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Interpretations on Movement and Affordances in the Built Environment

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ABSTRACT

Is it possible to discuss behaviour pertaining to movement and affordances depending on its potentials for social and physical reflections? To answer such a theoretical question, this study brings forward space syntax with its broader concepts and morphology studies in the building scale. Movement, whether it is guided or not, can be examined as a consequence of people's interaction with the space, related to their activities of exploring, navigating, and also getting into a congruent relationship with it. This study aims to tackle three major discussions and their interrelationships. Firstly, affordance and syntactic relationship in relation to the nature of the movement through space; secondly the relationship between building programming and its behavioural occurrences, and finally presenting a dialectic discussion about human movement and building function through case studies of the authors' previous works.

Herein, the discussions on how movement occurs in spaces and how architecture and configurative conditions change the nature of the movement as well as how the behaviour patterns emerge in this framework are important. The main emphasis of this study is not only the configurational effects of the space on movement but also the various multi-layered movement that occur in space and change over time depending on behaviour settings. In the framework of the methodology, the presented case study sections on various building types reflect the outcomes of behavioural observations of various individuals' movement which act as liberating outcomes where the discussions on *copresence, encounter,* and *coawareness* are crucial. Thus, it is aimed to gain insight into a comparative discussion between the behavioural and syntactic datasets related to typologies such as a hospital setting and an elderly institution where the movement is

assumed to be more dictating as well as other typologies such as university buildings and exhibition halls where the movement is assumed to be more spontaneous. With this in-depth synthesis and discussion based on the previous case study findings of the researchers, it has been noticed that many variable situations can be observed in which *behaviour settings* are highly influential on movement regardless of the building program depending on people's age, professional roles, gender, and life cycles.

KEYWORDS

Affordance, Behaviour Setting, Movement, Copresence, Coawareness, Encounter, Isovist

1 INTRODUCTION

It is widely discussed in recent literature (Koch and Steen, 2012; Sailer, 2007; Sailer et al., 2013; Sailer, 2015) that the physical characteristics of some buildings restrict people's behaviours while some others make people's movements more liberal. Some buildings are considered to be dictating the movement, while some others are considered to be guiding the movement. Modes of movement theoretically have their roots in Gibson's preliminary works on spatial perception (1977; 1986) which is known as the affordance theory. This theory is later discussed by Benedikt (1979) and Turner et al. (2001) in such a way that the concepts of the isovist and the parameters of the convexity were developed.

The theoretical discussion on movement has always been about understanding the capacity of spatial configuration as an independent variable. Built space is defined as a field of structured copresence, coawareness, and encounter, in which movement regulates the behavioural patterns of people, depending on the permeability and accessibility characteristics of space (Hillier, 1989; Peponis and Wineman, 2002). What they emphasised with these terms was that the syntactic characteristics implicitly point out the reflections on behavioural modes. In space syntax theory, the discussion of movement is a mechanical convention in such a way that "the movement we observe is the result of the spatial formation". Supporting Gibson's theory, Hillier et al. (1984) discussed that buildings are *strongly* or *weakly programmed* in relation to their typologies, and they stated that the layout directly affects movement. In this perspective, behavioural outcomes are considered to be derived from architectural programs, however, it should not be ignored that movement may also be related to *behaviour settings* and spatial conditions of the individuals' life cycles, age, gender, and being in a place due to a necessity.

1.1 The Aim of The Research

This paper intends to contribute to the field by analysing building layouts and presenting how the movement is shaped and how perceptual properties of space can be grasped on human interactions titled *copresence, coawareness,* and *encounter*. Both social meanings that emerge from spatial configuration and the geometry of space that shaped the movement are key

discussions here. In other words, the relationship between the orientation of individuals and the restrictive and/or liberating syntactic features of the space are aimed to be discussed in depth through different typologies. The discussion is oriented to how movement occurs in space and how configurative conditions and syntactic measures change the nature of the movement. Thus, the paper intends to explain a range of studies depending on different building typologies. In this framework, the research questions can be listed as follows:

- Do various individuals sharing a space simultaneously create different movements?
- How does strong or weak programming be effective in understanding the movement and syntactic attributes?
- How are interactional modes of movement considered here as *copresence, encounter*, and *coawareness,* linked to syntactic parameters and building programming?

2 THE THEORETICAL FRAMEWORK OF THE DISCUSSION ON MOVEMENT

In space syntax literature, the type of movements, the nature of various interaction types, and how the morphological characteristics of the space affect diverse human interactions and movement have been investigated and classified in various ways. Hillier, Hanson, and Peponis (1984) aimed to present a descriptive theory on building form and, considered space as a social product and stated that a theory of space should be constructed at three levels: representation of *spatial components*, analysis of *spatial relationships*, and *modelling of common genotype patterns* inherent in space. Studying individuals actively participating in the movement in two contexts as 'inhabitants' and 'visitors', Hillier, Hanson, and Peponis (1984) described how these two groups interact: (1) between the inhabitants and the visitors, and (2) between different categories of inhabitants of the building.

Besides the dual classification of the movement as *visitor* and *inhabitant* by Hillier, Hanson, and Peponis (1984), the movement can also be discussed through a human-oriented perspective such as *copresence, coawareness,* and *encounter* interactions among individuals. Hillier (1989) argued that spatial form creates probable *encounter* and *copresence* interactions within the spaces even though they may not lead to social interactions, but still they are important sociological and psychological outcomes. Hillier defined this field of interactions as the virtual community meaning that they exist even though they are latent and unrealized. Hillier (1996) added a third by-product of movement which he defined as *coawareness* and stressed that although being a potential interaction resource, *copresent* individuals may not acknowledge each other; however, *copresence* is the primitive form of awareness of others.

For Hillier and Penn (1991), configurations of the buildings were related to the generation or control of the human movement. The building programs can be classified as strong or weak

related to the movement of *inhabitants* and *visitors*, who are the main or the temporary users of the building, respectively. Additionally, an abstraction called an *interface,* established between these groups of users, defined the nature of permitted or inhibited movement.

Thus, in a strongly programmed building, such as the courthouses, where static positions and all movement routes restricting random encounters are defined, it was asserted that the layout does not determine the movement (Hillier and Penn, 1991). On the other hand, in an office building, which was given as an example of weakly programmed buildings, it was claimed that the *interfaces* established between people generated more randomized movements. It was stated that this freedom of movement is created by many intersecting routes, creating new encounter patterns. In such weakly programmed buildings, space emerged as a generative concept of various modes of social interaction. More interestingly, in these types of programs, physical layout determines the movement, contrary to strong programs (Hillier and Penn, 1991), especially in the absence of defined division of labour.

It was noticed that this dichotomous discourse regarding strong-programmed and weak-programmed buildings, was not wholly approved on the basis of building typologies in some of the case studies. As Sailer (2013) pointed out, this theoretical knowledge which was generated about strong and weak-programmed buildings (Hillier, Hanson and Peponis, 1984; Hillier and Hanson, 1984; Hillier and Penn, 1991) has been being questioned by various case studies in terms of different typologies by significant researchers after the 90s. Thus, in the following sections, the studies that bring new insights will be discussed, along with a number of case studies of the authors of this paper.

The researchers presented the importance of integration values as the reflections of movement in spaces (Sailer, 2007). This concern might be read in the case study of Hillier and Grajewski (1987), in which the frequency of movement was found more in the segregated zones of an office environment. On the other hand, through examining two different office environments, Penn, Desyllas, and Vaughan (1999) also stated that the integration value does not only affect the interaction and flexible working concept but it was asserted that various working activities mainly take place in such areas where spatial differentiations are observed.

This notion was supported through a more analytical case in Rashid et al. (2006) that emphasised the factors of visibility, copresence, and movement, especially in face-to-face interviews. In that case, the primary concepts might be discussed depending on the theory of affordances which was put forward by Gibson (1977; 1986) and developed later by Benedikt (1979), and Turner et al. (2001). Griz and Amorim (2005) who investigated strong programs through courthouses, stated that they obtained a result that confirmed the information in the literature that there is a high degree of control between the various individuals in courthouses. They searched not only the social concepts such as power, hierarchy, and control, which determine the interaction between

people in court buildings, but also the setting-specific concepts such as segregation, depth, and high differentiation. Griz and Amorim's (2005) research might be assessed as a continuum of Hazard's (1962) comparative analysis in courthouses about how the configuration shaped the behaviour setting in the courtroom according to the juridical system. This deterministic comparison can be considered to be reinforcing how strong programming changes the design, milieu, and the synomorphies. Despite all designated areas concerning juridical roles, Griz and Amorim (2005) explained that although individuals with various roles in the courtroom exist in *copresence* in the same setting, the duties of individuals regarding their status restricted their interactions.

This observation was also valid for Rashid et al. 's (2006) study through which the relationships between space, behaviours, and organizational outputs were explained, and the types of direct and indirect interactions that generate between organizational behaviour and culture were revealed. Rashid et al. (2006) used the concept of *movement* for the people moving along a certain route, the concept of visible *copresence* for the people seeing each other, and the concept of *face-to-face interaction* for the people engaged on the certain route. In their study the importance of spatial interconnectedness for the visible *copresence* was emphasised, the concept of movement was interrelated with *face-to-face communications* while the space was concerned to be a part of the organizational resource. Thus, the potentials of the environment like visibility, accessibility, and openness were considered to be the main factors of visibility, *copresence,* and movement. Although as Rashid et al. (2006) mentioned that these variables might be the main concerns for *face-to-face communications*, fewer interactions among people might have been due to socio-cultural patterns.

Although positive correlations were found between the value of integration and an increase in interaction in the studies of Hillier et al. (1993) and Peponis et al. (1989), it was noticed in the study of Rashid et al. (2006) that people avoid interacting with each other in the spaces with high integration and high connectivity. As a result of behaviour mapping studies carried out in offices (Rashid et al., 2006), it was revealed that the relationship between movement and interaction showed inconsistent correlations. An unexpected result about few interactions was found in such zones where the integration, connectivity values were high. Moreover, in behavioural observations, it was observed that people mostly established face-to-face interaction in their personal offices. This result suggested that although open office environments seem to be featured as weak-programmed buildings that reinforce encounter and face-to-face interaction, the visibility value might be revealing the feeling of being under control (Rashid et al., 2006). Before starting the discussion of case studies, it should be asserted that the hindered context of building programming and behavioural occurrences were considered to be highly related to resource planning and organizational issues (Koch and Steen, 2012). The notions of working tasks and underlined designated roles in spaces were discussed, and the concept of "spatial practice" as a movement in space due to the arrangement of the designated programs was

asserted. In other words, from Foucault's understanding of *panopticism*, the designated functional programs were tremendously linked to the regulating mechanisms in human communication systems. In this sense, Sailer (2007) also considered spatial functions mainly as *attractors* and asserted that attractors have the potential to change the dynamics in space since there is always a focus on attractors regulating the accumulated frequency of behavioural modes that may cause different modes of movement affecting visibility and metric integration. It should be added that space syntax theory has been expanding in recent years, with the discussions of the effects of visibility (Franz and Wiener, 2005), perception (Seamon, 2007, 2012) and cognition (Conroy-Dalton, 2003; Peponis et al, 2004; Hölscher et al, 2007) on movement, planning, and programming, and the inclusion of new technologies such as immersive virtual technologies into the field (Turner et al, 2001; Unlu et al., 2022).

3 A DISCUSSION ON PREVIOUS CASE STUDIES

The methodology of this paper is based on datasets of different case studies which reflect the outcomes of behavioural observations of various individuals in relation to movement and interactions in terms of *copresence, coawareness,* and *encounter*. In this framework, the methodology of this study that is leading the discussion based on previous case studies is a synthesis through the research that have already been done. Herein, the new approach of this paper is coming out of the synthesis of the previous data and focusing on the discussion of movement and affordances. The case studies presented here are such settings that are considered as strong and weak programmed buildings in the literature. Syntactic and behavioural datasets extracted from various building types such as hospital settings, elderly institutions, university buildings, exhibition buildings, and museums, are discussed.

3.1 Case Study 1: A Paediatric Healthcare Environment

Case Study 1 presents a discussion about a hospital setting that is generally considered to have a strong programme. Children's healthcare settings are spaces simultaneously shared by various individuals with different roles; physicians and nurses are the health professionals who are the mandatory members of these settings while the companions and the paediatric patients can be considered permanent members as a reflection of child-centred design principles. Although the paediatric patients and their companions are not as permanent as the health professionals, these two groups tend to become the owners of the setting in time. Therefore, the discussion here concentrates on the *copresence* modes regarding the movements of these three different individuals in a paediatric oncology inpatient unit (Canakcioglu, 2016; Canakcioglu and Unlu, 2017).

This study was based on the hypothesis that due to their physical, social and emotional needs, the three different groups of individuals -paediatric patients, their companions, and nurses- sharing the same space 24 hours a day, use the setting synchronized in time and space in terms of social interaction and copresence. The research questions were determined as follows: How can the

concept of *copresence* be attributed to syntactic values in the design of healthcare settings? How strongly-programmed buildings regulate *face-to-face interactions* in hospital settings, and how do these settings regulate the concept of *encounter*?

Behavioural data of three groups of individuals were recorded; the behavioural datasets of (1) paediatric patients, (2) their companions, and (3) nurses constituted the dependent variables of the study. As a result of observing 30 paediatric patients, 30 companions, and 13 nurses, the spatial components that each group used the most were revealed. The independent variables of the study were the syntactic parameters of the paediatric treatment environment, so that the integration, isovist area, isovist perimeter, compactness, circularity, occlusivity, connectivity and mean depth values of the layout were obtained. When the behavioural datasets were examined, it was revealed that the nurses mostly used the nurse's station, the medicine preparation room, and the corridor; while the paediatric patients used the playroom, their wards, and the corridor. Behavioural data of the companion group, on the other hand, revealed that they often used the kitchen, the corridor, and the playroom.

When the behavioural data of these three groups was examined cumulatively, some common features were noticed; it was found out that the corridor was the space that was used extensively. It is important that the corridor was heavily used not only as a circulation component but also as a socially interactive domain by nurses, companions, and paediatric patients (Figure 1). Moreover, when the behavioural performances of nurses and companions in terms of change of place were also examined, the average spatial change frequency of the companions was almost the same as that of the nurses. Considering this result of frequency among nurses and the companions, this result showed that companions were at least as active as nurses. Thus, in such an environment where the treatment of the child is the main concern, companions can be described as the teammates of the nurses because they are the indispensable stakeholders of the treatment process who take care of their children, keep records of their daily routines, and share them regularly with nurses.

a b c d

Figure 1. Encounter and coawareness behaviors in the corridor of various user groups using the healthcare setting (Canakcioglu, 2016); (a) paediatric patient-companion, b) companion-paediatric patient-companion, c) physician-paediatric patient-companion, d) nurse-companion.

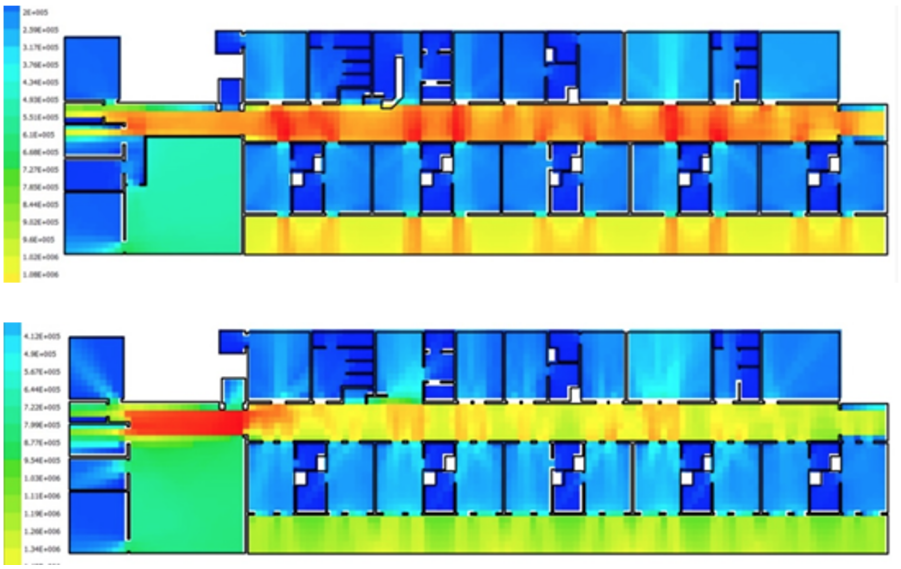


Figure 2: Accessibility graph (top image) and isovist graph (bottom image) of the inpatient unit (Canakcioglu, 2016).

Considering the correlations between the behavioural frequencies of children and the syntactic values of the spaces in the setting (Figure 2), it was revealed that the frequency of children's use of the spaces is independent of the syntactic values. However, considering the correlations between the behavioural frequencies of companions and the syntactic values of the setting, it was revealed that the frequency and duration of the companions' use of the spaces are significantly related to the isovist area ($r2= 0.323$, $p=0.037<0.05$), isovist perimeter ($r2=0.513$, $p=0.001<0.05$), and circularity ($r2=0.472$, $p=0.002<0.05$). These results showed that the companions tend to use the shallow and visible spaces that they feel secure. In other words, it can be said that the spaces with these values above are located in central locations in accordance with the frequency of use of the companions in the floor plan. Because the space that appears at the highest frequency in the behaviour maps of the companions is the kitchen space where they perform the cooking action. Although the meal is centrally cooked and served in the hospital, cooking action is mandatory for the companions in their daily routines due to the fact that children need to take additional food. On the other hand, occlusivity ($r2=-0.328$, $p=0.034<0.05$) and mean depth ($r2.=-0.308$, $p=0.048<0.05$) values of the spaces were revealed that these values were also significant, but inversely correlated. These results also support the results above regarding the companions in terms of shallow spaces with low mean depth, but rather with high visibility value.

It was revealed that the nurses use the spaces in the setting with high circularity value ($r2=0.35$, $p=0.023<0.05$). Despite the intense mobility of the nurses on the corridor, it can be asserted that this mobility is a necessary action for the nurses since their field of responsibility is to provide the medical interventions for the patients, but the frequency value of the companions was almost equivalent to that of the nurses. This result can be considered as a result underlining the fact that the companions are the important collaborators in the inpatient unit as main teammates of the

nurses with high interaction with the healthcare environment so that the social needs of the companions should also be taken into account in the healthcare design.
In this section, behavioural data of different individuals in hospitals demonstrated that the individuals cannot directly be considered as *inhabitants* versus *visitors*. On the contrary, even some of the individuals who join the healthcare setting as visitors -in this case, the inpatients and the companions- turn into the owners of the setting over a certain period of time (Figure 1a, 1b, 1c, 1d). Thus, the inpatient unit can be considered a closed-circuit spatial system that continuously generates the *encounter* and *coawareness* interactions between different individuals in the healthcare setting.

3.2 Case Study 2: An elderly institution

Case Study 2 concentrates on a previous case study of Akan (2017) which was conducted in elderly institutions where elderly people are presumed to have limited competence and behaviours. The elderly institutions present designated specific social interaction areas in their building programs, which may be considered as guided. In this case study, the discussion is mainly concentrated on elderly people's preferences of daily activities, functions, and preferred spaces. The research question was whether they preferred to carry on their daily activities in the designated spaces or whether they choose these spaces randomly anywhere that are convenient for their physical actions and competencies. Through this discussion, it was aimed to shed light on the behavioural modes of the elderly in relation to *copresence, encounter,* and *coawareness.*

The outcomes from two elderly institutions located in Istanbul presented elderly people's behaviours reflecting their behavioural frequencies and their utilization of the designated spaces. The behavioural outcomes showed how the elderly occupied the designated areas which they prefer to be in *copresence* with others, how, where, and why they interact with their peers in these areas (Figure 3). The case study revealed that the behaviours of the elderly mainly concentrated on two concepts; limited *encounter* and random *copresence* opportunities with others.

Figure 3. Unoccupied social interaction areas vs spontaneously occupied areas on corridors (Akan, 2017).

Akan and Ünlü (2015) supported that the frequency of utilization of spaces was highly correlated with syntactic values such as visibility integration, isovist area, isovist perimeter, and connectivity. The research conducted by Akan and Ünlü (2015) proved that modern elderly institutions provide various opportunities for elderly people in their building programs and also proved that visibility was significantly correlated with *encounter* and *copresence* interactions due to the permeability and affordance characteristics of spaces specifically regarding the corridors. Although these results confirmed that the architectural scenarios aim to realize the expectations of the elderly, the occupancy of corridors was still a critical point to understand the concepts of *encounter* and *copresence.* In this regard, the significant correlations confirmed that the frequency of occupancy in corridors was highly correlated with the isovist area (r= 0,683, p=0,043<0.05).

In strongly programmed buildings, social interaction areas tend to be designed for their main spatial functions. However, as approved by the significant outcomes above, the corridors displayed “specific behavioural exposures” randomly created by the elderly. The generation of social gathering places was observed to occur on the long corridors that might be considered as an “unpredicted design scenario”. This result might be related to two reasons; primarily, the elderly find a gathering place that is suitable to his/her competence around his/her room, secondly, the spontaneous gathering area presents a high isovist value so that it demarcates such a node that syntactically provides a more visible area. The specific area might also be presenting an opportunity for the elderly to *encounter* others, especially in front of the doors opening to the corridors (Figure 4).

Figure 4. Elderly groups occupying areas in the corridors display encounter and copresence interactions with others (Akan, 2017).

Akan et al. (2017) also implemented a cognitive mapping procedure with the elderly through which the elderly people were asked about their spatial remembrances in the institution. The outcomes were assumed to be related to the duration of stay, occupancy modes, and competence of the elderly. It was interesting to find out that the remembrance frequencies of the spaces were significantly correlated with syntactic values, e.g., isovist area (r=0,693, p=0,006<0,05), isovist perimeter (r=0,634, p=0,015<0,05), visible integration (r=0,711, p=0,004<0,05), and connectivity (r=0,716, p=0,004<0,05).

Within the framework of the main discussion about the movement in this paper, the findings of the cognitive mapping procedure can be considered as the outcomes related to the concept of *coawareness* which can be discussed in terms of the memory of the elderly depending both on their duration of stay and their competencies. The configuration of spaces regarding permeability, visibility, accessibility, and openness eventually contribute to the remembrance of the elderly so that these attributes recreate recalling modes. So, the concept of *coawareness* should be discussed with the concepts of visibility and accessibility that are derived from the *encounter* with other individuals in spaces rather than being associated with the objective understanding of the environment. These coincidences exposed as human behavioural occurrences in spaces may be derived from the provision of permeable places that motivate individuals to be *encountered* and *copresent* in space. Besides, the concept of *coawareness* in this case study is mainly integrated with the memory of the elderly and the intelligibility of the configuration so that it should be considered as an inseparable part of the concepts of *encounter* and *copresence* as the dynamic models of the movement.

3.3 Case Study 3: University Buildings

Case Study 3 comprises case studies that were conducted in two different historical buildings that have been used as university buildings for architectural education. The modes of interaction, movement, and how attractors regulate these modes of interaction are discussed here. Hillier and Hanson (1984) suggest that students in schools are visitors, who do not have control over the spaces they use temporarily. However, schools would be merely office buildings if there were no students; moreover, students' random spatial transformation may be overlooked and even encouraged while similar actions necessitate permission and paperwork for faculty and staff. Two previous studies executed in the two oldest architecture schools of Istanbul both located in symmetrical historic buildings show that students are not only able to control the social and physical space but dichotomies are not the underlying rules of configurations and spatial behaviour in the 21st century.

Based on Barker's (1963) actors, milieu, synomorphy, and time components, Ünlü et al. (2001) proposed that social interaction in space can be explained by the nature of social relations in the transformed layout of a historical military hospital to the school of architecture of Istanbul Technical University. Social interaction discussed here has its roots in Gibson's visual field and affordance theories (Gibson, 1950; Gibson, 1977) in which Ünlü et al. (2001) emphasized that actors in the medium, not only have the sensory data about the visual impact of the architectural features but the non-verbal communication data about others' movements, postures, and activities. In this research, the case study environment as a behaviour setting medium was classified again in a dichotomy, such as sociopetal or sociofugal.

Sociopetal and sociofugal essence of spaces, which brings people together or forces them apart, can also be understood as spaces encouraging or discouraging interaction especially in a building

with a dominant institutional character. Peponis and Wineman (2002) emphasize that generative spaces are flexible, and they can be changed by society, as they are movement-based; however, reproductive spaces are the spaces that are labelled with their functionality, which is fixed and transferred accordingly. As the building has many spaces allocated for different fixed functions, wide corridors connecting four vertical circulation towers and the courtyard, which may be referred to as generative spaces, are the basis for modes of movement as *copresence*, *encounter,* and *coawareness.*

In order to get information about the visual capacity of spatial configuration, e-partition analyses (of Spatialist) were applied to spaces where students used the most on the floor plans (Figure 5). E-partition analysis created a base for randomly selected 28 bubble zones. Observations on social interaction and movement-based behaviour in these zones were recorded within 30-minute intervals twice a day on peak hours. The size of the bubbles was limited to 4-6 meters in diameter indicating a social distance limit. Sitting and standing modes were considered as social activities while passing through the bubble was considered as the density of movement (Figure 6).

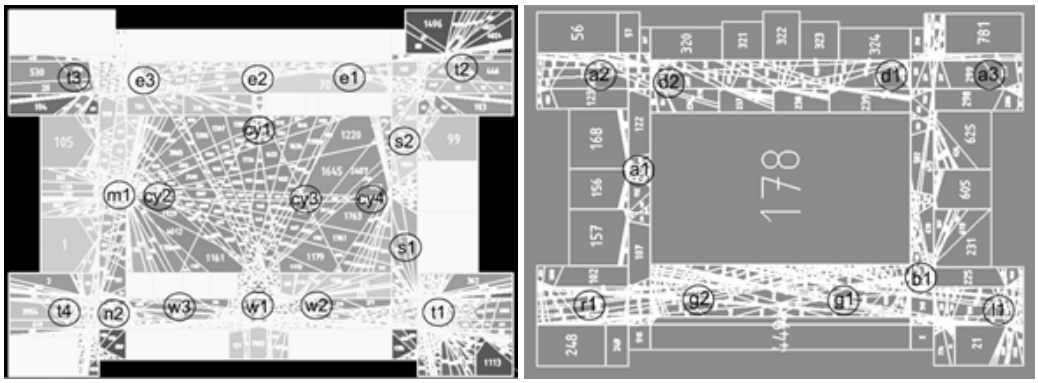


Figure 5. Ground and first floor e-partition analyses showing bubble zones.

No	Bubbles	Space	Hours	Total Social Activity (per 30 min.)	Sitting Mode (per 30 min.)	Standing Mode (per 30 min.)	Density Passers by (per 30 min.)
1	W1	entrance hall	10.30-11.00	37	3	34	195
2	W2	exhibition hall	11.00-11.30	14	0	14	214
3	T1	grand amphi-109	14.30-15.00	4	0	4	124
4	S1	computer c. corridor	10.30-11.00	0	0	0	95
5	S2	computer centre	15.00-15.30	8	3	5	136
6	T2	library hall	10.00-10.30	2	0	2	204
7	E1	research centre	14.00-14.30	3	1	2	91
8	E2	courtyard exit	10.30-11.00	7	3	4	79
9	E3	social sci. institute	14.00-14.30	0	0	0	146
10	T3	kiosk hall	10.30-11.00	14	11	3	67
11	M1	stationery-photocopy	15.00-15.30	41	0	41	61
12	T4	foundation hall	10.00-10.30	0	0	0	57
13	N2	hall	13.00-13.30	2	1	1	79
14	CY1	courtyard exit	10.30-11.00	28	13	15	54
15	CY2	courtyard exit	14.30-15.00	56	26	30	108
16	CY3	courtyard-pool	10.30-11.00	54	21	33	97
17	CY4	courtyard exit	14.00-14.30	39	20	19	117
18	W3	CEC corridor	10.30-11.00	2	1	1	55

No	Bubbles	Space	Hours	Total Social Activity (per 30 min.)	Sitting Mode (per 30 min.)	Standing Mode (per 30 min.)	Density Passers by (per 30 min.)
1	G1	grand studio corridor	10.30-11.00	35	7	28	123
2	G2	grand studio corridor	14.30-15.00	33	3	30	137
3	R1	president's office hall	10.30-11.00	12	0	12	65
4	A1	amphi corridor	14.00-14.30	28	0	28	97
5	A2	tower hall	10.30-11.00	6	2	4	84
6	D1	studio corridor 217 a	14.00-14.30	17	5	12	112
7	D2	studio corridor 217 d	10.00-10.30	13	2	11	105
8	A3	tower hall	14.30-15.00	8	2	6	77
9	B1	studio corridor 212	10.30-11.00	21	0	21	98
10	L1	library hall (sinan)	14.30-15.00	15	0	15	95

Figure 6. Social interaction counts of ground and first floors.

According to the analyses, lower visual stimulation creates less social interactive spaces, and higher visual stimulation creates more sociopetal spaces. The most visually integrated areas of the ground floor are the courtyard, entrance hall, and some specific zones such as stationery, photocopy room, and the most densely used settings such as studios or their extensions in circulation areas. The correlation corresponding r2=0.47 between real integration values of e-partition lines and the level of social interaction shows the dispersion of social activities on the ground floor. However, it is important to mention generative spaces, as well as reproductive spaces, could be perceived as sociopetal in terms of student behaviour modes. For example, courtyard exits towards the main entrance, courtyard pool, stationery, and photocopy rooms are the most active spaces interaction-wise. Both standing and sitting modes of action are at the highest levels on these three bubble zones. These spaces are generative spaces and are being used as interaction zones by the students. On the other hand, labelled spaces such as the stationary and photocopy rooms provide *copresence* and *coawareness* with the highest number of standing modes of students.

As for the first floor, the correlation between real integration value and social interaction level is found as r2=0.74. The reason for high accordance on this floor is based mainly on the studios located here and sociopetal characteristics of design studios extending into the corridors. Here, we see again that the corridors are not just spaces of *encounter* and *copresence* but they also serve as an ad-hoc social interaction medium. This behaviour is different for students compared to faculty and staff. For example, we can easily see students' taking stools and chairs out of the studios to create a sitting space or just sit on the floors if the conversation is getting deeper; similarly, they can do the same on staircases, even though the configuration in circulation towers do not provide a sociopetal space. However, these types of space uses are out of the question most of the time for the faculty and staff due to many regulations or basically psychological reasons. Therefore, we can easily conclude that generative or reproductive spaces, along with owner-controller/visitor dichotomies do not apply to all cases worldwide.

On the other hand, the study shows that visual stimulation and more openings to main halls and corridors enhance the occurrence of social interaction between students supporting the importance of functions, which the space syntax literature defines as "attractors", especially concentrated around the public halls. Therefore, if there is a functionally attractive point for occupants, social interaction is a natural outcome in the selected setting, and sociopetal spaces

extract more information about settings; they enrich the settings and define the spaces as being more memorable and descriptive. Students do not select social interactive settings randomly, their allocation is in accordance with the visual capacity of the space.

In the second study that was executed in two symmetrical historical buildings that were converted to architectural schools in Istanbul, Ünlü et al. (2009) stress the importance of interrelation of indoor/outdoor spaces for the social interaction of students. What might be considered as pragmatic solutions to the need for space in times of economical and technological deficiencies, these two oldest state architectural schools of Istanbul, ITU, also presented above, was converted from a military hospital and MSGSU was converted from twin seaside palaces built for Sultan's daughters. Therefore, based on visual field and its potentials of movement within a milieu (Gibson, 1950; Barker, 1963; Chang, 2002; Peponis et al., 2004) the research compares the students' time-dependent occupancy of the indoor, outdoor, and interfacing spaces in mid-day clear (18°C) and mid-day rainy (10°C) weather conditions, in both schools.

In this research, functional attractiveness refers to the functional values of space, such as cafeterias, stationery shops, exhibition areas, milieu types referring to designed, semi-designed, or non-designed points such as sitting on a chair of a cafeteria, sitting on a courtyard parapet wall, and standing individually or with a group, respectively and location type that refers to a place where something happens or is situated, such as outdoor, indoor or interfacing spaces in-between are the compared factors of the two buildings according to students' usage preferences. The outdoor spaces are determined as the courtyard for ITU and the seaside terrace for MSGSU. The indoor spaces are the locations where there's no visual connection with these outdoor spaces, while the interfacing spaces are locations where visual contact is present with outdoor spaces although the location of the point is indoors. Similar to the observation method used for the Ünlü et al. (2001), interactions less than a minute are eliminated from the records, while the recorded postures indicated behavioural modes (Figure 7 and Figure 8).

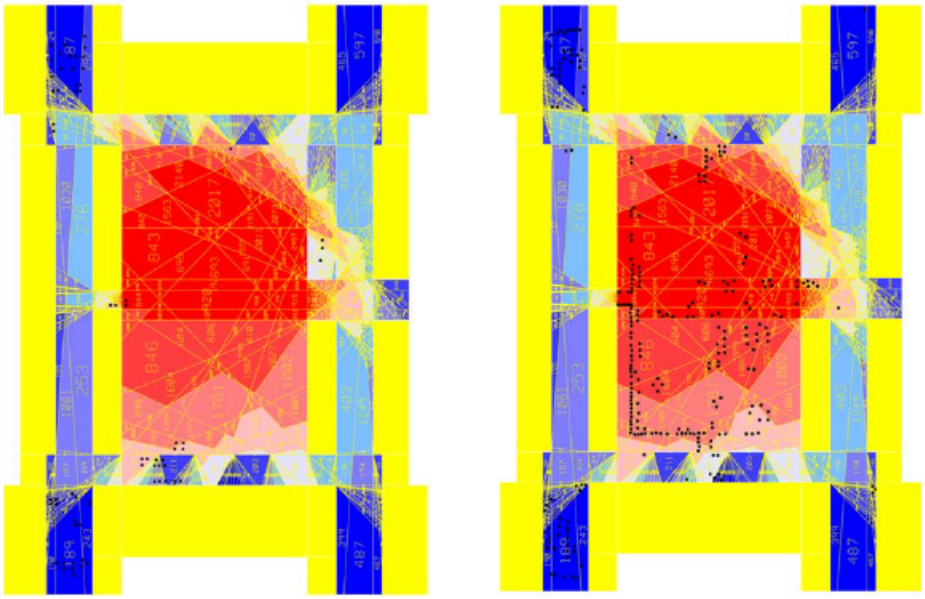


Figure 7. Occupation density and e-partition analysis of ITU in rainy (left) and clear weather (right).

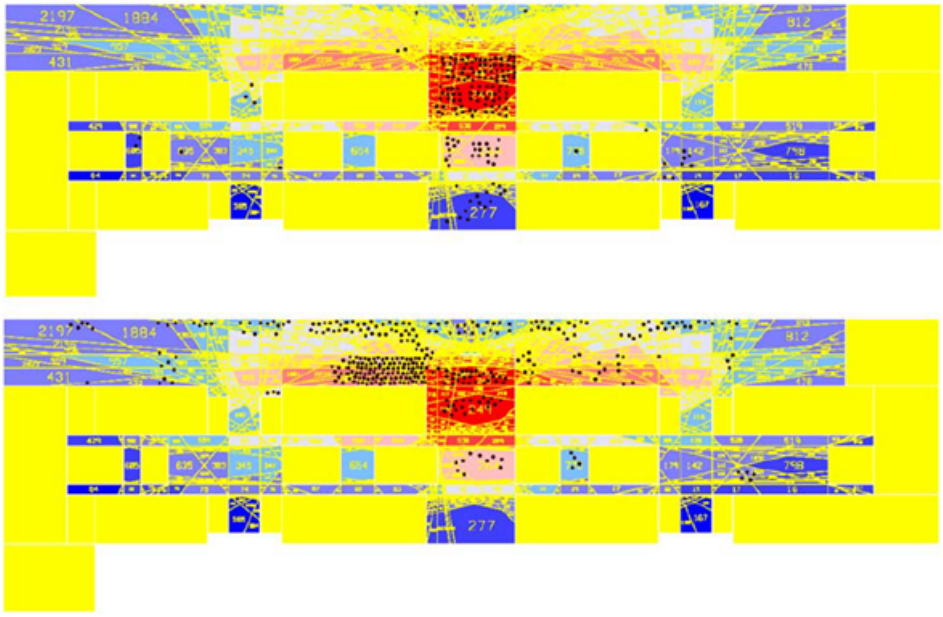


Figure 8. Occupation density and e-partition analysis of MSGSU in rainy (top) and clear (bottom) weather.

During the rainy days in both ITU and MSGSU, indoor designed milieus where the functional attractiveness is high are highly occupied; this space is relatively low integrated cafeterias for ITU, but highly integrated cafeteria and transition space, which happens to be an interface for MSGSU. The occupation of semi-designed or non-designed outdoor spaces is high for clear days whereas the occupations of indoor and interfacing spaces are higher on rainy days. In both schools, semi-designed or non-designed interior spaces are not preferred in clear weather. The nodes here may be related to being reproductive, semi-generative, or generative spaces,

indicating that solid thick walls and labelled voids in historical buildings force the students to create interaction nodes in interior spaces.

However, functional attractiveness is still a preference factor for indoor occupation even though the node has low integration values; functional attractiveness usually surpasses the integration quality especially indoors. On rainy days, ITU students prefer locations where they can check the circulation routes or courtyard density. Moreover, ITU students expose stronger attachment to defined spaces whether interior or exterior, while they use interfacing spaces mainly for transition and circulation. On the other hand, MSGSU students prefer the locations where they can check outside weather and entrance halls to a degree, rather than circulation routes. They prefer to occupy exterior and interfacing spaces, while they do not favour interior or low-integrated spaces, regardless of their functions. This may suggest that ITU students' location preference indicates encounter and co-presence on rainy days, while MSGSU students' preferences indicate copresence and coawareness.

The research concludes that designed or not, the presence of exterior spaces, and preferably a natural vista are important for academic life, and students do not need a defined function to enjoyably use these spaces. If interfacing spaces can form a niche or a change in level, then they are preferred spaces and afford social interaction, if not, they act as undefined circulation paths or transition spaces.

3.4 Case Study 4: Museum and Exhibition Layouts

Case Study 4 extends the discussion through museum or exhibition configurations with their contribution to spatial memory and intelligibility. The mode of *coawareness* is a significant issue here with the emphasis on short-term or long-term memory discussion. The movement modes are changing due to the physical and semantic aspects of the space as well as the art object exhibited and its interaction with the visitor.

Hillier and Tzortzi (2006) define space syntax in two main ideological frames; the first one suggests that "space is not just the background to human activity and experience, but an intrinsic aspect of it" and the second one states "how space works for people is not simply about the properties of this or that space, but about the relations between all the spaces that make up a layout". Therefore, how a museum or a curatorial space is serving the experience of visitors and the activity pattern it creates is important for discussion. Depending on the relations based on the theory of natural movement (Hillier et al., 1993), the behaviour setting theory (Barker, 1963), the *copresence* as well as *coawareness* (Peponis and Wineman, 2002), the museum space whether it is curated and emerged as a temporary or permanent configurational setting, is a source both for understanding the changes in contextual society and the effect of space as well as behaviours emerging in that space.

The design of an exhibition gallery or a permanent museum installation requires understanding how its layout influences the use of space, as well as the spatial experiences of visitors. The layout of a gallery may affect the display of the artwork, visitors' activities, and their movements. Antrepo No 3 of Istanbul Modern Museum's main exhibition gallery of the 2013 Istanbul Biennial (Figure 9) was explored to find out: 1) how museum design influences integrated or segregated locations, as well as visitors' use of the space; 2) how spatial layouts influence visitors' explorations in gallery spaces; 3) which spaces are more or less visited, and 4) what the predominate path is depending on the number of visitors during a specific period of time (Salgamcioglu et al., 2015).

Figure 9. Location of the artists (left); Various views from the exhibition space (right) (Artist 42 upper left; Artist 3 & 4 upper right; Artist 2 lower right; Artist 42 & 43 lower left)

Beyond the fact that configuration has a strong impact on visitors' experience in the Antrepo No.3, attractors as artworks and configuration based on movement were mutually influential on the number of visitors. For example, the mild significant correlation of circularity and visitor frequency at some weekday and weekend hours showed that the number of visitors increased when the convex spaces are more linearly shaped in terms of the geometry of spaces. Herein, *copresence* and *encounter* through the strong impact of geometry exist, on the other hand, the influence of *coawareness* based on the perception and cognition of space had limited influence when the total number of visitors to the venue rises dramatically at certain peak weekend hours. At that time, the visitors were looking more to the artworks in the more integrated space in the venue, passing through the highly integrated gates, but when the number of total visitors decreased on weekdays, visitors were more likely to look at the artworks in less integrated spaces, passing through a less integrated gate. It was important to see that as Kaplan et al. (1993) also discussed the concepts of being extent, fascination, and compatibility through museums that act as a restorative environment, the influence of *coawareness* was seen in Istanbul Modern

Museum. The impact of the configuration was independent of the installation of the artworks in relation to the number of people circulating in the setting, but knowing the space and engagement with the artwork were beyond the configuration.

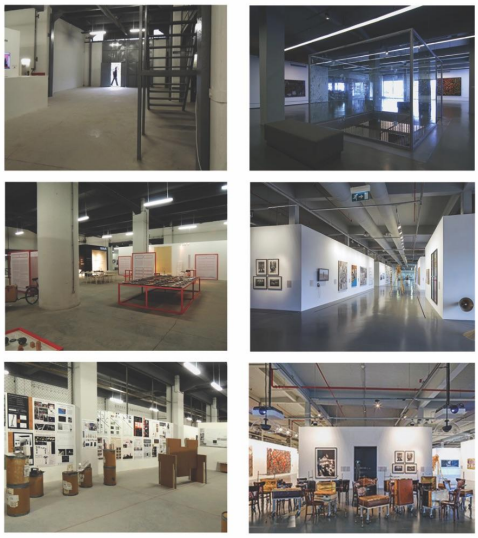
In another study conducted by Salgamcioglu and Cabadak (2017), temporary and permanent exhibition spaces were scrutinised based on the movement behaviours of people in relation to configuration and exhibited works (Figure 10). The main question was whether the type of the space (temporary/permanent) affects the behaviour of people in relation to the exhibited items and configuration. Two of the former warehouses were selected as case studies where Istanbul Modern Museum in Antrepo No.4 was a permanent museum space; and Antrepo No.7 was recently used during Istanbul Design Biennial in 2014, which was a temporary exhibition space. Both of the warehouse structures that we call "Antrepo"' are the parts of the main port region between Karaköy and Kabataş in Istanbul; and they have similarities such as space configuration, size, and environmental characteristics.

The movements of visitors through the selected gates in Antrepo No.7 are significantly correlated with the syntactic values of integration and circularity. These findings denote weak programming and short-term memory-related experience of the temporary exhibition layout. Visitors follow the path and *coawareness* in relation to familiarity or "restorative space" characteristics of Kaplan et al. (1993) is relatively weaker here. Flexible and temporarily programmed spaces are experienced in relation to the increasing or decreasing values of integration, where higher integration means more visitor movement frequency in the venue, compared to Antrepo No.4's more permanent and long-term memory-related, learned configuration setting. The permanent character boosts *coawareness* and the interfacing spaces in relation with the outside view to The Bosphorus is strengthening the restorative character in addition to the experience of the permanently exhibited artwork.

On this basis, the circularity value is having significant correlations with visitor frequency, where the geometry of space is significantly supporting the movement. The gates that are connecting and supporting the movement by their central position in the layout are attracting more visitors due to the flexible and permanent configuration of the venue (integration, circularity values of gates respectively, and frequency of visitors passing through the selected gates: $R=0,728$ and $p=0,026<0,05$; $R=0,737$ and $p=0,023<0,05$ respectively).

Antrepo No.7's non-distributed and deeper configuration may be seen as a disadvantage, but the significant correlations of visitor frequency with mean depth and integration (mean depth, integration, values of convex spaces respectively and frequency of visitors using the convex spaces ($R=-0,504$ and $p=0,007<0,05$; $R=0,518$ and $p=0,006<0,05$ respectively) show that the flexible-soft programmed space and the exploratory character of the temporary exhibition

increases or decreases the number of visitors in accordance with the increasing or decreasing integration and mean depth values of convex spaces.



ISTANBUL MODERN MUSEUM							
correlation gates and visitor frequency		R	P	correlation convex spaces and visitor frequency		R	P
mean depth	**frequency-gates**	**-0,537**	**0,026**	**mean depth**	**frequency-convex spaces**	**-0,652**	**0,001**
integration	frequency-gates	0,473	0,055	**integration**	**frequency-convex spaces**	**0,629**	**0,002**
circularity	frequency-gates	0,433	0,082	**circularity**	**frequency-convex spaces**	**0,666**	**0,001**
BIENNIAL							
correlation gates and visitor frequency		R	P	correlation convex spaces and visitor frequency		R	P
mean depth	frequency-gates	-0,336	0,377	**mean depth**	**frequency-convex spaces**	**-0,504**	**0,007**
integration	**frequency-gates**	**0,728**	**0,026**	**integration**	**frequency-convex spaces**	**0,518**	**0,006**
circularity	**frequency-gates**	**0,737**	**0,023**	circularity	frequency-convex spaces	0,34	0,083

* Visibility parameter
* Just walls are evaluated as barrier; artworks haven't taken into account

Figure 10. Convex spaces of Antrepo No.4 and No.7 (upper left) (above and below respectively); Views of Antrepo No.7 (upper right) (temporary exhibition of Antrepo No.7 - left column; permanent exhibition of Antrepo No.4 - right column) (photos – Murat Germen, 2015); The results of regression analysis (lower table)

Herein, the behaviour of people seemed affected by the type of the artworks mostly on the basis of the time spent over them. In both cases, the behaviours of people were verifying the attractor-movement-configuration theory. In the temporary case, artworks were the major parameters affecting the behaviour whereas in the permanent exhibition case interfacing spaces between interior and exterior were affecting the behaviour, as well. In the temporary one, artworks were affecting the usage more than the permanent one, with their physical existence beside their context. Here, the impact of the configuration was also independent of the visitor experience at most times where knowing the space in relation to the memory and engagement with the artwork is again beyond the configuration, and also supports *coawareness*. Copresence and encountering are mostly seen as a part of the configurations' syntactic values' (such as integration and circularity) significant correlations with visitor frequency.

4 CONCLUSION

This paper intended to discuss movement in spaces which is mainly accorded with spatial affordances, specifically in the architectural settings. The cases here should be taken as exposures of a predicted architectural scenario in the design process presenting various behavioural modes, however, they mainly represent the interactions of movement e.g. *encounter, copresence,* and *coawareness* independent from their building programs. In this sense, the discussion about the strong or weak programming of buildings or the distinction of being an inhabitant or a visitor does not always have a direct effect on the movement.

Encounter is a necessity for social interactions not only in strong-programmed buildings but also in weak-programmed buildings. As it is presented in the case studies, companions in hospitals or elderly people in institutions formed spontaneous gathering areas on corridors that were not intentionally designed by architects. However, *encounters* in the corridors coexisted with the *copresence* modes. The university buildings and elderly institutions also support the notion of *coawareness*, spontaneous gatherings, and chatting although they are realized and created on milieus. Due to the symmetrical and historical backgrounds of the buildings, the university settings studied here were examples of strong programme layouts. However, it was seen that the students, who were considered as the visitors in literature and therefore who were supposed to have limited control on the space, were creating semi-permanent ad-hoc social interaction medium, on the circulation routes, regardless of the integration values or sociopetal nature of the nodes. This means that they were generating social interaction niches in the reproductive spaces so that mere encounters could be transformed into copresence and coawareness. Additionally, these generative spaces are usually weather operated and work only in unfavourable weather conditions. Therefore, we can easily conclude that generative or reproductive spaces, along with owner-controller/visitor dichotomies do not apply to all cases worldwide. In this case study, it was shown that *encounter* and *copresence* were correlated with the content of space and the quality of social interaction.

On the other hand, the conditions of *encounter* and *copresence* in weak-programmed buildings were the dynamics of *behaviour settings*. In this regard, *encounter,* and *copresence* drive us to see different formations in museums and exhibitions. The codes that emerge in relation to the building layout and its meaning as a museum or exhibition space are also important in terms of coawareness, where long-time memory and engagement with the artwork are setting the primary modes of behaviour. Here, the impact of the configuration is also independent of the visitor experience at most times where knowing the space in relation to the memory and engagement with the artwork is again beyond the configuration. Therefore, the concept of *coawareness* might be connected to the coexistence of the behaviour. Whether it is permanent or temporary, the exhibited material and visitor relationship are important based on memory, the codes that emerge in relation to the building layout, and its meaning as a museum or exhibition space in terms of *coawareness*. As Wineman and Peponis (2010) mentioned “behavioural patterns of access and

visibility construct a spatial discourse that flows in its own right, although not entirely separate from the curatorial message."

Questions and discussions might sometimes be arbitrary about the building programming strategy whether the building is planned weakly or strongly, whether it is controlled or not. The critical point here is the necessity of humans, and what they expect from spaces subjectively or what they see as an extension of their behavioural modes. Space syntax analytically examines all building typologies and explains the spatial affordances of the configurations and how they provide social or personal areas. Therefore, the control of the space is an arbitrary notion that is definitely evaluated in phenomenological or social meanings, eventually, the space syntax is a regulating mechanism of the movement flow. Moreover, it has an active role in affecting the quality of interactions of individuals in terms of being together or apart. Considering the previous case studies conducted with lesser syntax parameters, we are now capable of measuring various aspects of space, thanks to the many improved software developed by the syntax community. However, we still have to accept that human interaction emerges in different frameworks, and human behaviour is far more complicated than being trapped in a mere mechanical discussion of syntactic variables.

This study sheds light on the discussion that people's interactions are not dichotomously dependent on building programs but rather dependent on *behaviour settings* and asserts that people tend to come together through interactional modes, considering their age, gender, personal and professional roles, social and psychological needs, and life cycles. Consequently, we have to remember Durkheim points out that even an abstract concept such as "time" which we see and evaluate objectively, has its origins in the culture of that society. Whether it is believed to be linear or cyclical, everyone in the same society thinks about time, in the same way, showing its collective character; such as the rituals, festivals, and feasts as the basic divisions that constitute the time. Similarly, Durkheim's ideas lead to Lévi-Strauss's definition of mechanical and statistical societies related to the scale of the workable model in comparison to reality and the differences of approaches (de Ruijter, 1981) towards the acquired data from these two. According to Thomas Kuhn's understanding of the paradigm, society not only determines what topics scientists will be interested in but also influences their assumptions.

This situation is also seen in space syntax studies. Not only the pragmatic uses of research studied in the office and hospital staff's effective working goals (Hillier and Grajewski, 1987; Penn et al., 1999; Koch and Steen 2012; Sailer, 2007) but also dichotomies play a major part in the literature such as global or local, strong or weak, inhabitant or visitor and such. For example, the mechanical and statistical models of Lévi-Strauss were the initial idea of strong and weak programs of space syntax literature (Hillier, Hanson and Peponis,1984; Sailer et al, 2013). It seems to us that scientific determinism forces us to think in dichotomies and generalise the situation towards inductive modelling. In a post-structuralist era, however, rather than

dichotomies that point out to distinctive classifications, we may as well notice the exceptions brought by perceptions of cultures, personal differences such as gender, professional roles, and life cycles. Thus, in this study, we showed that forced dichotomies do not always apply to cases and that a new approach towards the latent aspects of space should be considered.

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