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The Kinetography Model – a Mean of Producing Space Scores, Based on Recording Users' Movement in Space

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Abstract

When one enters a space, perceives the material geometry of that space. Walking inside buildings or across the city is generating a geometry of moving bodies that fills the space. These two geometries coexist: a static geometry of the space and an invisible one of the moving bodies. The space that we actually experience, whether interior or exterior, is a continuous network of voids. Individuals' movement will fill the network of voids that we understand as "the city". Our environment of voids and borders is organized by the means of architecture and urbanism. The geometry generated by motion affects both the limits and the voids, thus space can be defined by the tandem of the moving bodies and their environment. We propose in this study a mean of investigating users' movement and thus understanding the qualities of space while introducing the concept of space scores as analytical maps and design tools.

Keywords: Kinetography, Labanotation, Movement, Space score, Users' Interaction.

1. INTRODUCTION

Movement - this succession of moments of transition from potential to kinetic energy represents a possibility of viewing and analyzing the spatiality of the architectural object, of the city or territory. Thus the aim of this study is to highlight the value of the interaction processes that happen between the moving individuals and the space, as the internal set of reciprocal relationships that affect both the space and the users.

Space score is a concept that we propose in order to bring into dialogue architecture and choreography, with regard to the relation between spatial shape and human processes: architecture through its main purpose – space, and choreography through its science of recording and translating the movement of bodies in space. Concerning this relation, the main reference for the study is the Laban Movement Analysis and Dance Notation System: a movement theory and practice that we have identified as a potential tool for understanding and designing spaces (e.g., [10]).

The method of motion recording is well known and used in various fields of science and knowledge. Without being descriptive or mathematical, kinetography can become a mean of spatial recording and quantification. The notation of movement is analytical and brings the dynamics of time and space into question. It produces a meta-text, based on a complex process and the correspondence between the graphic sign and the information it encodes. The notation is similar to an executable code because it reproduces a certain movement pattern it has previously registered and thus is valid as a tool for producing also space scores.

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2. THEORY

Kinetography or Labanotation was conceived by Rudolf Laban (around 1928) in response to the need to transpose the dance into a sheet music-like score and gained an important role in the study of movement in time and space. The human body is decomposed according to the parts that can support the movement, and translated by signs and symbols, in a very clear alphabet, which also indicates what part of the body is moving, in what direction, as well as the nature of the intensity of movement. In a short time, Rudolf Laban the author of the choreographic notation, has come to develop this objective and a specialized method of observing movement and explaining its nature and its qualities for people. His applications can be used in space design with the aim to improve the relationship of man to his environment through the study of movement, and to bring knowledge in the field of practical design.

Another common point that can link this model to space design is that the Laban notation refers to the scale of the human body. The movement of the body is first decomposed according to three planes: horizontal, vertical and diagonal / sagittal. The composition of the movement in these planes produces the image of the kinesphere - a very important notion for the present research. Any form of movement will produce a specific geometry, namely the kinesphere: „*the ultimate reach (of movement) defining the limit of our Kinesphere – «the bubble» in which we all move*”. (e.g., [7])

The movement within the three planes defined by choreography can be quantified in terms of volume and space, as it varies between the extreme values: the maximum of openness and intensity are forming the kinesphere. One of the results produced by Rudolf Laban's kinetography is that each individual has their own way of shaping movement, and executing it. Thus we can also talk about communities or groups and their specific spatial forms such as bird flocks, animal herds, fish banks, bee colonies or groups of people.

Laban's Movement Analysis is a revolutionary approach not only because it conceptualized movement but also because it worked scientifically putting the basis of choreutics and eukinetics. Choreutic notions refer to the architectural and sculptural aspects of movement, which are based on patterns of nature and of man as part of universal design or space harmony. Eukinetics refer to the qualities of movement like strength, control, coordination, intention. Each movement contains both aspects: spatial form and coordinated effort [3], as well as relationships in space and not just movement of body parts.

From the conceptual point of view, the definitions of space emphasized by Laban are of great interest. Space is a quality of effort as defined by Laban and refers to the relationship between the force that produces the movement and its environment or surrounding space. The body adapts its movement and energy to explore the environment according to its nature. For this reason, effort is a function of the surrounding space. If space is the whole kinesphere, the full extent of the bubble in which we move, the effort in space is the quality of the movement we use to explore the whole kinesphere.

3. EXPERIMENT

Individuals or groups build their own perception of the space of a building or of the city. In the first hand, this perception is related with experiencing any environment through movement (e.g.,[1,8]). The mechanisms based on motion that occur amongst people and their spatial environment (e.g.,[3]), are similar to those that stand between dancers and choreography. The performance of the dancers is in essence a space unfolded in time. This approach aims to bring the discussion about space into a different light, making visible a set of less obvious spatial qualities and new generative means for design. The Laban model was chosen as relevant, because in contemporary times, movement is the basic interaction parameter in conforming and experiencing spaces.

Starting from the example of kinetography, we question if there can be space scores generated based on the users' movement and if the kinetographic recording can be a tool for understanding and approaching existing spaces and even improving these spaces, by modifying the way people move inside. In practice the conventional space plans, sections, elevations or maps that render only static aspects can be completed by movement scores.

With the study of the moving body during the dance, Laban's research reaches as far as dealing with the

movement of the car or even robots. The transition from kinetography or the expression of dance to an analytical tool has made his ideas produce applications in the most varied fields, from industry, agriculture to ergonomics (e.g.,[2,5]).

In order to apply this model in the field of space design, we propose to observe and analyze users' movement in terms of direction, orientation, speed, acceleration –meaning those parameters that provide clues about its development in space. From a technical point of view these parameters represent also the effort of the mobile mass with its concentrations and detentions over a continuous period of time. As any physical phenomenon the movement of an element accompanied by the necessary state changes, or the potential energy of interaction can be recorded graphically and mathematically, in order to show the trace and the points of intensity and energy change. The effort, the vertical axis of the moving body, the movement, the center of gravity, the direction vector and the speed of movement are the elements that underlie the notation of movement - essential elements that generate the continuous change of the energy state of a body. All these rendered together produce visualizations and diagrams complementary to the classical tools of space design. This explanation of movement is essentially a quantification of the interaction space. The continuous phenomenon of potential energy transformation is recorded by the means of kinetography. We propose the interpretation of these data by the architect and their translation into elements for designing and upgrading spaces.

Related to improving the relation between humans and their surrounding environment, we propose to focus on their natural movement, as the primary movement. According to different studies, when our motion becomes mechanical it affects the exploration of space so that the relation of the individual with his environment becomes mechanical too (e.g.,[8]). We consider there is a generative connection between spaces and the movement of users and that the designer has to investigate and to manipulate this. Thus, the Laban notation opens a deep and scientific analysis of the movement of people in space. Studies on the rhythmic movement of workers in factories, or people in subway stations, or in parks that Laban has carried out bring not only the relationship of people in space and the regulation of flows, but also the conformation of space and its modification according to the pattern typical of each person's movement (e.g.,[4]). These studies are particularly interesting because they are showing how to operate with flows of people and activities, with the effects of collective interactions that also leave their mark on space and which in turn are obviously influenced by space. The notation graph thus produces the visualization of the flow of movement of a body or of a crowd - a useful image in the architectural spatial analysis.

Another perspective related to space is that the model can operate also with design elements such as forms of perfect solids, composed of triangular or regular faces - the cube, the pyramid, the octahedron, the icosahedron and the dodecahedron. The human body is inscribed as geometry in these solids and the alphabet of movements is transposed into symbols depending on the relation to the faces and corners of the circumscribed solid. So we can generate a space by placing these faceted solids or shapes to highlight and to control the volume and dynamics of the movement. In our point of view this is another possible tool that can be introduced in the design of spaces for generating and manipulating complex geometries.

Nevertheless along with the scale of proportions established by Le Corbusier's Modulor or the Vitruvian Man, as the main scales referring to the human body applied to space design, we propose the focus on the scale of the bodies in movement, as a more suitable reference for contemporary contexts.

4. RESULTS AND DISCUSSION

Some of the first applications of Laban's theory were focused on the movement of people during work, the efficiency of the work and the performance level in actions that involve the movement of the body. This implies observing movement according to time, space and the effort made in making it. Effort notation and analysis has revolutionized the method. One of the scientific results of kinetography refers to the existence of a unique model of movement characteristic of each individual, with implications in how the individual performs any task both from a practical and mental point of view. This emphasizes how one's natural movement pattern can be efficient or not and how residual movement can be modified and improved, or how spaces can be adapted or modified in order to enhance users movement.

Second, the scale flexibility and the functioning of this model are obvious: from the scale of body parts, to

the scale of the individual and collectivities, from the movement of disabled bodies or body parts, to the most effective and performant entities. This opens a broad potential of developing a new tool for both object and space design: from body prosthesis to robots, from analogous to digital, from individuals to roaming collectivities.

Therefore according to kinetography, the movement is depicted by effort, which depends on the relationship with the pre-existing space as the environment in which the movement takes place. Thus it can be stated that from the perspective of architecture and the study of space, the vision is perfectly valid, the connection between space and movement is one of reciprocity. The weight of the movement is a parameter that can be entered in the matrix of conformation of a space. It should be noted that the qualities of effort as can be analyzed in terms of how they are influenced by the existing space, and vice versa.

As a result we find relevant the definition of space based on the notion of flow that reflects the connection between users and space. A space can produce a certain flow of user movements, and the analysis of this flow contains clues about space and its morphology and qualities as effects on users. Manipulating the flow and applying it to the effort or form, will change the appearance of the movement and will produce a different reality, so a different relation with the space. In connection with the effort, the notion of flow indicates a more sustained or easier control, constraint or release, while in the case of the shape it operates on the space bubble by increasing or decreasing it (e.g.,[7]). Manipulating the flow in space design can produce points of intensity and interest but also areas of openness or restriction.

Regarding the spatial flow-shape relation there are typologies of users occupying and exploring spaces (e.g.,[6]), patterns and ways in which certain categories of users generate their own type of kinesphere (expanded or reduced), influencing the spatial morphology at a greater scale. Vice versa, the scale of the space influences also the movement and size of the user' kinesphere, namely: a person will move in a certain way and with a certain magnitude in an open and generous space and in another way in a restricted space. The relation between the human scale and the space can be observed deeply through the movement of different groups of people. The relationship remains mutual: a space will induce a certain flow, and the flow will account for the scale of the space and its qualities.

5. CONCLUSION

The understanding of the cotemporary space both architectural and urban is done by analytical and critical methods related to the users' forms of interaction, among which movement is one of the most important interactions. The nature and form of the interaction creates intensity and activates the space. The movement, interpreted as an executable code, becomes interesting insofar as it manages to produce new analyzes and new spatial scenarios based on real phenomena which will affect the space and the user. The space of the city structure faces complex phenomena both at functional and morphological level (e.g.,[9]), especially since mobility is the key word of the present. Conceptualizing the idea of space score on the basis of both philosophy and generative code, helps to underline the potential and the practical role that kinetography can play in spatial analysis. Kinetography is in our view an important mechanism involved in the design of space. It is identified with the structure of the movement, while the kinesphere of user processes provide a visualization of interaction manifested in space. That is why the spatial form of all kind of interactions, is important in future design as a latent potential that need to be practically approached.

Looking at the urban space through choreographic scripting can be an important future development. As an application of the kinetographic model, we propose to generate visualizations of the human processes that involve motion and that shape the city and the buildings. These visualizations will be the result of overlapping architectural and choreographic means on mapping motion in certain public spaces. It will be in the same time an investigation about the actually condition of the metropolis: its intensity, its spatial qualities, etc. that the public will acknowledge.

The development can have different stages and immediate results for improving the qualities of spaces: first mapping aspects of daily life form public urban spaces - aspects concerning motion and direction, rhythm and pause, flux and flow of movement, that will afterwards be translated with the aid of choreographic notations,

subjected to architectural interests, and represented in a visual manner so that can become accessible to public and to specialists as an operative design tool. This means also complementary adaptations of a system of notations on more of the parameters of human processes that occur in space, and that can't be quantified with the classical means of architecture and urbanism.

The several situations revealed will become reference points for the quality and the structure of any metropolis. From this perspective, a parallel will be possible between the visualized spaces and similar ones from different cities that are successful in relation to their users. An archive of comparative cases and situations can be gathered in this way, in order to provide a starting point for any future intervention or projects.

The scores of the urban spaces can become also a tool for classifying these spaces: the intensity of interaction, or the flow of movement in a given space, are linked to the qualities of that space, to its success and attractiveness to public. Understanding and becoming aware of the city scores means being able to tell if certain spaces are functioning well as parts of the urban structure. It also means providing a step forward to their upgrade and future development.

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