

Wayfinding in Hospital: A Case Study

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Abstract. The purpose of this study is to understand how the human displacement in large buildings takes place and suggest solutions to improve its flow. The type of installation to be focused on is the hospital environment. For case study, we took as example a hospital based in Recife, capital of Pernambuco - Brazil. The importance of this research lies in the fact that it opened new horizons for the study of accessibility, bringing together areas of management and design, which are often treated in an isolated manner, but actually complement each other in order to reach an overall result for the various users of this type of system.

Keywords: Wayfinding, Design, Ergonomics and Usability, Healthcare.

1 Introduction

Space is essential for the survival of human beings and it is through it that man creates environments to fulfill ones tasks. In order to carry out activities there will always be a space built with specific functions. One of man's main tasks is the act of moving between spaces, which consists of moving from one point of origin to a destination. This act of displacement is considered the basic unit to perform almost all human activities, that is, the functional basis of a built environment is to facilitate orientation and mobility between sectors. Clear access to built environments is a basic requirement of every architectural design [1].

The influence of the environment in the way people carry out their activities, shows the importance of evaluating the quality of built environments that are increasingly inefficient for user performance [1]. We live today in a more complex and saturated world. Therefore, we are forced to live in areas where boundaries are difficult to be discerned. To detect the specific characteristics and nature of the environment allows for the creation of communication systems that improve human interactions [2].

According to modernity with its new technologies has brought about profound changes in the way of conceiving space. The built environment should now be thought to accommodate a greater diversity of people and perform different activities [1]. In light of such developments, people start to travel longer distances in shorter periods. However, their spatial skills are insufficient for locomotion in spaces of high complexity without support from systems thought to adapt the environment for everyday activities.

It is understood that the act of signaling is a multidisciplinary study, that plans the space globally, i.e., it goes beyond the use of graphic language in built environments and is above all the act of planning space with dynamism, to facilitate the flow of people in a safe, natural and orientated way [3]. An example of a complex space with high variety of services and movement of people is the hospital, where it is of complex nature and presupposes certain urgency in the flow of patients and staff. It is this background that the current study focuses on, analyzing specifically a hospital based in Recife, capital of Pernambuco - Brazil. This hospital is a nonprofit organization designed to provide eye care services to the population using public health system. Its current building is used in a disorderly manner. It consists of adaptations and extensions of several houses in the region, forming an improper complex for the activity that is proposed.

To conduct the case study, this work is based on complementary theoretical references that represent a series of recommendations that will bring to the environment not only agility in moving and task performance, but will also give the environment larger personality. It is known, however, that the use of wayfinding as main reference is the best way to minimize weaknesses and find solutions for high complexity and great population flow locations.

The use of señalética of Costa [2], as a theoretical reference, comes after the flow issues and spatial organization are well studied and will serve as an additional signaling system. According to O'Neil cited in Ribeiro [1], in installations with wayfinding issues, the use of graphics system serves to compensate the complexity of the design and those who perform the route gain speed. Finally, informational ergonomics is used as support both for wayfinding studies and for studies of graphic signage.

The aim of this study is, in addition to point out the major flaws of flows and sectorization in hospitals, to generate unified method recommendations based on principles of Wayfinding, Señalética and Informational Ergonomics, in order to minimize disruption caused by environments without architectural planning and make them able to facilitate the tasks that each user will have to find their own destiny within a building.

2 Methods and Techniques

2.1 Wayfinding

The theoretical basis for the unification of methods aimed at improving the spatial organization and the flow of users within built environments is wayfinding that has as its object of study the dynamic relationship of human behavior with the space, resulting in drawing up a plan of action in which three processes are involved: decision making, implementation of the decision and information processing [1]. The process of wayfinding is a dynamic relationship which involves the individual, one's personal skills and the environment in which one is inserted. Thus, wayfinding is a process of behavior, design and operation.

Behavior is the external manifestation of the processes of perception and cognition related to the skills and experience of each person, i.e., involves the individual and the person's ability to interpret space and from that take decisions based on the information gathered in the environment. Spatial navigation requires capacity of perception, interpretation, memorization and spatial skills from the user, thus the subject is capable of building the mental map of the given environment [1].

Design involves the elements and organization of the built environment such as the system of architectural information that studies the morphology of the building. In order to facilitate the morphological definition of a building, Arthur and Passini cited in Ribeiro [1] distinguish three phases to define wayfinding layout: identification of spatial units; grouping of these units in zones; and, finally, sectorization no these areas and the connection between them.

Another aspect of design concerns the way the room is decorated, i.e., the information system of objects, which are the spatial elements that reveal the identity of the environment and the function of each sector [1]. The information system of objects consists of geometry, colors, lighting and finishing, as well as the furnishings and equipment that make up the space [1]. The purpose of implementation of object information system goes beyond the generation of comfort and enhances the informational matter in the environment.

A final aspect of the design is the information system that, according to [1], is everything that complements the environments in which previous systems do not address the issues of wayfinding. These systems can be graphic in nature (use of signaling signs, displays, maps and brochures), sonorous (whistles or sirens), verbal (interpersonal communication) or tactile (signaling through textures on floors and walls and Braille used on maps, signs and brochures).

The transaction relates to administrative decisions that managers tend to make in the built environment, which will affect the way space is considered and, consequently, affect positively or negatively the behavior of users in the system. They are: the choices of terminology in graphic signage, the way employees are trained to receive and inform users, the deployment of anticipated information when there are changes in the sectors and maintenance of the imaging signal system.

2.2 Señalética

Señalética is a discipline that collaborates with engineering, architecture, environment and ergonomics, under the graphic design vector, responding to the needs of information and orientation caused by the contemporary phenomenon of mobility, which is the movement of different groups of people able to generate new situations and difficulties in environment navigation [3].

The concept of señalética is divided into three systems of language (linguistic, iconic and chromatic) which, although they relate to form the graphical signaling system, contain expressions that should be studied in detail for the creation of a cohesive system, integrated with the identity of the studied area and always taking into account the studies of informational ergonomics.

2.3 Informational Ergonomics

The discipline is interested in improving the human interface of workspaces and its objects, taking into account how the environment acts in the performance of people in their workplace and during the work break [4].

In this study, fundamental concepts will be used of what is known as Informational Ergonomics, based on studies of legibility and comprehensibility of texts and images, however, regarding the signaling of constructed environments, informational ergonomics can cover not only what relates to graphic design issues, but also the layout issues of the environment and the types of flows they generate, in addition to studying human behavior when connected to these factors [5].

In terms of environmental design in wayfinding, the main contribution of informational ergonomics is to add surveys concerning zoning and recording the movements of users in the location to define dislocation problems, thus indicating possible solutions in improving the flow of people in the building.

3 Results and Discussion

3.1 Mapping of the System

The System User. Through institution database research and on-site observations, information from users of this health system was obtained. Because this is a charity hospital, it can be said that the majority of the patients are public health system users, so those without financial means to pay a private health insurance or treatment and who already attend the hospital long enough need to develop a cognitive map of the environment.

Given the previous matter, it was noted that the attendance regarding age varies between children, adults and seniors; however, with a slight advantage for the elderly, since the main vision problems in need of surgery occur at this stage of life. The increased demand from children occurs due to the existence of a program focused on the rehabilitation of this public. It was also found a great demand for routine and urgent medical appointments, both with patients varying in terms of age and physical condition. With regard to education, we observed a lot of people with problems of functional illiteracy and again, in this matter, the elderly are the ones with the most difficulties. In terms of physical impairment, motor and visual were the most noticeable types. Again, it was found that the elderly public accounts for most cases of disabled people seeking care.

Based on this survey, it is necessary to think of a wayfinding system focused on comfort, with simple morphology for users to be able, during the visits, to create a cognitive map of the location. In terms of graphical signaling, one must think about panels that favor the elderly, children and disabled users, i.e. panels with effective printing and contrasts, besides the use of good graphic resources, since the location is used by children and persons with low reading proficiency.

The Architectural Information System. The layout of a facility shall be defined by identifying the spatial units so they can be grouped by zones, and these shall be organized and close to each other according to the similarities in needs and demand from users [1]. The environments are grouped by areas having common characteristics and, in turn, the zones should be differentiated from each other.

The areas should be grouped according to the homogeneity of services, facilities, functions and even types of users. The zoning of an installation should always be done by taking as basis the main areas, i.e., the most important and most sought after, followed by their sub-areas and so on, always following a hierarchy of importance or demand [1].

Evaluating the layout of the hospital blueprint (Figure 1), it is possible to identify that the sectorization of its current headquarters is made in an arbitrary manner and that even if an environment that grew without planning, zoning could be done correctly, taking into account space limitations.

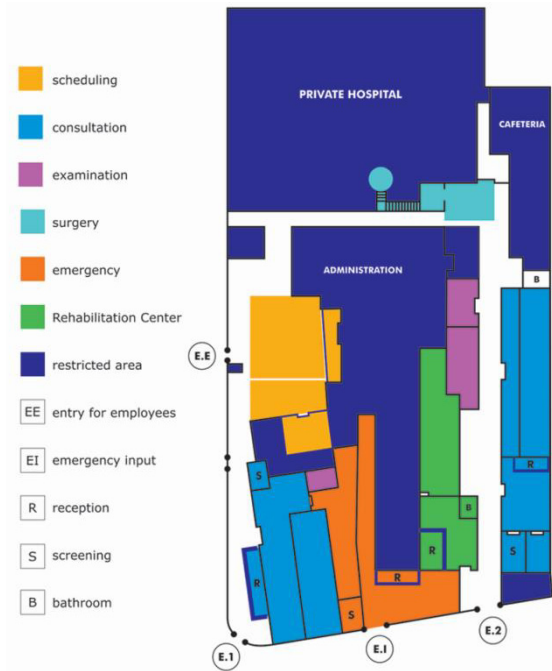


Fig. 1. layout of the hospital blueprint – sectorization arbitrary

Even without solving the chronic wayfinding problems of the current headquarters the institution first because it is a structure that was not born to house a hospital, second because the demand for services has surpassed all limits of the physical space, it is possible to indicate a simple sectorization and more integrated into the environment, as long as there are changes in the layout of the building, which should be held in a multidisciplinary way between architects, decorators, designers, ergonomists and administrators.

After mapping the environment sectors, it is necessary to trace the flow of user movement because this movement record will identify the dilemmas of environment areas, i.e., the places where bifurcations in the flow of movement occur. Based on the informations of the movement registration on the floor plan, it is also possible to set the existing activity flowcharts in the hospital, and its type of morphology.

As can be seen in the representation of the movement flow below (Figure 2), in order to navigate between sectors, users and hospital staff are required to perform unnecessary tasks to go from a given starting point to a destination. People with different needs within the facility stumble confusedly, without knowing where to go and therefore depend, for the most part, on the verbal assistance of staff and volunteers.

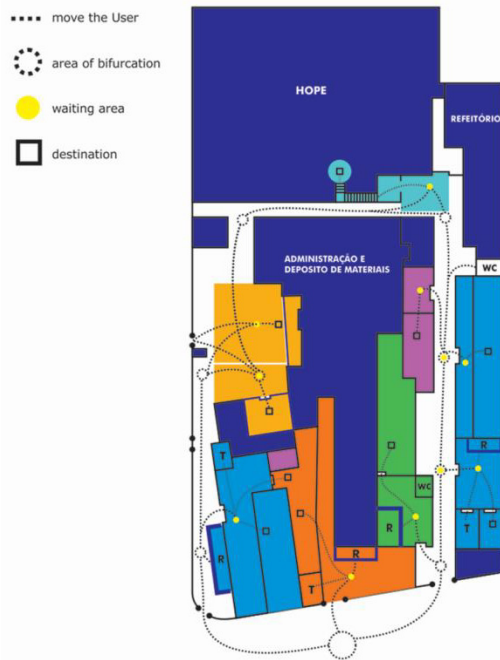


Fig. 2. representation of the movement flow below - unnecessary tasks

In view of the flow movement analysis it is possible to say that all dilemma points and sectors of the institution can be linked together, creating an interconnected system. This does not follow any organized route and the circulation paths are sinuous and defined on the basis of pre-existing barriers in areas that were annexed as the headquarters expanded. In this type of movement organizational pattern is random, there is no structural order and its information structure can only be performed using reference points and anchor points at intersections, because hierarchical order among the sectors is nonexistent.

The Information System of Objects. Environmental aesthetics is one of the strongest subjective components within a health institution and directly influences staff, patients and visitors [7]. The correct combination of hospital sectors, associated with the right choice of color, lighting and texture, makes the healthcare environment less stressful, and serves to reinforce the cognitive map of each visitor at the facility [1].

The health institution studied flees from all aesthetic rules applied to hospitals, but not in a positive way. While healthcare environments have mostly white walls as the main color and blinding lighting, the hospital analyzed has as main tone gray color followed by blue, considered the standard color of the institution, and brown, present in much of the furniture. The lighting, especially in the corridors, is precarious (see Figure 3). Not being enough the fact of it being a narrow place with dim lighting, to further aggravate the difficulties of movement, the sectors consist of cool colors poorly differentiated from each other and that, instead of increasing the lighting and giving the idea of expansion, they retract and absorb the little lighting existing in the building. Being a monotonous environment, the psychological result of misuse of colors are boredom, fatigue, drowsiness, unwillingness, decreased attention and, consequently, the disorientation.



Fig. 3. The lighting is precarious in the corridors

The System of Additional Information. The main system of additional information to the institution is the verbal system, i.e., personal communication of staff and volunteers with patients and visitors. Through field studies, it could be noted that this is the only system that really works, especially among users who visit the institution for the first time and older people who have the greatest difficulties to build cognitive maps. The institution users are approached by volunteers at the entrance, which is the beginning of the process. Instead of people seeking the reception, they are welcomed because the physical structure of the current building no longer absorbs the daily demand of patients, i.e., to prevent that a patient spend a lot of time in the wrong line or waiting for a service that will not work that day, volunteers are ready to report availability for treatment and directing people entering the wrong traffic flows.

Despite being an institution with a focus on visual impairment, there is no tactile signage to minimize possible embarrassment to the blind and visually impaired. There is a notorious lack of use of graphical signs, starting by the visual identity which is reduced to a logo without manual standardization, implementation and use restrictions. The existent graphical signs are facades and location plaques (Figure 4), placed without the slightest concern for the image of the hospital, so important in the study of señalética approached by Costa (1992).



Fig. 4. The existent graphical signs are facades and location plaques

The Operational System. Based on field research and interviews with hospital workers, it was possible to find the following administrative restrictions which can lead to problems in the implementation of a future wayfinding system [1]: lack of knowledge or interest in the technical standards dealing with organization quality management; lack of understanding the relationship between ease of navigation in the environment and quality of the services; ignorance of real importance for a designer to work with architects during the new building development, which is already in planning progress. Another limitation arising from administration is that they think that a signaling system is reduced only to the creation of direction and location support.

However, a wayfinding system covers issues that deal even with how an institution manages its spaces and services. For example, always looking to improve the infrastructure system and make a regular maintenance of the environment, and seek greater efficiency in service flow. The control over decisions on layout and ambiance of the facilities is in the hands of management and without the involvement of a multidisciplinary team. The result is poor sector division, many employees are unaware of the environments subjacent to their workplaces, and do not understand how the process of care within the hospital works. As a result, workers are unprepared to provide adequate information to system users, the forms for scheduling of appointments, exams or surgeries do not provide sufficient information for patients to find their destinations on days when attendances are marked.

As one can see from the moment the administration restrictions for each wayfinding subsystem are understood, and thereupon adjusted, the professionals involved in designing a new wayfinding system have greater dominance in applying the new project, which according to Carpman and Grant [1] should solve the existing problems and prevent new ones. For a project focused on studies of wayfinding to have wide success, it is necessary that the administration understands its physical environment as dynamic, that is, able to avoid further issues arising from possible structural changes or extensions.

3.2 Recommendations

Bearing in mind that the analyzed institution is to plan a new building, it is necessary to suggest, before the design of the new building, a type of movement system that takes into account the most sought after areas for their users. With respect to morphology and zoning, the most appropriate thing for the types of services offered by the institution would be a system of hierarchical central circulation, where the pattern of organization is through a network. In this case, users of the system come into contact first with the most popular environments, and these determine the next steps to reach the most important sectors of the building. The two most sought after areas within the hospital would be the general reception area, which does not exist in the current circulation system, and the emergency.

There is also need for a circulation system for employees that connects the restricted areas adequately to public areas, focused on the mobility of patients. In this case, it is necessary to understand how worker and health professionals should flow within the system. Only a multidisciplinary study involving architects, designers and administrators of the hospital is able to reach a circulation system that is born already predicting future extensions and modifications, since an architectural system such as the system of hospitals, is dynamic and should be expanded over time, according to the birth of new specialties, sectors and technologies. From a well resolved circulation system, it is possible to start the design of the floor plan having in mind a structural pattern that takes into account the priority needs of users, so that they reach their destinations in a safe and more agile way.

Regarding the information system of objects, it is necessary to bear in mind the their aesthetic integration to harmonize and thereby help the users in designing the cognitive map of the building. In the hospital environment there should be two kinds of lighting, natural and artificial [7]. Some studies, according to Hood and Brink [7], show that the use of natural lighting benefits the health of people who spend many hours of the day indoors, and brings economy to the institution. The natural lighting is crucial tool for connecting the hospital building with nature, assisting in the circadian system. However, in the case of this institution that is focused on eye care, there has to be caution with the excess of natural light in the environment so no problems are cause to patients with serious ocular sensitivity.

On the use of color and knowing that most of the guidelines for its use in design is based on pre-established cultural beliefs and that there are no universal guidelines for such use in hospital environments, due to the complexity of groups that use this type

of environment, especially those focused on public health, Young cited in Hood and Brink [7], conclude that the definition of color for environments is subject to a number of approaches that should work jointly and they will always vary according to installation type and work carried out in the area. The choice of colors to compose the environments of a hospital building must conform to the design principles that take into account the best degree of reflection, culture, local behavior and representative visual identity of the institution. These aspects should be arranged so that they make the best composition of lighting, surroundings and graphic signage chromaticism.

Regarding the proper use of the furniture when they are well selected, they can enhance spatial orientation of those inserted into the system as well as improve the populational flow, providing support, comfort, safety and promoting the correct interaction between visitors and employees [7]. In terms of the current case study, it is suggested that furniture use be considered so that it is appropriate in terms of comfort to the types of users in the institution. The color coordination should follow the principles of color research that should be used in the environment, i.e., in addition to providing comfort, furniture should work on strengthening user's cognitive map.

For the additional information system, the main suggestion is around the use of appropriate informational graphics systems in the new layout and objects aesthetic to be applied to the analyzed hospital environment. The system of graphic signs must respect principles of hierarchy and suggested information in the work of Joan Costa [2] Directional signs should have three to four information and messages neatly listed according to the degree of importance or demand for each sector, giving particular emphasis to primary information, ie, the name of the entry sector. The planning for the sub-sectors should be given following the order of distance of each destination. On the use of color in panels, one should always seek the contrast, i.e. the colors for each of the main sectors of the hospital should be quite different from each other so there is no orientation confusion among users of the system. Another important question regarding the use of colors is to avoid a large number of shades, answering only to the key sectors, because a large number of chromatic signs disrupt the recognition of sectors, especially for people with visual impairments.

Regarding the use of pictograms, as this study analyzes a big hospital with public health insurance, the proposition is to work the historically accepted style, the silhouettes technique produced by AIGA and applied in the research of the program "Hablamos Juntos" in partnership with the SEGD [8]. Regarding the use of maps, it would be interesting to work with them like infographics. Infographics combines images and words harmoniously, making the information in the panels contain a story for the user with beginning, middle and end [6]. The proposal to use Infographics refers to the journalistic work, since the current study goes further, suggesting that this type of approach be used not only in so-called general location maps or part of a signaling system, but also in newsletters that should be printed to educate users, causing them to become accustomed to the system of pictograms and to the movement flow logic of the institution being discussed.

Regarding other systems of additional information, it is required the use of a tactile system on floors for the visually impaired, where the textures on floors should be able to guide passersby not only to the maps with Braille communication, as well as to the

main destinations within the facility. About the additional verbal system, it is necessary, in accordance with the operating system, proper training on the flow dynamics of the hospital for all staff and volunteers, so that they become part of the system helping to guide patients and visitors. This training can be done from the process flow diagram, which shows all steps of the users in the search for appropriate services within the building.

4 Conclusions

With the current research it can be concluded that to effectively work a signaling system is to go beyond the graphics system. One must work together with other disciplines beyond the ambit of graphic design. This set of disciplines addressed in harmony is called Wayfinding, which means to know where you are, know your destination and walk up to it, always having in mind evidence that the route taken is correct, without going through unnecessary procedures. Environments where the architecture favors navigation cause people to improve their cognitive skills.

An environmental project focusing on wayfinding promotes not only physical and mental health of users, but also the financial health of the institution, because it is implicit that employee productivity problems are associated with navigation issues, since they often waste time guiding patients instead of performing their tasks.

Finally, it is concluded that this case study is a rich example of how not to use health environments, as they contain errors ranging from the use of space to employee training, encompassing flaws in all subsystems of wayfinding. Therefore, it is important to demonstrate that healthcare environments should be designed by multidisciplinary teams in order to minimize future errors.

References

1. Ribeiro, L.G.: O Onde estou? Para onde vou? Ergonomia do ambiente construído: Wayfinding e Aeroportos. 120 f. Dissertação (Doutorado em Design) – Pontifícia Universidade Católica do Rio de Janeiro, Rio de Janeiro (2009)
2. Costa, J.: Señalética. Enciclopedia del Deseño. Barcelona (1992)
3. Velho, A.L.O.L.: O Design de Sinalização no Brasil: A introdução de novos conceitos de 1970 a 2000. 92 f. Dissertação (Mestrado em Design) – Pontifícia Universidade Católica do Rio de Janeiro, Rio de Janeiro (2007)
4. Cruz, F.R.F.D.: Estudo das relações entre as linguagens pictóricas e verbais: sistemas de sinalização de edificações. 31 f. Monografia (graduação) - Universidade Federal de Pernambuco, Recife (1999)
5. Moraes, A., Mont’alvão, C.: Ergonomia: Conceitos e Aplicações. iUer, Rio de Janeiro (2003)
6. George-Palilonis, J.: Graphics Reporting: information graphics for print, web and broadcast. Focal Press is an imprint of Elsevier, Oxford (2006)
7. Lahood, S., Brink, M.V.: Aesthetics and New Product Development. In: McCullough, C. (ed.) Evidence-Based Design: For Healthcare Facilities, pp. 19–44. Sigma ThetaTau International, Indianapolis (2010)
8. Project Hablamos juntos, <http://www.hablamosjuntos.org>