

Interaction/Cognition in Design: The Red Bull Station's Classroom Case Study

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Abstract. The present article aims at observing the possible interactions/cognitions of users, based on the activities and events that take place in the built spaces of a public building wherein educational, ludic, creative and experimental experiences occur. In this investigation, we will focus on the building that houses the Red Bull Station in São Paulo, Brazil, in particular the spatial arrangements of the Classroom, as they have been adapted to provide great flexibility for the artistic practices that are developed following the curatorial and projectual proposal. In the proposed study, the object of analysis are three situations that occur in the venue's auditorium, which elicit and foster interactions and cognitions resulting from and rooted in a variety of content knowledge. The analysis of the aforementioned space is performed based on an understanding of the Classroom as a complex and fluid system, whereby the relations between the user and the built environment are alterable and articulated with the spatial configuration in which they occur. This condition foregrounds the great relevance of both the vision and the actual architectural design of the Classroom, as proposed by the Red Bull Station for the occupation/participation/experimentation of the user, whereby a crossover of educational, creative and cultural activities takes place. For this reason, the diversity of spatial arrangements provides a noteworthy experience, which stimulates and fosters open interactive engagements and encounters. The Red Bull Station's proposal is articulated with a significant level of complexity, which allows for a constantly changing space, affording projectual flexibility to the project. Ultimately, this expands the possibilities for interaction and fosters a dynamic creative and cognitive process. As a result of the study, it can be observed that the Classroom's projectual design provides much potential for interaction between the space and the user, and a high level of adaptability which enables a broad range of activities to be carried out.

Keywords: Interaction · Cognition · Classroom · Design · Spatial arrangements · Systemic complexity

1 Introduction

This paper is an investigation into the discussion of the possible user interactions/cognitions that stem from the spatial arrangements of a built environment set up within a public building, where a range of educational, ludic, creative and experimental

activities is carried out. The study centres on a cultural venue called the Red Bull Station¹, which runs in a building located in the heart of São Paulo's city centre, in Brazil. The Red Bull Station's activities take place in the building's auditorium², and the programme follows a projectual approach that defies the notion of a centralized, rigid structure, operating with a high degree of flexibility and adaptability. The artistic practices developed in this space broadens users' experience by promoting experimentation, occupation and participation by the public. In addition, the programme fosters a process-based dynamics of interaction and cognition with a profusion of highly diversified content.

The Red Bull Station is housed within a historical building that was originally an old power station, shut down in the early 2000s³. With support from the Austrian company Red Bull GmbH, the space underwent extensive rehabilitation/restoration work, carried out by the architecture firm Triptyque, and was re-inaugurated in 2013. From then onwards, the Red Bull Station's programme has been run by curator and artistic director Fernando Velázquez, and the overall proposal follows many of the notions we propose to discuss here concerning a free-flowing approach to the configuration of spatial arrangements and their potential variations, promoting a range of situations for user interaction/cognition with the site itself.

In developing this reflection it is important to turn back to the first lines of investigation into the projectual conception of classrooms, auditoriums and other communal areas in schools or public venues as presented by architect Neufert et al. [1] in his reference book *Architect's Data*. He objectively and systematically drew up an instructional handbook for designing architectural projects, with protocols that determine the spatial requirements in building design and site planning. Neufert's guidelines are regarded as fundamental principles, and include scalability rules, rules for furniture arrangement and for the maximum capacity of users to occupy the projected spaces.

Following the same line of parameterisation of architectural projects, in *Human Dimension and Interior Space* [2], Panero and Zelnik describe the spatial relations of the human body in internal environments, drawing up projectual guidelines according

¹ The Red Bull Station is part of an international project known as the Red Bull Studios, set up in 10 cities across the world. As part of this discussion, we will focus on the Red Bull Studios São Paulo. <http://www.redbullstation.com.br/> and <http://www.redbullstudios.com/saopaulo> [Accessed: 1 March 2017].

² Although the space is known as Auditório (Auditorium), for better understanding we will call it "Classroom", as this term encompasses the spaces wherein a variety of activities are held and afford a high level of dynamism to its spatial arrangements, which are modified according to the needs of the activities proposed.

³ For the renovation of the building that houses the Red Bull Station, it was necessary to respect the regional norms for the preservation and conservation of cultural heritage, which, in this case, determined that the original façade of the building was maintained. This included the restoration of all parts of the façade that had been deteriorated with the passage of time, due to lack of maintenance and years of neglect. In regards to the configuration of the interior parts of the building, the regional norms did not specify preservation works as a requirement for occupancy and use of the building. Nevertheless, the architecture firm decided to maintain the identity of the building, including various finishes and surface materials, apparent structural elements, original internal doors, besides maintaining part of the collection of industrial parts and objects from the old power station.

to the activities or function developed in a wide range of spaces, including educational spaces such as classrooms and conference rooms. The authors present typical layouts and fixed spatial arrangements, employing predetermined frameworks and dimensions wherein ergonomics and anthropometry are used as the main reference.

Yet, it is possible to affirm that an extremely functional project, as those put forward by Neufert, Panero and Zelnik, ultimately renders the space rigid and inflexible, imposing limits on the user's use and occupation, and overlooks the activities proposed for the space as an important factor in its organization.

Following a different line of thought, in *Lessons for Students in Architecture* [3] Dutch architect Hertzberger puts forward reflections on classrooms that go beyond the physical demarcation of space. The author argues that built environments should stimulate appropriation by the user according to his desires, whereby "the point therefore is to arrive at an architecture that, when the users decide to put it to some different uses than those originally envisaged by the architect, does not get upset and confused and consequently loses its identity" [3].

In this way, it is possible to find holes in these investigations, as the spatial arrangements proposed by the authors do not take into account or anticipate changes in the activities being carried out in the space, thus limiting, to an extent, the possibilities for interaction and cognition, seeing that, once users are already acquainted with the spatial organization that has previously been set out for them, or come across traditional arrangements, the interaction is bound to be influenced by the norms of behaviour established by the projectual design.

However, when the user is faced with a more fluid spatial arrangement, one that is constantly changing due to the demands of certain activities, the projected place can potentially enhance interaction and cognition, seeing it enables greater movement and displacement of the body in space.

In this sense, the Classroom, located in Red Bull Station, dilates and broadens the meaning of occupation to include participation and experimentation in activities, expanding users' experience and interaction with a diversity of spatial arrangements, in turn promoting the interaction between users and content. Based on this observation, it is important to note that the configurations of spatial arrangements open other cognitive paths and enable an interactive experience that dialogues with the same space, but in different projectual situations, on account of the objects, furnishings and equipment being used and of the stimulus provided by the content itself. In this perspective, the Classroom is understood as a complex system where the spatial organization is promoted through the interaction of its agents, represented by all the elements that compose this space.

The relevance of this study lies in its ability to make us see the potential that resides in the space of the Classroom for educational activities and for experimentation, in other words, as a place where creative actions can unfold. Even though the cognitive process is unique for every individual, as an agent that takes part in a system, he comes under the direct influence of the interactions generated by the experience that the space produces, not only by means of its physical limits, but also from the interferences caused by the uses it is put to.

In this text, the analysis of space is understood as a complex system [4], particularly due to its adaptability and its free-flowing projectual proposal [5], which allows

interaction between its agents, namely, in this case, the Classroom and the elements that compose this space, such as the furniture, equipment, content and the actual users. In this condition, it can be identified that when interaction takes place unpredictable behaviours manifest themselves, seeing that interaction and cognition are conditioned to the situation in which the agents find themselves [6]. Users' interaction will be analysed based on their distances and on the synaesthetic experiences that arise from this condition [7, 8], with the stimulation or inhibition of the senses.

Therefore, it can be accepted that the flexibility found in the Classroom at the Red Bull Station enables the study of interaction/cognition which this article sets out to investigate, as this space can be used to host events that range from small meetings, with an attendance of ten to fifteen people, to lectures for a public of up to 110 people. In addition, the type of furniture being used can also vary depending on the need of each particular project that is carried out in this built environment. The space can be furnished with tables for workshops, and rows of chairs for the audience can be arranged in front of a small stage that has been set up as part of the architectural plan, chairs can be arranged in a circle for debates, sofas and cushions can be laid out for film screenings, and ultimately the space can be used without any furnishings at all.

At the end of the study, the investigation performs an analysis of three situations of interaction and cognition, from events and activities - lectures, workshops and film screenings - held in the Classroom at the Red Bull Station, all of which entail changing the layout of the space, both in regard to the typology of the furniture as well as the way it is arranged. In this way, as part of the proposal for the Classroom there is a free-flow approach to occupation/participation/experimentation, seeing that its spatial arrangements constantly change their configuration and function according to a diversity of activities, whereby adaptability becomes a key, necessary element.

This study on the reorganization of a multi-use space and on the ways that the interaction that take place within it are promoted can potentially contribute to the broaden our understanding of existing spaces in other buildings and sites which share the same characteristics, and also to future projects developed by creators who seek to promote in-built spatial fluidity, allowing for a high level of dynamism in the process of interaction/cognition.

2 The Classroom's Interaction/Cognition and Its Systemic Complexity

This approach is based on a vision of the world, understood in this text as a systemic complexity, in which the events do not present a linearity nor a Cartesian order, for they are far from a functionalist and rationalized approach that reduces people to resources or means of reaching certain objectives [5].

The discussion with regards to the actions and the activities of the Classroom at the Red Bull Station is understood as a complex system, because the configuration of its different spatial arrangements allows for the adaptability of the space. These arrangements, in turn, unfold into a proposal of projectual design with fluid and flexible characteristics. The user of this space is open to the propositions that stimulate the articulations between the agents and expand the interactive and cognitive possibilities

with the spatial experiences. It is emphasized that, in the events that occur in the Classroom, in a complex system, user's behaviours are not always predictable [4].

In this sense, the aim of this investigation is analysed as a space adaptable to the specifications of the three chosen activities, as, for each event there is a variation in the format of spatial arrangement.

These distinct formats explain the condition of adaptability because they are actions with particular characteristics. Activities in the form of lectures, workshops and film screenings were chosen to highlight, in this article, the possible projectual design variations in a system, and how this space, which is apparently static, is rendered dynamic by the action between agents. For each activity, the architectural project presents a reorganization of furniture and equipment, which attends to the content, occupation, participation and experimentation of the user.

As a result, the relations between the system's agents produce significations interaction patterns and temporary configurations that can always be redefined or readjusted [6], as can be observed in the three selected proposals, which will be developed further along.

Varela [6] also adds that the system possesses agents and agencies, in which, these definitions depend on the scale in which the space is observed. An agency can be observed as a group of agents interacting with each other, in which, as the focus is modified, a new group can also be understood as an agency.

Another issue concerning the Classroom environment is that it promotes the formation, from lived experience, of creative and experimental processes, which is highly relevant, as according to Driscoll [9] it is necessary to consider that the cognitive process is not limited only to the formats and places of traditional learning. Learning is a persistent change in the performance or in the potential to perform, arising as a result of the learner's experience and interaction with the world.

Cognition becomes flexible and continuous, in establishing and enhancing connections, as well as making decisions, which are fundamental processes for the constant and desirable updating of knowledge. In this way, the cognitive process occurs in the collaborative networks promoted by the space. For this, the challenge of keeping the user engaged is identified, promoting spontaneous interactions with other agents which are involved in the process of interaction-cognition, such as the speakers, other users and interactions with the content itself.

According to Rogers et al. [10], one of the ways to analyse the spatial arrangement relates the interactions that occur from the user experiences, which are understood as: user – user, user – instructor and user – content.

The Red Bull Station Classroom has technological devices that interfere in the built environment when used. In the case of film screenings, the screen is positioned in a particular spot, where there are no distracting elements or interferences between user and content. When it comes to a lecture, we become aware of the mediation of the content by the lecturer, and the screen is positioned in the foreground, functioning as a supporting tool.

According to Hall [7], the space's characteristics only become visible when the user's behaviour is observed, in other words, when particular activities are promoted where people behave in different manners. Still according to the author, human's sense of distance is not static and has very little to do with the linear perspective of a unique

point of view. It is observed that perception is dynamic and is related to the action, that is, it interacts with the activities that are carried out in the Red Bull Station Classroom.

Cognition becomes flexible and continuous as it establishes and enhances connections. This condition enables the individual to make decisions and take new directions, which in turn are essential processes for the constant updating of knowledge. In this way, the interaction between the agents of the system, despite presenting a non-linearity, a high level of dynamism, an ambivalence and an ambiguity which insinuate a disorderly functioning [5], show an organization which manifests itself in a flexible manner, where the users constantly and continuously influence and are influenced by their surroundings and their relations with the environment.

3 Interactions According to Distances

The projectual proposal that concentrates on the spatial arrangements for the carrying out of particular activities determines the distances between elements that compose the space. These activities, in turn, are determinant in the interaction and in the sensorial experiences of the user. According to Hall [7], synaesthesia related to proximity results from the user's articulations with their surroundings. In the opinion of the author, users interact with the space as a consequence of their synaesthetic senses, such as vision, touch, smell and the thermal sense, can be inhibited or stimulated by the environment.

Therefore, it is possible to affirm that experiences will occur from interaction and from the synaesthetic relation of users with the environment and with the content as well. As stated by Dewey [11], experience is a transaction that that occurs between an individual and his surroundings, whereby the interaction between them generates longitudinal and transverse aspects.

Within this perspective, the user's experience is one of the most important factors when an activity is being carried out. In relating interaction and experience, it is possible to observe that the distances that arise between the users and the content enable particular senses to be enhanced. Thus, the more synaesthetic relations the user has, the greater his experience.

Hall [7] defines four distances related to the interaction of agents within a system, which are termed the intimate, personal, social and public distance.

3.1 Intimate Distance

The intimate distance indicates a relation in which sensory information is potentialized, wherein interaction occurs with all the senses, promoting a complete synaesthetic experience. Sensations of discomfort may occur when the distance between the agents is imposed by the spatial format, for example, in the case of an interaction in an elevator [7].

3.2 Personal Distance

The personal distance indicates a relation of proximity, but the sensory information between the agents regulates itself. This distance allows synaesthetic experiences to arise without sensations of discomfort, as in the intimate distance.

3.3 Social Distance

The social distance indicates impersonal relations between the agents, and the amount of sensory information is reduced. At this distance the synaesthetic experiences decrease and physical contact does not occur.

3.4 Public Distance

The public distance indicates a formal relation between the agents in which there is no sensory information from physical contact, and the sense of vision and hearing are compromised.

Scott-Webber [8] interprets Hall's theory [7] by analysing sensory information and behaviours oriented towards interaction, based on the distances between the agents in the proxemics zones, as can be seen in Fig. 1.

ATTRIBUTE	PROXEMIC ZONES			
	Intimate	Personal	Social	Public
Distance	0 - 18 inches	18 - 48 inches	48 inches - 12 feet	12 feet - 25 feet plus
Sensory Information	Vision is blurred Smell and sense of touch are fully engaged Body heat is experienced All senses are heightened	Normal vision Smell is strong and touching is engaged Body heat is experienced	Reduction of: sense of smell, ability to touch, visual details Voices get louder No body heat sensed	Facial expressions and gestures are exaggerated Considered a formal distance
Accepted Behavior	Physical contact Kissing, hugging, nursing, or procreation	Grasping to just touching Holding hands, walking arm-in-arm	No physical contact Impersonal business occurs Interaction among casual acquaintances Space used to screen others out	No physical contact Formal behavior

Fig. 1. Proxemic zones [8]

4 Methodology

- The Classroom at the Red Bull Station was identified as a space in which the spatial arrangement articulates itself with a diversity of activities in the contemporaneous context, enabling a multiplicity of uses.
- The Classroom at the Red Bull Station was analysed as a complex system, taking into account characteristics of adaptability, complexity, flexibility and non-linearity in its spatial arrangement.
- To investigate the potentials for interaction offered by different spatial arrangements from this build environment, three configurations were selected, namely, lecture, workshops and film screening activities.
- Concepts of distances between agents, their interactions and perception of proxemics zones were articulated.

5 Results and Discussions

Interactions between agents in the system were investigated based on the selection of three spatial arrangements, which accommodate lecture, workshop and film screening activities, arriving at the following results:

5.1 Activity: Lecture

Spatial arrangement project: chairs placed in rows, sofas set against both sidewalls and a sofa set on the stage (Fig. 2).

Interactions analysed:

- (a) Instructor – instructor: the lecturers are positioned at an intimate distance from each other.
- (b) Instructor – user: the lectures and most of the agents are positioned at a public distance.
- (c) User – content: users are positioned at public distance from the content exhibited on the projection screen.

The spatial format for the lecture activity predominantly promotes interaction at public distance, except for the lecturers themselves who are positioned at intimate distance from each other. In regards to the experiences of proxemics zones, a variation occurs between multiple sensory information from the agents at intimate distance, and also significant reduction of synaesthetic relations at social distance (Fig. 3).

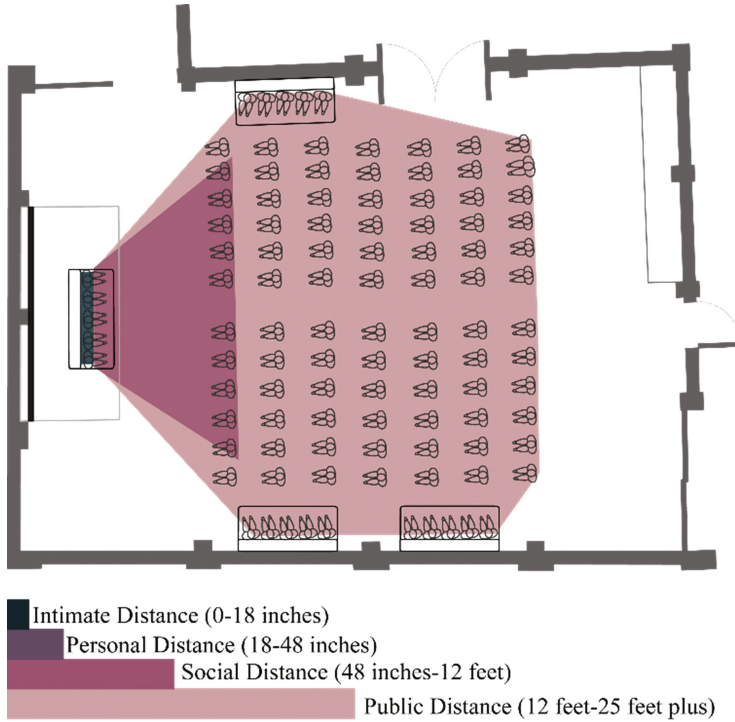


Fig. 2. Spatial arrangement for the lecture activity



Fig. 3. Spatial arrangement for the lecture activity. Credit: Red Bull Station. Used with permission

5.2 Activity: Workshop

Spatial arrangements project: tables are arranged in the Classroom forming small groups (Fig. 4).

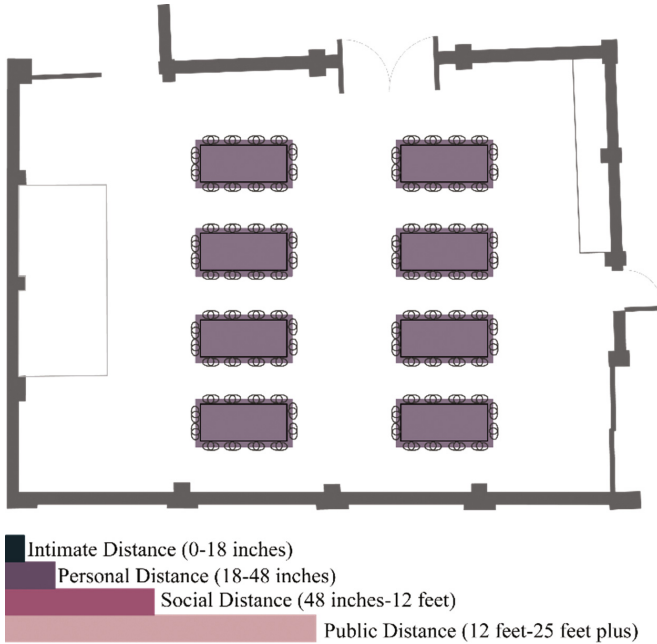


Fig. 4. Spatial arrangement for the workshop activity

Interactions analysed:

- (a) User – user: users interact at a predominantly personal distance.
- (b) Instructor – user: the instructor manages to interact with all the agents at personal distance, according to his movement around the Classroom.
- (c) User – content: users are able to interact with the content on the main screen at public distance, and with the content lying on top of the table, including computers, at intimate distance.

The spatial format for the workshop activity predominantly promotes interactions at social distance and this configuration allows the instructor’s circulation around and between the tables. With regard to the user – content interaction, interactions vary between intimate and public distances. Regarding the experiences of proxemics zones, a relative stability and a balance in variation of sensory information may be considered, in relation to other arrangements (Fig. 5).

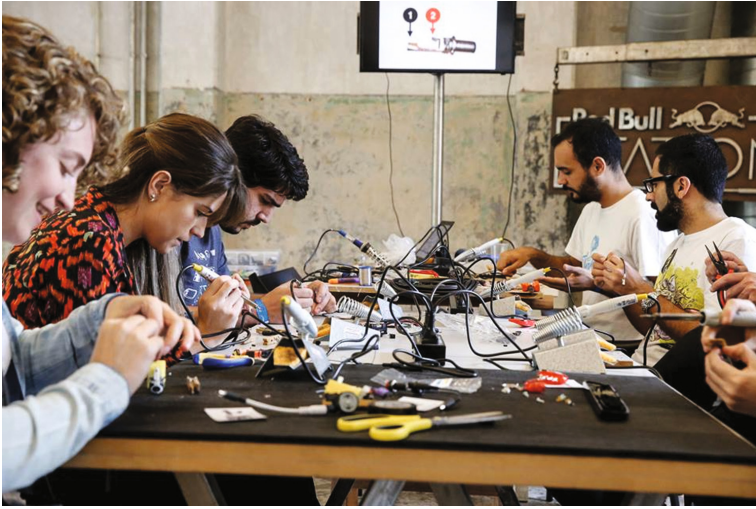


Fig. 5. Spatial arrangement for the workshop activity. Credit: Red Bull Station. Used with permission

5.3 Activity: Film Screenings

Spatial arrangement project: sofas and chairs are arranged facing the projection screen (Fig. 6).

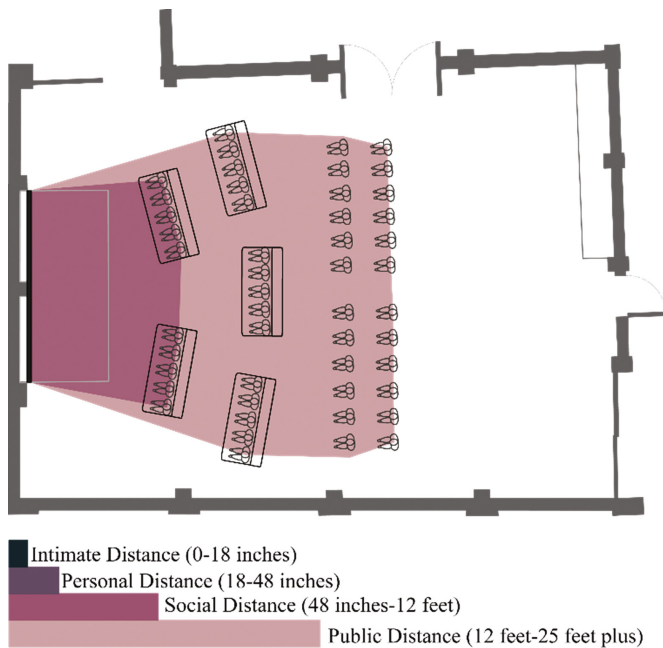


Fig. 6. Spatial arrangement for the film screening activity

Interactions analysed:

- (a) User – content: users interact with the content on the main screen predominantly at public distance.

The spatial format for the Lecture activity primarily promotes an interaction carried out at public distance. In regards to the experiences of proxemics zones, it is hoped that a reduction of sensorial information can be achieved. However, even though the users are positioned at a social and public distance from the screen, it is relevant to take into account the power of immersion of the exhibited content (Fig. 7).



Fig. 7. Spatial arrangement for the film screening activity. Credit: Red Bull Station. Used with permission

In this paper, we have investigated the hypothesis that the different spatial arrangements of the Red Bull Station Classroom, configured according to the activities being offered, promote different interactions between agents and broaden cognitive and synaesthetic experiences.

Here we consider the ways in which the projectual proposal interferes in the interaction of the user and how it potentializes cognition during the experiences with the various activities. It is important to highlight how systemic complexity is in effect in daily life, as this article recognizes that the lived experience of a situation of spatial adaptability and flexibility promotes a change in behaviour and dilates users' possible responses to occupation/participation/experience. Moreover, knowledge creation takes place as part of a dynamic creative process in which users are open to stimuli from their surroundings. In this way, this analysis identifies three spatial arrangements that encounter potential deviations, evolutions and directions according to each particular experience.

Another point of interest in this approach, which is important to note, is the relation between the elements in the space, as the connection established between the agents is realized in such a way that the interaction/cognition becomes unpredictable and flexible, and this condition, in turn, promotes a variety of openings and connections for each element in the space. Within this context technology is one of the crucial elements, because it is instrumental in improving and extending the content's reach and in stimulating user experience. Thus, the experience of the user in the built environment occurs through their interaction with the agents, arousing their synaesthetic senses.

6 Conclusions and Future Work

In this article, we have proposed to discuss the ways in which proposals for different spatial arrangements lead to synaesthetic experiences based on the interaction between agents of the complex system of the Classroom.

In relation to future developments, this investigation opens many windows of opportunities for analysing spaces like the Classroom, based on distances or types of interaction. It also opens up the possibility of performing this analysis in other spaces with similar characteristics, in order to find new projectual practices oriented towards spaces or venues like the Classroom.

In this sense, it is considered that the research study took on an exploratory character vis-à-vis the possibility of promoting interactions at different spatial distances. The study has opened new avenues both for a qualitative and quantitative investigation of interactions in a complex system like the Classroom, taking into account other projectual variables. By way of analysis of the interactions based on the distances between agents, designers can plan spaces that are aware of the action that different spatial arrangements can generate in users.

Additionally, spaces like the Classroom studied in this paper enable the participation of remote agents via technological interfaces and human-computer interaction (HCI), expanding the reach of the distances addressed in this article.

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