revealed, making the analysis more objective rather than subjective

Case Study

The plan from the architecture department at COMSATS University Islamabad has been chosen to research how spatial design influences students' socializing and how space syntax aids in our investigation of the entire process. Easily obtainable web software, A Graph, and DepthmapX is used to evaluate the layout. It provides us with a clear illustration of the numerous outputs that may be further examined in light of the obtained data. The Department of Architecture was established in COMSATS almost 15 years ago. The Department is located on the 4th floor of Faculty Block 2 at CUI Islamabad Campus. The Department comprises studios, a lecture hall, a computer lab, faculty offices, and administration areas. The department shares its space with the Department of Art and Design too. Therefore, it is a bit tricky to keep control over students. Students usually use elevators to climb the floors; therefore, the lift lobby is the central crush space or space for informal socializing. The building does not cater to specialized spaces for socializing. Usually, corridor spaces are used by the students for informal socialization. Thus, the corridors leading to studios and lecture halls have become spaces to socialize. Two staircases at both ends of the building serve as emergency exits. Since the Department is located on the 4th floor, those staircases are rarely used and have become spaces for students' gathering and informal interaction.

Appreciation Of Spatial Layout of The Architecture Department

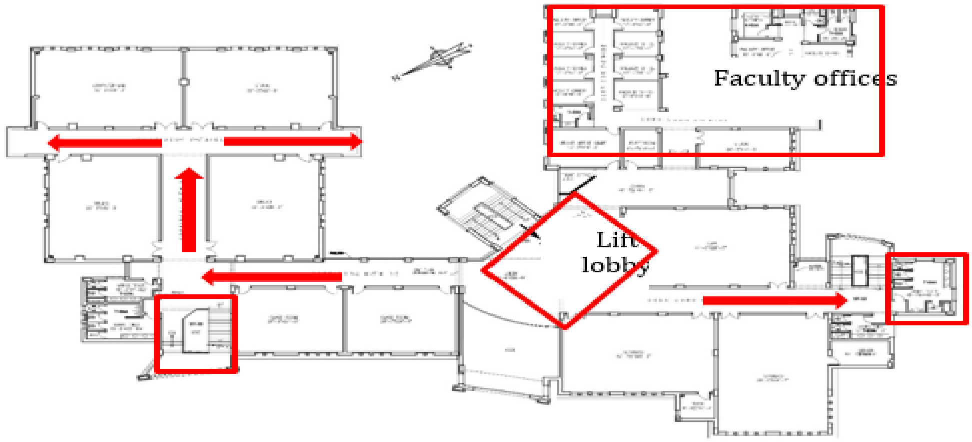

Figure 1 Architecture Department Layout

Fig 1 shows the layout of the Department of Architecture at COMSATS University Islamabad. Circulation is clear from the lift lobby. The emergency exits are located at both ends along with gents' toilets on the right and ladies toilets on the left. The four studios on the left are off from the central circulation. The corridor leading to the studios on the upper left is visually inaccessible from the main lobby/circulation area. This corridor is named Corridor 1B(31) during analysis, and it leads to dead end 1 and dead end 2(34&35). Similarly, the emergency exits are not visually in line with the main lobby. Students usually use the emergency staircases for informal interaction as well as the corridor spaces.

Results and Discussion

Based on the literature review in the Introduction section, students in Universities need uninformed checks and vigilance. Therefore, it is essential to design socialization spaces with high controllability and less depth. The analysis of such paces in the Department of Architecture is made using space syntax in two stages.

Analysis Using A-Graph (Step depth)

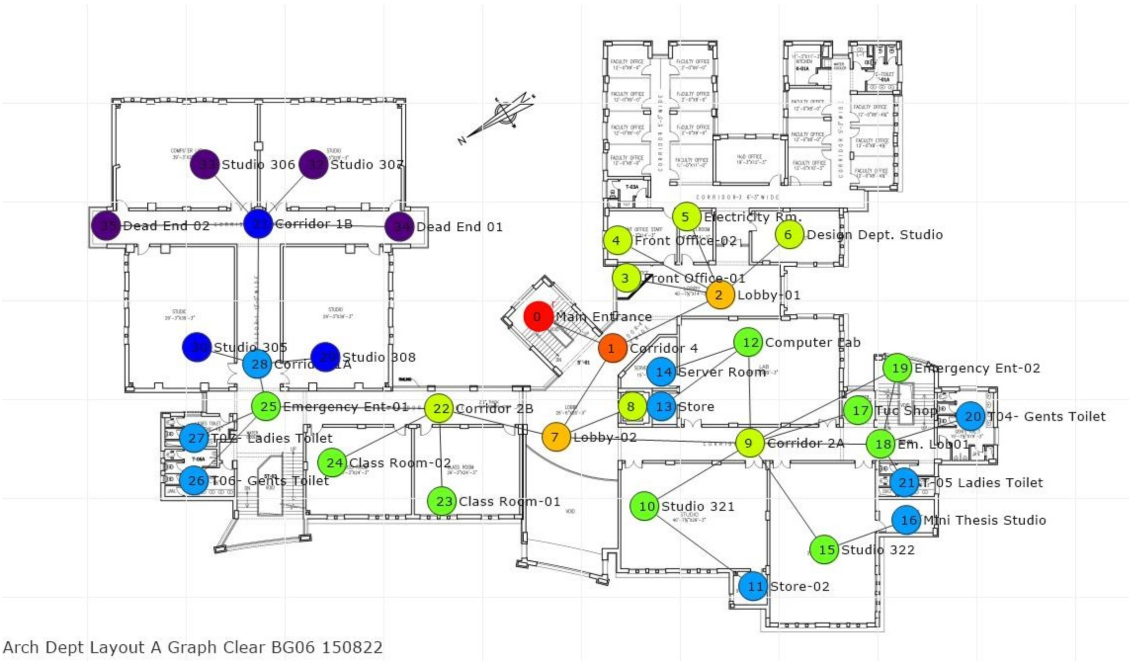

Figure 2 Step depth analysis through A Graph

Step depth analysis displays the gap and visibility between each place. 'It is also known as point depth and denotes the shortest path from a certain section to all other sections within the arrangement, and the path length is documented in the section' (Turner,2004). The software shows step depth from this point as we move the cursor on the graph, as the point is indicated here by an arrow. Step 1 denotes visible, and Step 2 represents indirectly observable. Additionally, it is depicted using color codes, with blue denoting the highest value and orange the lowest depth (Fig 2). Depth tree using A Graph s hows the similar results with orange and yellow denoting the crush spaces to the dark blues with a maximum depth(Fig3)

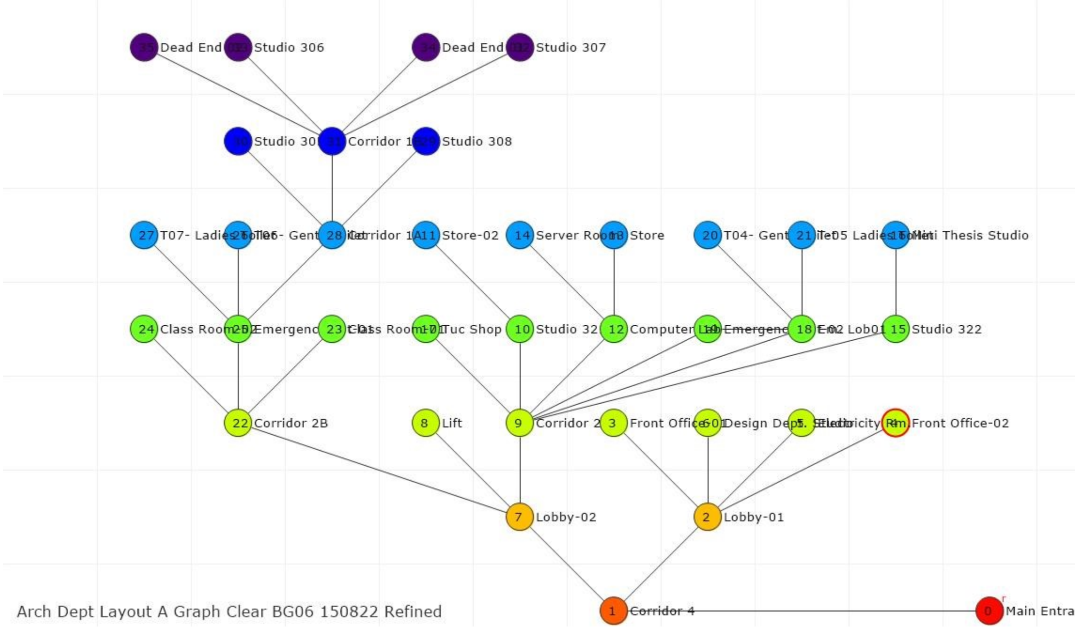

Fig 3. Step depth tree through A Graph

Maximum depth represented with dark blue in Fig 2 & 3 means the spaces with minimum direct access and control.

Integration

Integration means how one space is linked to the other space. The degree to which a region is connected, Siregar (2014) claimed that it is important to understand the degree of space interaction by considering the space's integrity (Navastara, et al, 2018). The depth and number of integrations it has with other spaces are indicated by the color codes with orange as highly integrated to blue with the lowest linkages value In this instance, the Department's lift lobby is the area that is most connected to all other areas, such as studios, etc.

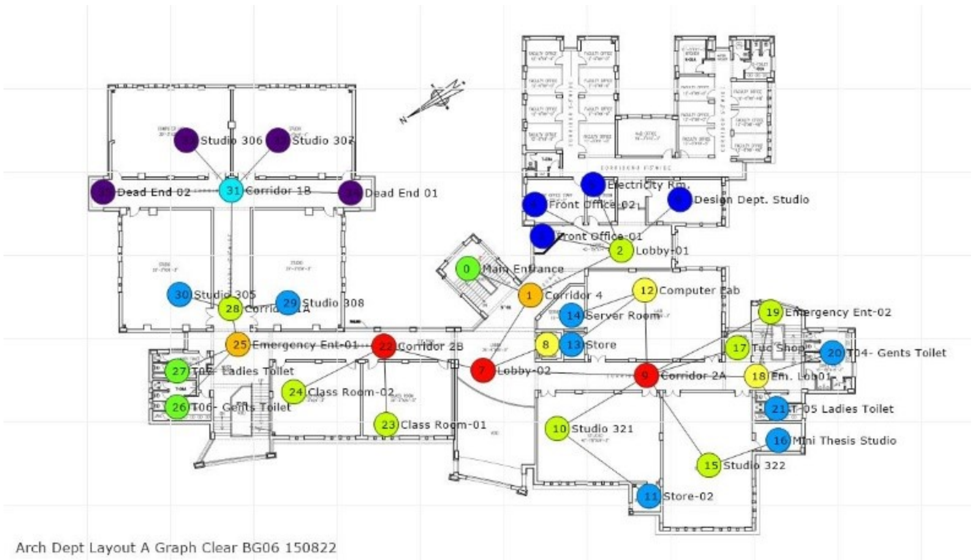

Figure 4: A-Graph Integration Reactive

Table 1
A-Graph values of different spaces in the Department

	Spaces	TDn	MDn	RA	i	CV
0	Main Entrance	153	4.37	0.19	5.04	0.33
1	Corridor 4	119	3.4	0.14	7.08	1.45
2	Lobby-01	145	4.14	0.18	5.4	4.33
3	Front Office-01	179	5.11	0.24	4.13	0.2
4	Front Office-02	179	5.11	0.24	4.13	0.2
5	Electricity Rm.	179	5.11	0.24	4.13	0.2
6	Design Dept. Studio	179	5.11	0.24	4.13	0.2
7	Lobby-02	97	2.77	0.1	9.59	1.72
8	Lift	131	3.74	0.16	6.19	0.25
9	Corridor 2A	107	3.05	0.12	8.26	3.33
10	Studio 321	139	3.97	0.17	5.72	1.14
11	Store-02	173	4.94	0.23	4.31	0.5
12	Computer Lab	137	3.91	0.17	5.83	2.14
13	Store	171	4.88	0.22	4.37	0.33
14	Server Room	171	4.88	0.22	4.37	0.33
15	Studio 322	139	3.97	0.17	5.72	1.14
16	Mini Thesis Studio	173	4.94	0.23	4.31	0.5
17	Tuc Shop	141	4.02	0.17	5.61	0.14
18	Em. Lob01	136	3.88	0.16	5.89	2.64
19	Emergency Ent-02	138	3.94	0.17	5.77	0.39
20	T04- Gents Toilet	170	4.85	0.22	4.4	0.25
21	T-05 Ladies Toilet	170	4.85	0.22	4.4	0.25
22	Corridor 2B	105	3	0.11	8.5	2.5
23	Class Room-01	139	3.97	0.17	5.72	0.25
24	Class Room-02	139	3.97	0.17	5.72	0.25
25	Emergency Ent-01	119	3.4	0.14	7.08	2.5
26	T06- Gents Toilet	153	4.37	0.19	5.04	0.25
27	T07- Ladies Toilet	153	4.37	0.19	5.04	0.25
28	Corridor 1A	139	3.97	0.17	5.72	2.45
29	Studio 308	173	4.94	0.23	4.31	0.25
30	Studio 305	173	4.94	0.23	4.31	0.25
31	Corridor 1B	165	4.71	0.21	4.57	4.25
32	Studio 307	199	5.68	0.27	3.62	0.2
33	Studio 306	199	5.68	0.27	3.62	0.2
34	Dead End 01	199	5.68	0.27	3.62	0.2
35	Dead End 02	199	5.68	0.27	3.62	0.2
	Min	97	2.77	0.1	3.62	0.14
	Mean	155	4.42	0.2	5.26	1
	Max	199	5.68	0.27	9.59	4.33

Where TD =Total Depth

MD =mean depth

RA=Relative

I = Integration

CV =Control Value

Analysis Using DepthmapX

VG is carried out using the DepthmapX program. Braaksma and Cook were the first to use visibility graph analysis (VGA) to architectural environments (1980) and lately Turner (2001) used Depthmap. It allows us to see how the space is laid out from different angles (Lang,1987). As indicated in the picture(Fig 5), different colors indicate how many other places are visible from this spot, ranging from blue (low visibility) to red/orange (to high visibility).

VGA Analysis

Fig 5. Visibility Graph

The DepthmapX software also generates Visibility Graph Analysis, which reflects the visibility of different spaces from a certain marked place. Color-coded viewing angles from various points inside the Department have been shown in Figure 6. various viewing locations have been assigned distinct codes to indicate their viewing depth. Here again color coding from orange to blue shows maximum visibility to minimum visibility respectively.

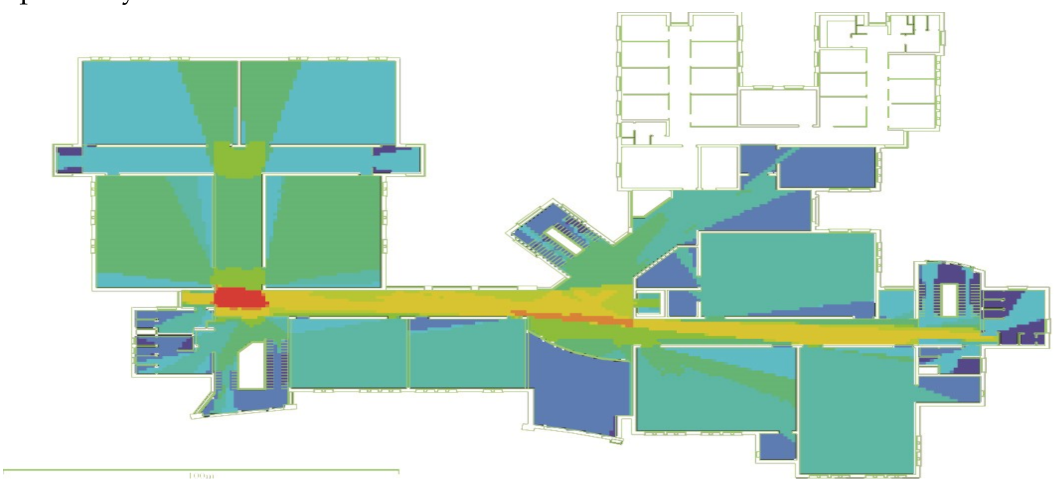

Fig 6 Visibility Graph Analysis color

Integration using DepthmapX

Maximum integrated space, revealed by Depthmap X, in the Department, is indicated by orange color. The color coding exposes the maximum to integrated ranging from orange to blue respectively. The results with A Graph and Depthmap X are almost the same with dead ends 1& 2 and as least integrated spaces

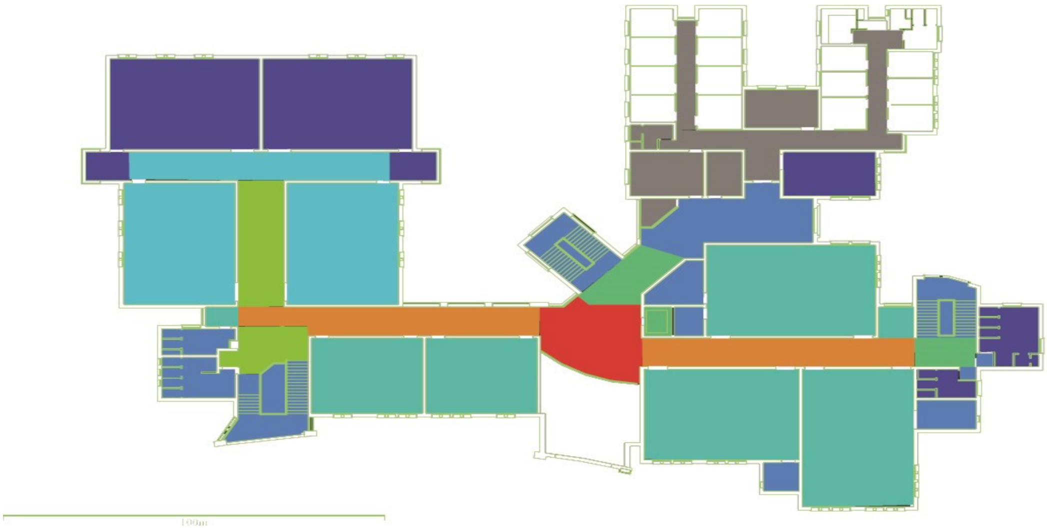

Fig 7 Integration of spaces using DepthmapX

Discussion

Any space's social and configurational characteristics are no longer the secondary components in defining the overall students' learning; instead, they are the key determinants of the student's learning and development achievements. The arrangement of the built environment and opportunities for social contact both play essential roles in learning, which may be argued to occur in any setting other than classrooms (Zaman et al.,2021). The above study carried out through different steps of the analyses offers numerous hints about the design effectiveness of the Department's layout plan. As a result, the outcomes of this case study are now being discussed in light of the findings.

Fig 2 &3 shows the depth of spaces in the Department through A-Graph analysis. Color Dark blue in these figures shows the space is at maximum depth. It means the user of the space has to pass through maximum spaces to reach the dark blue space. One-step depth indicates the separation of two spaces that are directly connected, while two steps depth indicates the separation of spaces A and B, where one piece of intermediate space must be traversed and so on(Navastara, et al, 2018).It is found that studios 306 and 307 along with dead ends 1 and 2 are at maximum depth. Fig 8 endorses the findings of A-Graph analysis in figs 2 &3.

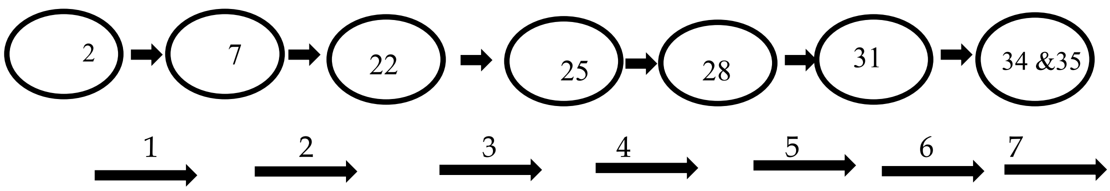

Fig 8: spaces with maximum step depth in the Department of Architecture

Where

2=Lobby1, 7= Lobby 2, 22= Corridor 2B, 25=Emergency Entrance 1,

28= Corridor 1A, 31=Corridor 1B, 34&35= Dead Ends

The above-mentioned spaces with high depth show the least integration in Fig 4 and the same is reflected through the values in table 1.

In comparison, the control value of the spaces (34 &35) is the lowest according to table1. In a visually controlled space observing individuals can quickly see what people are doing without having any trouble doing so and vice versa (Long & Baran, 2006). This finding of Long & Bran is truly represented through an A-Graph analysis of the Architecture Department. These spaces are identified as problematic since less degree of control leads to crime. Similarly, spaces with less integration are more prone to crime (Long & Baran, 2006). Likewise, it has been established that removing concealment and barriers for better visibility can make a place feel safer. (Appleton, 1975; Nasar and Jones,1992). A place appears safer when it is more visible (Appleton, 1975; Nasar and Jones,1992), since there are more opportunities for surveillance that is among 6 CPTED points. spatial Planning,and designing and architecture can all have an impact on the potential for monitoring, which can be seen as capable management that reduces crime. Offenders may be reluctant to commit crimes if they believe they might be observed (Crowe, 2000.P.46). Transgression caused by a lack of social surveillance includes both obvious transgressions and low-level crimes. (Lewis and Salem, 1986; Greenberg, 1986)

Fig 5 &6 shows the Visibility graph and its analysis through the use of Depthmap X. It is revealed through the colors that dead ends 1 &2 and parts of emergency exits show the most negligible visibility. Orange color depicts the maximum visibility that is the lobby space and corridors, while blue shows the minimum visibility that reaches its height at dead ends and in emergency exits. Fig 7 shows the integration between the spaces in the Department of Architecture. The lift lobby is the most integrated space with orange color, whereas studios 6&7 and the dead ends are in blue, depicting the least connection. Moreover, the staircases show less integration. For public places, connectivity is vital as Trancik (1991) has introduced 2 major behavioral setting categories that are widely observed at the city level as well in Architectural settings: "place" and "connection.". If a space has poor integration or weak connection with the rest of the building, it might lead to transgression since alienation causes a high crime rate and transgression (Jencks, 1977, p.9). Hall (1969), put it in terms of sociopetal and sociofugal spaces. The former type generates sociability while the latter causes alienation in society. Therefore the least connected or alienated spaces are likely to generate transgression because the layout of a space directs its spaces to act in ways that respond to people and environs (Waqas et al., 2021)

Perhaps these results can be related to the effects of 'eyes on the street' by Jacob (1961). Under conditions of high connectivity ('eyes on the street'), crime is lower, while crime is higher under conditions of low connectivity. Since high connectivity generates a high concentration of users in a public place. Rapoport (1990) states that a place also communicates messages to a user based on their interaction. Therefore, high levels of connectivity are associated with lower crime levels (Nubani & Wineman (2005).

The above analysis discussion reveals that emergency exit staircases, studios 6 &7, and dead-end corridors are the most problematic areas with maximum depth and least integration. Therefore, it is recommended to consider the suggestion of an open-ended, and flexible design for more adaption and synomorphy involving place and Behavior(Rapoport, 2016). In case of low visibility and surveillance, options for self-monitoring made possible by windows or Design, Formal or structured ways are recommended. Formal ways of surveillance include police or security patrols, and mechanical surveillance by CCTV (Cozens and Sun,2018) are some of the ways to make the buildings secure.

Conclusions

Universities in particular, which serve as the epicenters of urban drifts and the planning cradles for future generations, must be equipped with all the tools necessary to consider a variety of options to confront the difficulties of a changing world. Planning to remodel and reconstruct future mindsets is essential in urban and regional shifts in ideological, psychological, and physiological boundaries. By default, the space as the principal canvas assumes the role of an instructor. The spatial Configuration directs its occupants to act in ways that adapt to society and environs. The University period in an individual's life is significant since they experience independence and freedom from direct family supervision during this time (Olley, 2008). In addition, they belong to an age bracket, usually 18-29 years which is considered more complex and prone to transgression (Young et al., 2002). Hence, University is responsible for educating students and caring for their social grooming. The spatial Configuration of the built environment plays a significant role in this regard.

This research using space syntax has reframed the learning process as a social activity based on the community interactions. Building layout, particularly in formal studies, plays a crucial role in learning. Therefore, it is established, through case study, that there is relationships between the built environment, spatial structure, and its occupants' community behavior. According to the findings of the research, areas that are less integrated and less connected are riskier for criminal activity and fear of criminal activity. The conclusion that can be drawn from this is that when designing spaces, particularly for universities, it is best to avoid places that are more isolated and less interconnected.

Recommendations

It is demonstrated that visibility analysis has the potential to investigate site-specific dynamics of crime incidence, even though the results are not definitive. The research finds that the qualities like interwoven, integrated and interconnected inculcated in designing spaces make them less susceptible to crime and fear of crime. In the case of the spatial layout of buildings, the spaces having more depth establish less integration to the central circulation spaces. Consequently, there is a loss of visual control inviting transgression in the case of public spaces, particularly in universities. The findings and discussions made it evident that there is a relationship between community behaviors and the built environment. Therefore, it is recommended to make spaces visible, integrated, and controllable to reduce the tendency of transgression. Spatial Planning and designing and architecture can all have an impact on the potential for surveillance and integration, which can be seen as capable management that reduces crime. Since, if offenders feel they may be seen, they may be reluctant to conduct crimes because there is a higher likelihood that they will be intervened upon, apprehended, and prosecuted.

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