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Tactile Reality: the perception of space in the cultural heritage for people with visual impairments

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Abstract

This article has as theme considerations for environmental perception of people with visual impairment in environments of cultural heritage through the tactile perception. From the considerations, was made questions about as ergonomics should study the space of cultural heritage and the perception of people with visual impairment to promote accessibility by an information system that manages autonomy for their exploitation and recognition. From the "tactile reality" people with visual disabilities can create a tridimensional scene of a space from the perception of an haptic artifact like a tactile model, and with this information experience the real scenario.

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1. Introduction

People with visual disabilities represent an economically active population that conquest day by day more space in society and contribute to new ways of designing products and services that considers the difference, the ergonomics, the improvement of quality of life and accessibility. Currently, access to cultural heritage is still very limited for this population, because of the formation of Western culture, since its conception, the sense of sight was more valued to the detriment of others, which caused their exploitation through other senses have been little considered.

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However, it is considered that the combination of the other senses, especially involving the tact, is also able to make visually impaired can explore and recognize those property, in particular, of the built cultural heritage. In relation to the space built, some types of building, in particular the religious spaces, causing several senses at the same time, facilitating the perception of the environment even for an individual with visual impairments and intensifying their sense of belonging in the world. Due to the time they were built, most of the buildings that are part of this patrimony do not have accessibility, especially for people with visual impairment, either for its effective use as a religious temple or for visitation as well, with the need for cultural promotion of conditions managing autonomy to these people so that they can be explored and recognized.

The purpose of this article is to make considerations for lack of environmental information in the built cultural heritage for the visually impaired, since these are able to understand and explore the architectural space through other senses that not just through vision.

With what we call here a "tactile reality" bring a reflection of how people with visual impairment, from the way you perceive the space, you can build in their minds a three-dimensional scene from a real space from the perception of a tactile model and with that perception be able to experience, explore and finally recognize the scenario or real environment.

2. The perception of architectural environment

When man builds a building or architectural space he modifies his body and the outer nature. This built environment is able to affect the people who attend perfecting human perceptions and sensations. Even without an architectural form defined, it is possible that, for example, what is interior and exterior, open and closed, dark and light, hot and cold or private and public. Any enclosed space can set these sensations and turn them into something concrete. The built environment also defines the functions and relationships of people, these know better who they are to how best to behave when the environment is planned, and not simply when it is nature itself. Also teaches architecture, a monument or a simple housing can be a symbol. When there are no books or formal instruction, through architecture can be understood the reality.

The vertical and horizontal spatial dimensions, mass and volume are also experiences that the body knows, are felt, but these dimensions grow when they can be seen in a monumental construction [1].

Colin [2] say that the architecture has the ability to represent to people more than mere presence, not by physical evidence but for what transmit its forms. Recognize that architecture is experienced as language and that the physical elements of the architectural object provide communication tools through which other ideas beyond the strict formal settings universe can be transmitted.

A building can talk people's advance stage for which it was built, its aesthetic ideals, their way of life. Can still evoke military conquests and religious practices and witness mastery of who conceived and its moral concerns [2].

For Tuan [1] architectural space reveals and instructs, to the extent that there is a direct appeal to the senses, to the feeling and the subconscious. In a church, for example, both its exterior – volume, weight, height etc – as its interior – stained glass, pictures, candles, altar paintings and mosaics, and cross, plus other – contains signs that indicate the Christian doctrine with teachings and symbols that make the faithful respond with automatic often acts.

Vitruvius perceived that the vocation of the architectural forms to represent different things themselves, in other words, that the architectural forms have a symbolic vocation "in architecture should be considered two points: what is meaning and that meaning" [2].

To recognize the architecture is necessary to recognize these forms and their meaning, so the need for recognition of specific details, for its meaning, the characteristics of each, not only the sensation of inside and outside, but the characteristics of the place of her feeling the sensation of teaching.

3. Accessibility to cultural heritage

Due to the lack of professional training which takes into account accessibility content for professionals involved in the projects, are them designers, architects and even museologists, there is a difficulty in understanding the needs that require the different shortcomings. Often the ease in understanding the issues related to mobility causes are

disregarded more complex problems solutions such as access to information and spatial orientation, with a great importance for people with cognitive or visual disabilities [3].

Is function of professionals involved in projects on the theme finding ways of social inclusion by promoting accessibility to these goods with the same conditions and without discrimination, ensuring that all people who have desire to know and take advantage of this type of equipment will not be deprived of this right due to different forms of locomotion, perception and cognition they have.

For Dischinger, Bins Ely and Piardi [3], the spatial accessibility means much more than being able to achieve a desired place, it is also necessary that the site enables the user to understand its function, its organization and spatial relationships, as well as participate in the activities that occur there, all with safety, comfort and autonomy. That still stand for the good condition of spatial accessibility, the attendance of four components in its entirety are essential: spatial orientation, allowing people to be able to recognize the identity and the functions of the space in which they are and define strategies for your offset and use; communication, enabling the attainment of interpersonal information exchange or between people and assistive technology equipment allowing the use of the environments and equipment and access, understanding and participation in existing activities; displacement, with the possibility of individuals to perform horizontal or vertical paths, autonomously, safe and comfortable, free of physical barriers to achieve environments that wish; and finally the use that is given by the participation of individuals in desired activities, safely, comfortably and autonomous. The absence of one of these components entails the commitment of others [3].

4. People with visual impairment - limitations and abilities

According to Lima [4] one of the reasons for the questions about the limits and ability of persons with visual impairments is based on the belief and the philosophical basis of our society of Western thought with the theories that support the superiority of vision over the other senses. Within an Aristotelian philosophical thought, the vision would be superior to the other senses, as it would allow a better understanding and thorough knowledge of the world. For Aristotle the vision would have two preeminences on the other senses, one why would know and would judge more perfectly sensible things, another because it would show more things, and more differences in these things. This may be the cause of some policies and attitudes in teaching blind people doing with that many times the existing skills in these individuals are not developed [4].

From these beliefs, the question of the superiority of vision on the senses has been the subject of research by many scientists, especially in the last 50 years. Many of these searches have as their premise the superiority of vision, others, however, look for understand the other senses by themselves, without search to proof that this or that sense is superior to another.

Heller [4] says it is likely that if one sense is best to solve a given task and others don't compete with him to make it. For him, there are specific skills to the senses that only each of one can recognize how the color of a food that can only be recognized by sight, its temperature, which only the tact is able to perceive, and the flavor that only the palate recognizes.

To Lima [4], although a sense contribute to the other, in the absence of one or more senses, one person can perform a task, since her condition is given to do so, or if this task does not require the use of specific sense absent. This is because the resolution or good performance of someone is related to the conditions and not a sensory impairment which limits particularly.

Many researchers have get free themselves of the Aristotelian view about the superiority and necessity of vision and a quantity of jobs has emerged showing the capability and capacity of congenital blind people perform tasks previously only thought to people of normal vision or those who had visual experience, the blind adventitious.

About the ability of people with low vision or blind to understand geographic relationships such as distance, and configuration hierarchy, there are currently three groups who hold different positions. According to Kitchin [4], the first of them suggests that the vision is the space sense for excellence. For this group the congenital blind individuals are incapable of spatial reasoning because they never experienced the perceptual processes (vision, for example) needed to understand spatial arrangements. For the second group, people with visual disabilities can understand and manipulate spatial concepts mentally, but because the information is based on haptic clues (from the haptic system,

constituted by cutaneous system - distributed cells through the skin - and kinesthetic - muscles, joints and tendons) and hearing clues and that knowledge and understanding are inferior to those based on vision. Already for third group, people with visual impairment have the same skills to process and understand spatial concepts and that any differences, whether quantitative or qualitative terms, which can be explained by variables involved such as access to information and experience.

The sensations supposedly produced by the different senses can make a person to believe that the two senses (sight and touch) give us very different information about the world. Thomas Reid [4] and Gibson [4] attempted to clarify this issue, stating that while the sensations differ, perceptions can be amodal and can transcend sensory information [4].

4.1. The use of the senses

In relation to the recognition of space, it is believed that even if it is giving differently, this can be done with the lack of vision or with low vision that the individual still has, since available other ways to stimulate the other senses. The junction or combination of the senses allows recognition and perception of space.

Overestimate the visual channel like self-sufficient is misjudging the ability of perception of blind person. This, even with the absence of the sense of sight or with this compromised, realize the space, as well as organizes objects and communicates, through all your senses [5].

Even when it comes to understanding the use of the senses by people with visual impairments, we cannot disregard entirely the sense of sight, since, within the universe of these people there are those considered to be of low vision and who possess a residual vision. Their perception of the spaces however, differs completely from people that see, since they only see a portion of the image, depending on the type of pathology for which were involved [6]. This is fragmented, requiring the combination of its parts to the formation of the whole.

Dischnger [7] puts that in relation to people with visual impairment, disability or absence of the sense of sight, causes the sense of direction depends on more of the orientational and tactile references of individuals, being the sounds one of the most important means of realizing the exterior, following to a lesser extent by smells. In this case, the ears function as a receiver in attention to any stimulus from the environment, picking up information from all directions. The brain fit filter the noise information deemed important and desirable, or not, by the subject. So, the visually impaired, rejects with lesser intensity these stimuli, so if you use this sense with greater precision.

According to Tuan [1], people can identify the noise sources, and from this information, build the auditory space itself and the sound give impressions about space and increase your consciousness, also including areas that cannot be seen. So many objects and elements of the environment can be perceived, located and identified, and perceived their nature and trajectory in space.

The intensity of the sound makes that the ear receive information about the distance that the source meets. By experience, it is known that the sounds subside the intensity as they distance themselves from their sources. Another sound resource used by the blind people for perception of objects in space is the echo. They use the echo if your own steps for information of the presence of other objects and also have information about the objects in which the sound reflects [8].

The nose may also contribute to the recognition of objects and spaces. From experience by smell, is possible to recognize places, people and objects. In relation to blind people, the smell also contributes to the expansion of their knowledge about your local lived and the social relationships established in its day-to-day and helps them to understand, meet, recognize and study the various objects that make up the landscape of a place, whether natural or artificial [5].

As an immediate receiver, touch is one of the most important senses for the perception of people with visual impairment, in particular the blind people.

For Soler [5] touch is the sense that offers a wide variety of information to the human brain of the internal (I) and external (other). Tactile receptors are found throughout the entire cutaneous surface, connected to the nerve pathways that send the cerebral cortex a wide spectrum of coded signals. The identification of objects by the way of touch not happens just by touching them and explores them. It is necessary to develop a tactile sensitivity to perceive them and/or meet them.

Unlike the senses of sight (volunteer), hearing and sense of smell (unintentional), the sense of touch can be of two forms: actively (volunteer) and passive (involuntary). The tact is active when the person controls the stimulus, for example, when they take an object. It is passive when the person does not control the reception of stimulation as the temperature of a room [6].

Skin sensitivity is the sensory stimulation of the skin effect, but its surface is uniformly sensitive to stimulation. Even though all the outer surface respond to touch or pressure coming from the environment, the most of tactile sensitivity is in the parts of the body intended for orientation and exploration: hands and fingers, parts of the mouth and the tip of the tongue, especially sensitive due to the high density of innervation.

In the case of blind people, the way how it gives this stimulus, whether active or passive, makes difference in the perception of space. When a blind person captures the information acting actively, the touch is the extension of the body, the person captures an information based upon egocentric distance (distance between the individual and the object), unlike the eccentric distance (between two objects), characteristic of visual space where the person perceives form and estimate dimensions and distances.

It is important to note that the touch does not provide global and synthetic understanding, that the visual channel allows almost instantly. The tact composes the image of the object analytically as assembling a puzzle. The mental image formation of an object by touch occurs through the organization and assembly of "piece" with "piece". Therefore, the shapes of the objects should not be complex, like rich in details. For tactile stimulation for blind people, must be given a range of objects with varied shapes, however simple. The understanding of the complexity of shapes of objects will be according to age, level of maturity and experience of the individual.

The haptic system is responsible for perception of geometric properties, shapes, dimensions and proportions, in addition to weight and consistency of objects handled. Its base are the kinesthetic systems and skin. The kinesthesia is the perception of the position and movement of body parts, like posture, movement and spatial location of the members and of the movable parts of the articulated skeleton. The kinesthetic system, gives the individual consciousness of the static and dynamic posture of the body, and the cutaneous system gives the individual notions of out-of-body stimulation changes captured on the surface of the skin [6].

According to Shiffmann [9] affirmation, touch active, those that the kinesthetic and cutaneous stimuli together, arising from a farm produced by subject and purposeful (dynamic), is responsible for registering of information necessary to the haptic perception. Tactile receptors have the ability to register the degree of understanding of the skin by pressing an object, registering the sequel of deformations of the surface by moving the fingers when explores a tridimensional object, providing information on the form, as well as the frequency of ripples on the surface, where it has information about the texture. Along with the action of muscles and tendons, is also able to measure their consistency to tighten and identify your approximate weight when moving by hand.

So are the stimuli and information generated by these senses and how these are perceived by people are explained. What differs in blind people is the way they perceives, from further development and potentiation of the senses which feature.

But the perception of the environment is not made only by the information generated from the senses. It will also depend on the past experience, motivational and emotional state, and attitudes, prejudices and expectations of the person [6].

4.2. The perception of space by the blind

One of the fundamental differences between the perception made by the people who come, is the easy apprehension of space, once the vision gives dimension of almost the entire environment, made of integral form, at once, but, however, without stopping in the details. Already blind people have the perception of details, for them, all things are formed by fragments, which are not always able to understand in isolation. The look brings the finished object, complete, but not the other senses. For the blind people the details allow them to recognize and orient themselves, conceiving the space like a puzzle of fragments experienced, these fragments form the whole, while for the beholder, the whole is composed of fragments.

The blind people relate to the architecture, through other vehicles of perception, not vision. Even being heavily based on visual aspects, the production of spaces, brings, not only for the blind people but for all, dimensions of

smell, sound and touch also differentiated that allows to recognize, and even provide the spaces of a physiognomy [10].

Studies on environmental cognition of people with visual impairment indicate that the mind-body incorporates the experiences lived and acquired through internalization and the coordination of sensory systems at its disposal, in other words, their spatial orientation is provided by sequential references acquired mainly through the auditory, haptics and olfactory information, [11].

Merleau-Ponty [11] says that "the world is what we see and that, however, we need to learn to do" so, nobody can not consider that the perceived triggers the imagination regardless of the ability to perceive the world with all the senses [11].

In relation to the architectural space, the information most relevant to your perception are their spatial dimensions. Experiments conducted by Dias [10] shows that in the process of recognition of the dimension of the space by blind people, is formed by taking the person as a starting point, being through and from it that the space is configured, according to the measure of your perception. As the awareness of own selves is enlarged, the relationship with the world around them is being built.

On the issue of experience, when a blind person is exploring an area for the first time, she feels the need for a description of this, be it by any ways, before starting the operation, for the sake of safety and even to have autonomy to move around. This fact is given by the need to assemble mental schemes of spaces. These schemes, or mental images are much more refined than we can think, and comprise not only physical elements, seized by feel, but also counting steps, small changes in the texture of the floor, or even a sound or smell characteristic of certain space (use of all senses turned into information).

After "known", the blind seem abstract spaces, turning them into models that facilitate your orientation. When it comes to experience of interior spaces, it was realized that there is a kind of framing of space, where all the new spaces experienced are directed to other previously known. The construction of your mind map is given through differentiations of an initial model known and adapted [10].

The difficulties encountered in the perception of this space for people with impaired vision is emphasized by Dischinger and Bins Ely [12] and classified into two categories: the first when exists in space a precariousness or inadequacy of signs and references relative to the visually impaired with respect to sensory perception and identification and; the second when individual perceptual conditions do not allow the recognition of spatial information by the absence of previous experience of the individual against objects, images and places, decreasing its possibilities of action and participation in the environment.

Frois [12] presents the problem of the strong bond of the perception of architectural space with visual perception, and the need for development of projects capable of dealing with non-visual experiences that enrich the spaces, relating to all sensory experiences. Stresses that people with visual impairment perceive the space through the elaboration of concepts based on the perceptual experience of objects, finding, however difficulties of assimilation when these same objects are distant or even ethereal, getting apprehensible only by visual sense [12].

On this basis, in particular on the need for a person with visual impairment have a reference informational space's previous to perceive it, is how auditory resources alternatives, with descriptions about the place and haptics artifacts, such as maps and tactile models and even reproduction of objects. The two can be associated or not, and both have the ability to provide information and help in the development of concepts and spatial perception so that the individual has autonomy of recognition of architectural environment.

5. Final considerations on an information system for blind people

Informational ergonomics focuses on human cognition within the human activities. In this case, being considered the cognition of people with visual impairment, working in order to structure the information systems for these users in order to facilitate their understanding and carrying out their tasks.

As noted, there are many difficulties regarding the existence of environmental information to aid in the perception of people with visual impairment in cultural heritage, particularly in religious buildings. It was also exposed that even with disabilities or even absence of the sense of sight, it is possible to realize the architectural space through other senses, or combination of them. Visually impaired people navigate mainly from the tactile and

hearing perception, and so the designers of these artifacts to explore the most appropriate techniques and materials in the making of these artifacts [13].

From the considerations submitted concerning the perception of space for people with visual impairments, we see that it is possible to create a tactile reality, so that from the perception of tactile information system, having as initial starting point information from an haptic artifact, as a tactile model, where the user can build in your mind a tridimensional scene from a real space and from this knowledge can experience, explore and recognize the scenario or real environment.

We saw that in a cultural heritage building, its elements and shapes represent more than the space of the building itself. Being necessary for its recognition that architecture is experienced as language and that the physical elements in the architectural object provide communication tools through which other ideas beyond the strict formal settings universe can be transmitted.

This artifact, in case the tactile model, should be used as a resource to facilitate the perception and experimentation of space, with its forms and elements, user-deficient in particular environment in order to promote their prior knowledge to your understanding and exploration.

Most of the artifacts of the system should fit like a tactile means of communication, that is, one that takes place mainly through graphic symbols with different textures and/or papers or for issuing vibratory impulses and requires tactile perception for your reception. The interests are in their spatial and mental tridimensionality with possibility of application of different materials and techniques used for the confection of these artifacts.

According to the Labtate [14] tactile models are considered any tridimensional representation with textures, texts in Braille, shapes, bright colors, sounds or other tactile elements, scaled-down or not of an object of reality which is suitable for people with visual disabilities to obtain information about that object. Are information-gathering resources that will assist those individuals in understanding the space around them, contributing to its independence in locomotion, more effectively if used in conjunction with other forms of recognition of space.

In the confection of models, the ideal is to relate the tactile and visual aspects of materials that will represent with aspects found in the real environment, so that the user can make an Association of reality [13].

For making a diorama various techniques and materials can be used in conjunction, where appropriate, as well as sound resources can be added and/or olfactory.

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