THESIS FOR THE DEGREE OF DOCTOR OF PHILOSOPHY

DESIGNING FOR ALL SENSES

Accessible spaces for visually impaired citizens

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Para Luis, Manuel e Francisco

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Göteborg in December 2000

Marta Dischinger

INTRODUCTION

> "L'invisible c'est ce qui n'est pas actuellement visible, mais pourrait l'être"[1]

Often, it is only when we cannot do something that we realise how important all elements involved in our actions are. Since we strive to attain a very high level of control of our environment in accordance with our human needs, we tend to assume that environmental factors would not restrict our individual abilities and actions. However, it is a common fact that nobody can see without light (and blackouts do exist), and if there is too much noise we cannot listen to what we want to. We can have our route blocked by public constructions on a street, and if we do not have money to pay a bus fare another sort of restriction affects our mobility. In reality, our capacity to act in space depends not only on our human abilities (that are in fact limited), but is also affected by social rules and environmental factors. There are special situations when this interdependency is stretched to its limits. When the individual's capacities to perceive and act are restricted, very special relations between the spatial features of the environment, social integration and the individual conditions have to be considered.

In the design of urban environments the relations between physical features of space and limitations of movement performance (like the level of ramps or specially designed access of public transport for wheel-chair users) are very obvious, and there is a broad technical knowledge and detailed regulation in this field. In this way, it is easier for the professionals who work with the design

[1] Merleau-Ponty, Maurice (1964), *Le Visible et L'invisible,* Éditions Gallimard, Paris.

of urban public spaces to understand and to take into consideration dimensional and functional aspects of objects and spaces aimed at persons who suffer restrictions in their movements. However, it is far more complicated to know how the environmental features can help or hinder persons who suffer from perceptual disabilities, and especially, for those who cannot see.

The central purpose of this study is to contribute to our knowledge of designing in a way that can be supported by the knowledge of the situation, and by the experience and expectations of those who are affected by design. In this case it means to enable us to find methods that can support the development of design actions to improve the accessibility of public open urban places for visually impaired persons, enhancing their perception and understanding of space, increasing their possibilities of orientating and taking independent decisions, and enabling them participate in the city life. To fully achieve this aim it is necessary to understand their rights as citizens, and also their particular needs and problems arising from the reduction or absence of vision.

The problem involved in designing for visually impaired is that we are more 'aware' of visual information, and that it usually 'prevails' over information obtained by the other senses, in a normal spatial perception process. Yet not being aware of our feelings and sensations does not mean that we are not sensitive to them. Although 'forgotten', these other non-visual sources of information contribute significantly to our spatial knowledge. Can we infer, from the imaginary text below, if the person who describes an apparently usual route is actually 'seeing' the streets and places he, or she, is passing by? And which might be the resultant spatial 'images' with or without vision?

'Walking in the main pedestrian street of the city centre, rushing to catch the buss, I hear distant cars horns, and all the mixed noises from people leaving work places, shopping, trying to sell things on the street. I pass in front of a favourite bakery, but have no time to stop. Just the smell of fresh bread follows me for a short while. It is windy and cold, and I have too many books to carry. The stones of the pavement pass very fast, and I have to be careful to avoid the isolated areas where they are digging the underground light system. I cross the street in front of the main square, together with other pedestrians. The green light is on for us, and we avoid the cars that are almost stopped. Just two more squares and I will be at the bus-stop.'

Apart from a brief reference to the traffic light, no visual information is added in the description of the places. Stones can also be perceived through their texture, and it is possible to guess that the green light is on, from the sound of the cars. Even if the person is actually seeing what is described, probably visual attributes are not the only significant sources of information for the understanding of this specific moment and situation. However, most often than

not, the professionals responsible for the maintenance, improvement and creation of new urban spaces – when observing, registering, studying, analysing, planning and designing – tend to assume that spatial complexity can be reduced to what can be represented in visual terms. And perhaps, while neglecting the relevance of non-visual attributes in their practice, they might also reduce their understanding possibilities, about the variety and diversity of spatial qualities any place can have?

RESEARCH CONTEXT

This study has been developed in two different countries, Sweden and Brazil, and examines two different critical spatial situations for the orientation of visually impaired persons. In Sweden were studied open spaces that present a lack of references as to where information is obtainable, and in Brazil were examined the almost opposite spatial situation. This situation is encountered in open spaces where the excess, or 'pollution' of spatial information, makes the recognition and access of valid useful sources of information difficult. Also the target groups studied in each country and their respective needs were very distinct. In Sweden, the focus was placed on partially sighted individuals who lost normal vision mostly due to age problems. While in Brazil, the majority of the individuals studied were blind and at young or adult age. These two age groups are representative, in each country, of different critical situations of accessibility to public spaces, related to specific cultural, social and health problems of each country.

Not only diverse spatial, cultural and social contexts affected the general approach of the study. Internal changes also occurred during its development regarding the intended general aims, and especially concerning the ways in which they could be achieved. During the first two years of postgraduate studies, done in Sweden, the initial study methods were established with two main purposes. First, they should propitiate the acquisition of knowledge in the specific field of the study, and second, they should work like an inner methodological experiment testing their effectiveness and validity. It is important to mention here the reasons why it was necessary to verify the designed methods at this stage. And it is also necessary to briefly resume the first part of my studies, done until the Licentiate Degree,[2] relating this part with

[2] Further reading of some of the aspects briefly presented here regarding the initial results of my studies can be done consulting my Licentiate Thesis. See, Dischinger, Marta (1995) *Design in Research & Research in Design: spatial design for the visually impaired*, Chalmers University of Technology, School of Architecture, Göteborg.

the further development of the study in Brazil, since this thesis is focused on the latter part.

My postgraduate studies started in 1993, in a Design School, the 'Högskolan för Design och Konsthantverk- HDK (School of Design and Crafts) at the Göteborg University. At HDK, as well as in other schools of design, the academic research at post-graduate level is still a relatively new field of action in which also the research methods are object of investigation. This novelty brings the possibility of 'creating the way as one walks' along with the difficulty of choosing directions due to the lack of design research experiences on which to stand. To this situation, can be added the very nature of design practice and the inherent difficulty of conveying the essential introspective reflective design process into another level of communication.

It is situated in this context that I decided to develop my studies making use of my previous design experience as an architect and an interior designer. Since 1990 I had worked in the field of design for rehabilitation. As a teacher in the Department of Architecture and Urbanism in the Federal University of Santa Catarina, in Brazil, I had coordinated practical projects to ameliorate the interior design of the Paediatric Section of the University Hospital. During my Master Degree studies of Interior Design at HDK, from 1991 to 1993, different projects of toys to stimulate the senses and support the development and recovering of children with different kinds of impairments were made. I expected to be able to continue increasing my knowledge in this field through design projects, and this intention is expressed in my Licentiate dissertation, as well as my doubts about the difficulties to be met, in the following words:

'Attempting to work from this (design) perspective I decided to use the traditional design tools as the central methodological instruments of investigation, and to verify at this experimental stage its adaptability to the research objectives. Would the practical design methods be useful in enhancing, relating or creating knowledge, thus broadening the understanding of complex situations? Could the results obtained help to improve the quality of design interventions in the field? And which methods from other disciplines would be more suitable to the specific study in question? What kind of results could be obtained, employing methods that are current in design practice but not common in academic research, and in which ways might they be transformed? Which ways ought to be found to use and communicate methods that are both systematic and artistic, and operate in a more subconscious, creative area of thought? Finally if doing things means

essentially taking ethical decisions about *what* to do, and *how to do things,* which might be the roles of a design research?'[3]

Fig. 1 – The ´Blowing Toys' and the 'Mobile Child' projects developed at HDK in 1993.

The "Trädgårdsföreningen" Project

In Sweden, there are a significant number of studies and concrete realisations aiming to improve the life of visually impaired citizens.[4] At the time that this study started, two major problems of orientation in urban spaces were identified. The first one is the problem met in 'polluted messy places', and the second one is found in the 'empty places'. The second situation is typically represented by large public areas where the information that can be perceived, when vision is restricted or absent, is so scarce that it does not offer enough references for orientation. In special the second situation was in need of more studies and practical improvement. This information was given when my supervisor, Professor Olle Anderson, asked: "Which are the worst situations for the orientation of visually impaired persons?" during an interview held at the Synskadades Riksförbundet (National Visually Impaired Organisation) in Stockholm.

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[3] Dischinger, Marta (1995), Design *in Research & Research in Design: spatial design for the visually impaired*, Chalmers University of Technology, School of Architecture, Göteborg, p 27.

[4] Among theoretical and practical studies we can mention for instance the research of the psychologist Gunilla Preissler about integration of blind children in normal teaching system, and several books and booklets edited by different agencies of the Swedish Handicap Institute on how to improve practical life conditions of visually impaired persons. See, Preissler, Gunilla (1987), *Unga synskadade berättar*, Psykologiska Institutionen, Stockholm Universitet, Stockholm. See, Holmegard, Ingmarie (1989), *Måste vi se? Om synskadade barn och deras familjer – i utveckling*, Synskadades Riksförbund, Stockholm. See, Anderson, Olle (1991), *Känna, lyssna, lukta, smaka, titta – känna, lyssna, lukta, smaka: En bok om synskadade barn och deras boendemiljö*, Synskadades Riksförbund, Stockholm.

Giving continuity to my previous experience the initial focus of the study was placed on the problems confronted by visually impaired children in their first public open space, the schoolyard. Later on, due to different circumstances, this focus changed to the orientation in open spaces of elderly persons who present visual impairments as a new condition in life. For them, open spaces with few referential embody not only almost insurmountable difficulties for their orientation. They are also representative of their loss of independence, regarding their leisure time and enjoyment of activities in open environments, since many of these places are found in parks and public squares that they used to frequent before. The Park 'Trädgårdsföreningen', situated in the centre of the city of Göteborg, was chosen as a representative site to develop a design project aiming to improve the orientation of this users' group. This choice was expressed in the Licentiate dissertation as follows:

'The special physical characteristics of the park, plus the different activities and events existent, would make it possible to observe and analyse a wide range of different spatial relations. Besides, the existence of a project would enable the discussion and evaluation of the proposed interventions by the different people involved (visually impaired persons, health assistants, architects, designers, engineers, park authorities, disability organisations). Finally, designing specific forms or items will be necessary to apply, relate and deepen information from different disciplines, perhaps bringing forth new questions and knowledge. The project had to start from the park in itself: understanding its historical and affective importance for different groups of users; studying and classifying activities and places; analysing my own feelings and impressions by visiting and using the park during different seasons, occasions and events. Moreover, while searching for ways to enhance the visually impaired users perception, project interventions should be essentially connected with the physically existent places, and with the images that people carry from them without altering their character.'[5]

[5] Dischinger, Marta (1995), p. 37.

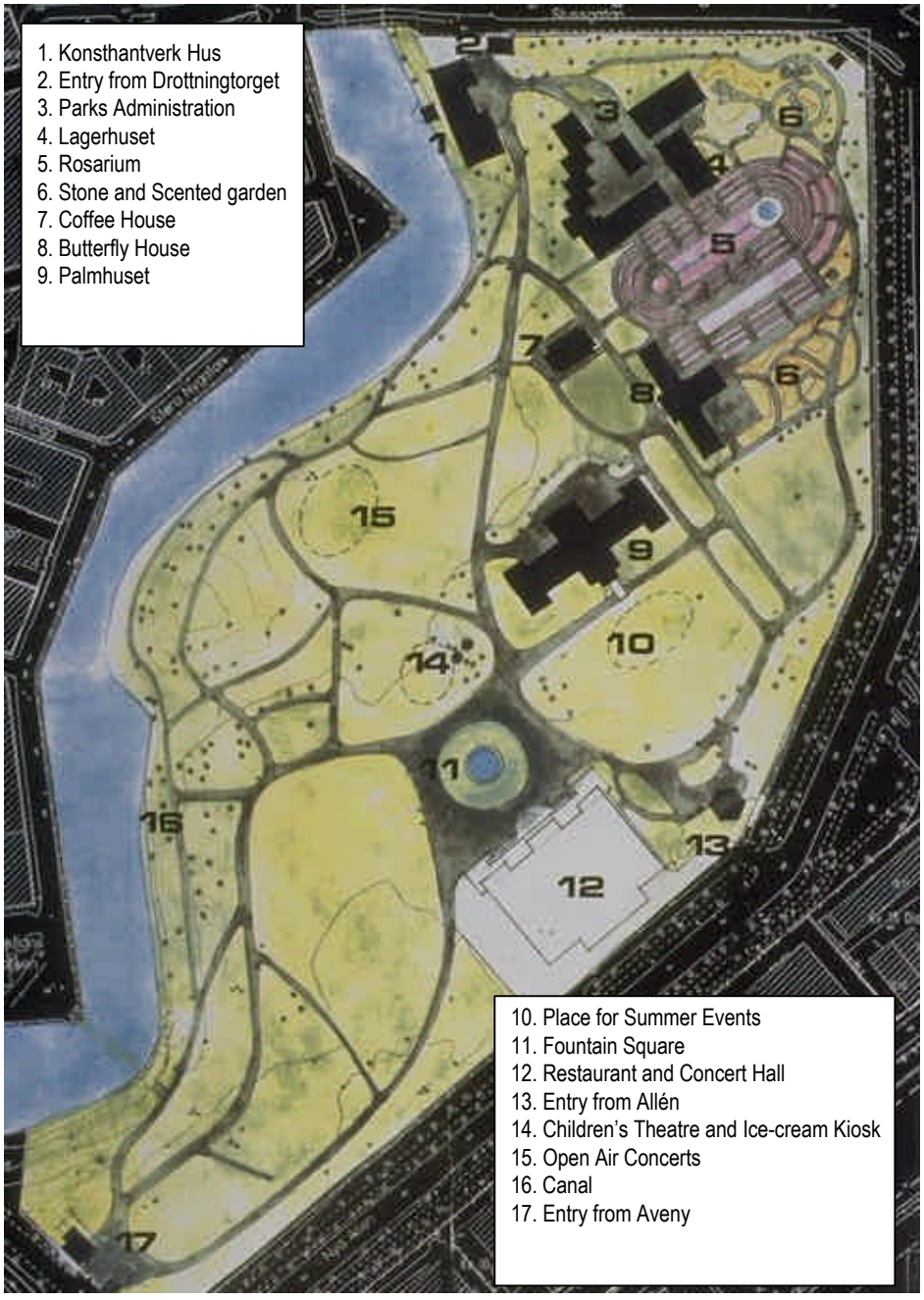
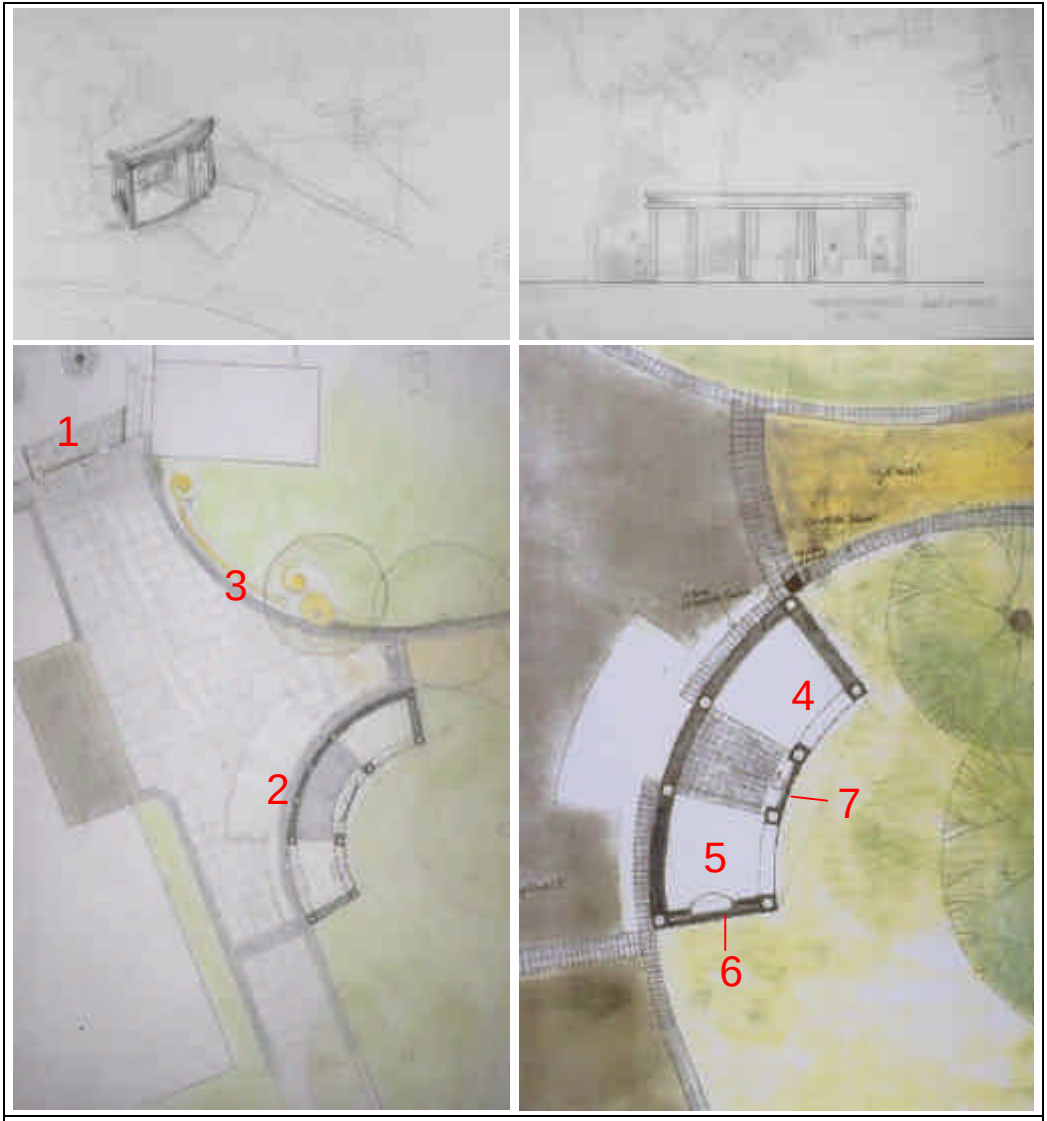


Fig. 2 – Map of the Park 'Trädgårdsföreningen' showing existent dynamic and permanent activities.

The final project was based on two basic hypotheses. The first one is that *centres of interest*, represented by park attractions, buildings and activities were central for the definition of an orientation system based on what happened in the park. The second is that *access to information* about the spatial disposition of the centres of interest, the paths' hierarchy and the design logic proposed by the orientation system, was crucial prior to the use of the park and also during its use. The first hypothesis is based mainly on the importance attributed to both permanent and dynamic elements as spatial references for orientation as referred to in psychology perception theories. The second hypothesis is born from the importance given to additional information not only in the specialised research in the field, but also from the fact that information systems perform a central role in different urban orientation projects. The significance of additional information to increase not only orientation possibilities but also real use of space was reinforced in several testimonies given by visually impaired persons during different interviews. In great lines, the project hypotheses generated the following design solutions:

- The creation of two centres of information close by the main entrance accesses - offering written, sound and tactile information about park activities, events and physical lay-out of the park to all users, with special information for the visually impaired;
- The creation of a distinct path design structure - distinguishing the paths' hierarchy in three different categories: central, peripheral and secondary (recognisable by their contrasting colours, texture, sound and dimensions);
- The creation of local points for orientation – information totems situated along the paths marking the position of centres of interest, providing spatial information (tactile map) and specific detailed description about the activities of each place (sound information). They also worked as minor landmarks for orientation.

Fig. 3 – The final project for the Park 'Trädgårdsföreningen', showing the central path passing in front of all main activities (1), the peripheral paths (2), the information centres at both entries (3) and the local points of information (red circles).



1. Park entrée
2. Information centre
3. Path marking the border pavement
4. Local for exhibitions
5. Local for studying tactile map and hearing information tape
6. Tactile map and Braille Text
7. General information for all users containing maps and events lists.

Fig. 4 – The information centres placed at the entries of the Park 'Trädgårdsföreningen'

Evolution of the study in Brazil

After defending the Licentiate Exam I returned to Brazil in December 1995. My intention was to continue developing design projects as a central method of work. A new representative situation had to be found for an orientation project. The search of how to enhance the access of already existent information in the environment through the creation of additional information systems continued to be my central quest. The design of an orientation project should deepen the aspects related to how spatial information could be transmitted through tactile and sound information. In Sweden, due to time restrictions, it had not been possible to develop full-scale prototypes of the 'local information totems', as much as the 'central information desks'. In this way, not only had it been impossible to test the devices, as the scale of the project did not propitiated a further investigation of which spatial information should be given in each place, and how it should be displayed and accessed by the users. This time, in Brazil, it should be possible not only to draw, but also to build and to test full-scale prototypes of the information devices.

An interesting situation was found when an architect invited me to make the landscape design for the park of a residence for assisted elderly persons. The project started, but in spite of the future possibilities of its concretion the expected increase of knowledge did not occur. I was only applying the same principles and solutions that I had previously developed in Sweden. Moreover, the question about which spatial elements constitute useful sources of information for orientation continued to be only partially answered. And, it was especially this knowledge that was crucial to support further developments of information systems or design projects to be created.

At this stage the study reached a turning point. Instead of giving continuity to the former focus on the accessibility of elderly persons to open spaces, I found it necessary to 'start again' and to find out which was a Brazilian critical situation. It was crucial to know more about the needs of visually impaired persons in Brazil, and in which ways solutions could be reached in a different political, social and spatial milieu. In this case, the problems involved the accessibility of open central urban areas for visually impaired adults. It was also necessary to find better ways of designing that could guarantee throughout the process that the design arrived at would be appropriate. The previous Swedish studies were based on the development of a traditional design work learnt from specialised practitioners and my own experience. I found however that this restricted me mainly to my own professional conception in terms of solutions and understanding of the problem in the situation. Even if I look on it as a quite good example of reflection in the design situation, as solutions could not be

tested in full scale, I can only trust my experience when I look at it afterwards and try to judge however they were good solutions or not. If they had been build I would know, but a little late from the point of view of the users, which is the case of many designs that are the result of traditional design processes. Hence after my Licentiate, I decided to reflect on my own design processes and try to develop new methods of designing and acquiring knowledge that would be able to include knowledge, experience and conceptions from others and from the situation itself.

As a consequence, the readers who expect to find in this book exceptional design projects, or ready-made technical solutions to be easily applied, will surely be disappointed. What is searched in this thesis is how to support the increase of the analytical capacity and reflective attitude, necessary in dealing with a complex problem such as the orientation of visually impaired persons. Accordingly, the resultant knowledge, which is communicated in this work, is expected to support the generation of other reflections and design solutions for different needs, of different people, in different spatial and social contexts.

THESIS ORGANISATION

The thesis is presented in a linear way, even though during the development of the study, different actions were overlapping and interconnected. The subjects of the thesis are divided into four parts: Part I – Situating the problem and setting of methods; Part II – How the problem can be learned from the theoretical knowledge of perception, from the study of concrete places and situations, and from the experiences of visually impaired persons; Part III– How the development of different design cases knowledge was combined and interweaved in the search for solutions; Part V – Conclusions reached through the reflection and interweaving of the theoretical knowledge with the results obtained in the design cases.

The subjects are organised according the following:

Part I:

Chapter 1: 'Impaired citizens and accessibility to urban spaces'

Situates the problem in a more general context of design and disability, known as Universal Design. This extends and relates the concept of accessibility with the concept of citizenship. It also introduces the concrete situations encountered by visually impaired citizens' access to urban public spaces in Brazil regarding their integration in an unequal society. A general comparison between the accessibility problems met in 'polluted' and lively urban environments, in Brazil, and the situations studied in Sweden, is made situating

the problem in a wider context. Finally, a more personal position is defined regarding the choices available for approaching the problem taking into account the ethical aspects of design practice.

Chapter 2: 'General approach and methods'

Defines the general methodological frame and methods of the research. Explains how an understanding of a complex problem can be reached by working with concrete design situations, discussing the relations between design cases and Design Theory. In the chapter, the need for developing interdisciplinary studies in the field is justified. Also the main reasons for the development of a differentiated spatial analysis, and the creation of special investigation tools to obtain first-hand information from visually impaired persons are introduced.

Part II

Chapter 3: 'Knowledge of spatial perception'

Introduces the studied knowledge about spatial perception from various fields, which was necessary to support the understanding of the problem. The chapter is divided into four sections. The first section, 'Relational Space', presents the main phenomenological frame of the study, distinguishing the concepts of space and landscape. The second one, 'How we perceive space?', introduces the main concepts of human spatial perception. The third section, 'What is orientation?', is focused in the definition of how we meaningfully orient in the environment. The last and fourth section, 'Spatial perception and visual impairments', presents the special process of spatial perception of visually impaired individuals.

Chapter 4: 'Knowledge of space'

Presents how the study of a concrete urban situation propitiated the creation of knowledge while aiming to solve a design problem. The section starts with a detailed description and history of the place, situating the main needs and problems related to the accessibility of visually impaired individuals. It finishes with a diagnosis of the accessibility problems in the centre of Florianópolis city.

Chapter 5: 'Learning from the experience of visually impaired persons'

Describes how first-hand information about a different process of perception and understanding of space was obtained, including a detailed description of the design, application and results of the main investigation tools applied: 'Accompanied walks' and 'Word's game'.

Part III

Chapter 6: 'Situated knowledge in design cases'

Three design situations with different scopes and levels of complexity are presented. The detailed recount of each one of the design cases aims to present how in each unique design situation knowledge was created to solve the problem.

Part IV

Chapter 7: ' General Conclusions'

Final reflections, divided into four sections, search to interweave the different stances of knowledge developed along the whole study. The first section, 'Design cases as central research methods', considers the need for a broader understanding of Universal Design principles and for the consideration of context in the development of design cases. The second section, 'Analytical approach of the environment considering its perception and use by visually impaired persons', presents a series of concepts, and combination of concepts, necessary for a different spatial analysis to support accessibility studies. The third section, 'Accessible design for visually impaired persons', addresses practical advises and general recommendations regarding the design of accessible urban public environments for visually impaired persons and introduces the need for future research concerning the investigation of non-visual means of representation. The fourth and final section, 'Design for all senses', sums-up the most important points of the thesis under a different perspective, relating them with the quality of space for all users. The reduction of complexity, and the dominance of visual, dimensional and technical aspects in the design practice are suggested as the main causes of a design that disregard all senses.

PART I

CHAPTER 1
IMPAIRED CITIZENS AND ACCESSIBILITY TO URBAN SPACES

CHAPTER 2
GENERAL APPROACH AND METHODS

CHAPTER 1 – IMPAIRED CITIZENS AND ACCESSIBILITY TO URBAN SPACES

IMPAIRMENT AND CITIZENSHIP

The UN 'Declaration of the Rights of Disabled Persons' declares that disabled persons and their families, irrespective of their race, colour, sex, language, religion, political opinion, national or social origin, and state of wealth, should be respected in their human dignity. They should share the same fundamental rights as their fellow-citizens. This means that persons having any sort of impairment have the right to a normal life and are entitled to the necessary support in order to enable them to be as self-reliant as possible. They have the right to special education, medical assistance and rehabilitation in order to develop their abilities and to promote their social integration. They also have the right to have their special needs taken into consideration at all stages of economic and social planning.[6]

According the first version of ICIDH – International Classification of Impairments, Disabilities and Handicaps published by the World Health Organisation in 1980,[7] the following definitions are made:

- *Impairment* is 'any loss or abnormality of a psychological, or anatomical structure or function', being the actual physical loss that is situated at the level of organs;
- *Disability* is 'any restriction or inability (resulting from an impairment) to perform an activity in the manner or within the range considered normal for a human being.' Disabilities are then described as functional limitations, or restrictions of activity imposed by the impairment which prevents a qualitative realisation of the potentials of people in everyday activities;
- *Handicap* is 'any disadvantage for a given individual, resulting from an impairment or a disability that limits or prevents the fulfilment of a role that is normal ...for that individual.' Handicaps are related to the social, cultural and environmental circumstances that may, but not necessarily, place the individual with some impairment at a disadvantage. It is important to stress that impairments may lead to a handicap, but not necessarily so (for instance, the use of special lenses might make it possible for a visually impaired person to cope with a reading handicap).

A second and newer classification of impairments by the 'ICIDH-2: International Classification of Impairments, Activities and Participation', elaborated in 1998 by the WHO, tries to match both the scientific and the

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[6] UN Declaration on the Rights of Disabled Persons, Resolution 3447 - XXX - 09 December 1975

[7] The first version was taken from WHO, ICIDH-2 (1998), consulted in 28/06/99, Web page: http://www.who.int/ icidh/introduction.htm

practical evolution which have occurred in the field during the last two decades. Disablement is considered 'mainly as a "societal" problem from the viewpoint of integration of persons with disabilities into society. Disablement is not an attribute of a person, but a complex collection of conditions, many of which are created by the social environment. Hence the management of the problem requires social action and it is the collective responsibility of society to make the environmental modifications necessary for the full participation of people with disabilities into all areas of social life. The issue is, therefore, an attitudinal or ideological one which requires social change, while at political level it is a question of human rights. Hence the issue is highly political for all intents and purposes.'[8] This new classification places disablements at three different levels: losses or abnormalities of bodily functions (corresponding to *impairments*), limitations of personal activities (corresponding to *disabilities*), and restrictions on personal participation in life situations in relation to impairment, activities, health conditions and contextual factors (corresponding to *handicaps*). All three levels depend on interactions between environmental and personal contextual situations. From the relation between social and physical environmental factors (social and cultural attitudes, laws, architecture, climate, etc.) arising from the environment and personal factors (like gender, age, social background, education, etc.) disablements are then experienced in different ways and degrees.

To fully understand the meaning of integration of impaired persons in society it is important to examine, first and foremost, the 'fundamental rights of citizenship' stated in the UN declaration. According to Milton Santos: 'The very fact of birth assures any individual of inalienable rights and to ingress in human society. To live, to be a person in the world, means to assume, like the others, a moral inheritance, that makes each one a possessor of social prerogatives. To have right to a roof, food, education, health, protection against cold and rain, right to work, to justice, to liberty and to a life with dignity.'[9] Unfortunately, there is a great rift between the laws that guarantee that any person can claim citizenship rights, its realisation, and the consciousness about these rights. In reality effective citizenship is a social and political conquest throughout history. According to Milton Santos, especially in the 'countries in development', the opposition of neo-capitalist ideals of cost optimisation and 'auto-regulation' of capital allied to the non-written relation between individual work capacity and access to social benefits, hinders the accessibility to opportunities for all. The costs inherent in an equal distribution of social justice are, in addition to these factors, subjacent to the idea that some citizens are 'more citizens' than others.

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[8] WHO, ICIDH-2 (1998).

[9] Santos, Milton (1987), *O espaço do cidadão*, Livros Estudio Nobel, São Paulo, unauthorised translation, p. 7.

Access to an effective citizenship depends upon political, cultural, and social forces attaining a relatively harmonious association into the spatial distribution of work opportunities, social equipment and facilities in any given territory. Unequal spatial distribution of all kinds of activities and services, in practice, creates spaces of 'non-citizenship' where the conditions for participation and integration in society are far from ideal.[10] Obviously these situations of exclusion are increased when individuals suffer some form of impairment.

Following the growing concern with the rights of persons suffering from some form of impairment and their integration into normal life, a whole area of practical and theoretical studies have grown since the 60´s where design plays a central part. Essentially, integration depends upon four interconnected aspects. Firstly, are the medical conditions for recovery or improvement of different types and levels of impairment, arising from the physiological problems. Secondly, is the use of assistive technology to overcome, support or attenuate disabilities. Thirdly, are the means by which the individual's competence can be improved through special education, training and rehabilitation. Finally, we have to consider the restrictions or facilities placed by the physical and social environments in the performance of desired actions. As cultural, social and economic contexts differ, so also the conditions from country to country, thus determining the real conditions for integration.

In a sense everyone can suffer restrictions in participation (handicap) at a certain stage of their lives, and come to rely on the support and care of other persons. This handicap may be due to infancy or immaturity, old age, pregnancy, illness or hospitalisation. Activity limitations (disabilities) can also be temporary or permanent, progressive or regressive. It is important to note that the original impairment may not necessarily imply a handicap, as the latter, depends more on the social demands that challenge the individual's competence. As much as the individual's competence can be improved through special education, training and rehabilitation, the difficulties can be reduced through environmental design, ergonomic studies and physical adaptations.[11]

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[10] Ibid., pp. 5-13.

[11] Fredericksen, Martin, Pereira et al., (1991), Impairment, disability, and handicap', in *'Issues in Telecommunication and Disability'*- Commission of the European Communities, Edited by Stephen von Tezchner, EUR 13845 - COST 219, Luxembourg, pp. 39-40.

Design practices known as Social Design or Inclusive Design, and more recently as Universal Design,[12] seek to design environments and objects to minimise the difficulties and barriers disabled persons confront in the fulfilment of desired actions. Besides, greater possibilities of maximisation of competence and abilities increase their chances of fuller participation, equality and independence in their conduct of a normal life.

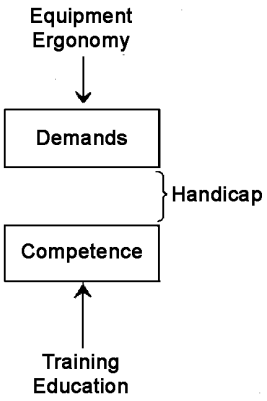

Fig. 5 – Diagram about competence and demands – Source: Fredericksen, Martin, Pereira et al.[13]

These concepts can, and should be, extended to all persons that suffer any kind of discrimination, which excludes them from certain social and cultural spheres. The Swedish interior designer and professor, Olle Anderson, has aptly denied, the common yet wrong misconception of this field as restrictive, in the following words: 'Universal Design should be understood as the design that aims to create spaces that can turn into places of all persons and each person, with their biological, cultural, social and economic differences'.[14] It is in this wider definition of the term 'Universal Design' that this study is inserted.

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[12] Both practical, and theoretical studies, in this 'new' field of research have been labelled with different names: 'Social Design', 'Inclusive Design', 'Accessible Design', and more recently 'Universal Design'. Independently of the given name, and their semantic nuances, all of them are concerned with the development of studies and practical designs that might decrease the difficulties and barriers met by disabled persons in the fulfilment of actions. The recently more spread term 'Universal Design' has somehow a connotation of 'universality', that might be wrongly interpreted as design solutions that can be applied indistinctly in different contexts and countries, as 'Social Design' might be identified with studies which stress social and economic aspects.

[13] Fredericksen, Martin, Pereira et al. (1991), p. 40.

[14] Words of Olle Anderson, in a speech held at the International IFI Conference in Nagoya, Japan, 1995.

INTEGRATION IN URBAN LIFE

However complex and multifaceted the questions as regards the integration of disabled persons in the cities might be, urban design certainly play a fundamental role in it. The lack of access to public transport system, for instance, can exclude an impaired person from reaching health services, education and job opportunities. These are basic factors in all levels of his/her social integration. In other words, when spatial access is non-existent, access to citizenship is also denied. To ensure integration and participation of impaired individuals, to guarantee their condition of citizenship, the design of built environments must be done to facilitate full participation and equality. Alleviating and/or eliminating difficulties and barriers, and taking into account the special needs disabled persons encounter in the performance of desired actions supports them to maximise their competence and abilities. This in turn makes it possible for them to participate independently. In spite of the strong interdependence between spatial characteristics and the exclusion of disabled persons, their segregation is hard to be bounded or located in a single place. Minority city dwellers such as impaired persons, irrespective of their age or social group, do not reside in any specified areas of the city. The exceptions to this are the specially assisted housing areas for dependant elderly persons and the severely disabled. Being a dependent small child, being sick, having some form of impairment, or being old, are parts of the human condition and do not depend on economic, social or cultural status. Crucial problems of integration and participation in the city life are met everywhere: at home or at school; in the slum or in the shopping centre; in work places or accessing service facilities; in public areas, like streets and parks; or using the public transport systems.

Other research currents focus on minority groups in the cities, and concentrate attention on the existent relations between social groups and places.[15] Slums of the poor and closed condominiums of the rich, the 'no-place' of transitional installations, foreigners and immigrants' neighbourhoods, gentrification of old historic areas, ghettos of racial and sexual minorities can be analysed, simultaneously, as places of segregation and mutual exclusion in the city. The essential characteristic of these places is, that they are appropriated by certain groups to the detriment of the 'other'. Usually this 'other' possesses a different socio-economic condition, a different culture, race or values, resulting in the appropriation (or exclusion) process on a clustered urban tissue where power,

[15] Jane Jacobs made an overview of urban studies where the focus is placed on spatial segregation and the space of minorities (such as the qualitative studies conducted by feminists, and social, political or racial minority groups). See, Jacobs, Jane (1993), The city Unbound: Qualitative approaches to the city, *Urban Studies*, vol. 30, nos. 4/5, pp. 827-884.

capital, goods, services and culture (or the very lack of them) are bound to limited spaces. Unlike these, the main objectives and focus of research in the field of Universal Design can hardly be located in one specific place of the urban environment.

It is important to repeat that inclusion of diversity in Universal Design studies or projects has necessarily two dimensions. First, the needs of persons with 'special demands' has to be considered in such a way that they can participate in society as unrestricted as possible. Secondly, if solutions are to be universal, they not only should meet the requirement of the group in question but also to improve the general environment for all citizens. Quite often good universal design solutions pass 'unnoticed'. And they can only be identified as such through the knowledge of the reasons underlying the technical solutions employed. This 'low profile' serves two reasons. Firstly, their already mentioned adaptability to a diversity of users, and secondly, the fact that 'striking' solutions might also stress differences instead of providing equality.

This study focuses on one very specific field: the study of public urban spaces' accessibility for persons with visual impairments and how universal design solutions where inclusion of diversity, and independence in their use might be searched. The studied situations – being developed in two very different countries, Sweden and Brazil, and focusing on related, but non-similar problems – reflects to some extent the circumstances of investigation in the field of design and disability. There is a great disparity of knowledge, resources, and practical assistance between developed countries and countries in development. Moreover, specific differences in educational systems, cultural and economical situation, affect social integration and job opportunities for the visually impaired. Moreover, each studied place possess *different spatial organisations*, with their particular uses and systems of space control, which are fundamental aspects worth considering when studying improvement of independent perception, understanding and use of urban spaces.

SPACE AND ACCESSIBILITY

A central concept of this work – closely connected to the definition of citizenship – is the concept of accessibility. The usual notion of accessibility means the ease to approach, enter or use something. It also involves an assessment of the practical suitability of what is available. Studies of spatial accessibility had their origins in the field of geography. A geographical definition of the concept state that, 'accessibility is determined by the spatial distribution of potential destinations, the ease of reaching each destination, and the

magnitude, quality, and character of the activities found there.'[16] On the other hand, citizenship is defined as a social right where all and each person has equal rights to housing, food, education, health, work, justice, liberty and dignity. Effective conditions of citizenship are strongly connected to the spatial distribution of social facilities, housing conditions, job opportunities, and their accessibility. A logical summation of such a conception would, therefore be, that there is no effective citizenship if accessibility is non-existent or limited. In these terms accessibility is not only linked to physical factors (as distance, location, comfort, etc.) but also to political, social, and cultural aspects (like location of facilities, prices of public transport, non-written rules of who can enter into certain territories or buildings, etc.).

Usually, studies about accessibility in the city take into account the offer, location, quality, and variety of existent activities, and the possible ways of reaching them, analysing distances, transport options and convenience of mobility.[17] Different relevant studies with different approaches try to 'measure' the accessibility conditions of urban places. One of these, is 'time-space geography' that considers not only physical distances between origins and destinations but the effective time spent and the personal resources to attain desired means. More recently urban 'post-occupancy evaluation' studies employ 'fuzzy' mathematical models to determine accessibility values of places considering the different qualitative attributes of urban locations towards the demands of different sort (housing, commercial and industrial activities, etc.).[18]

Another important research that aims to study the relationship between physical space and social life is Hillier and Hanson's theory of 'space syntax'.[19] Hillier and Hanson claims that the spatial morphology guides particular uses and circulation in urban space. The recognition of basic contrasting patterns, made of convex spaces and axial spaces, and the development of computer simulations have made both mapping and measurement of spatial attributes possible. Convex spaces are exemplified by squares and plazas, and can geometrically be described as areas inside of which no line drawn between any two points goes outside the area. Urban axial spaces can be exemplified by

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[16] Handy, S.L., & Niemeier, D. A. (1997), Measuring accessibility: an exploration of issues and alternatives, *Environment and Planning A*, vol. 29, pp. 1175-1194.

[17] By means of convenience of mobility I mean, for example, safety, price, and comfort during travel.

[18] For more detailed study of post-occupancy evaluation studies see, Preiser, Wolfang et al. (1987), *Post Occupancy Evaluation*, van Nostrand Reinhold, New York.

[19] Hillier, Bill & Hanson, J. (1984), *The social logic of space*, Cambridge University Press, Cambridge.

streets and represented by uninterrupted strait lines. According to Peponis and Zimring, 'The axial map is the most economical way of describing a layout as a pattern of potential movement, calling our attention to the changes of direction and the number of transitional spaces between (…) areas.'[20] The analysis of axial and convex spaces can bring insight about possibilities of movement, rest and encounter, feeling of locality and of being outside or inside spaces. Hence it also refers to space's accessibility in the sense of the existent possibilities of appropriation and social use. Once again we can use Peponis and Zimring studies about building connectivity and integration to further illustrate this idea. In their words: 'Our ordinary experience of buildings is affected by the way in which spaces are connected, the changes of direction imposed by the circulation system, creation of room sequences, the distributing of branching points, the availability of alternative routes, and the relations of visibility between and across spaces. These properties, which can be described as configurational, are critical to good layout over and above metric distances, area allocation, and functional adjacencies that are more usually taken into account in functional planning.'[21] Spatial syntactic analysis also represents visual fields, or 'isovists', that indicates all areas of a space that are visible from it. The isovist of a space indicates its visual attributes such as extension, unity, continuity/ discontinuity, and lines of contour.

In spite of the new possibilities represented by this late model of analysis, which mix qualitative and quantitative methods, these methods are not easily applied in the study of visually impaired citizens' accessibility. This difficult arises not only from the prevalence of essentially visually based definition of the attributes that are considered in the analysis. To support accessibility studies of urban spaces for visually impaired it is primary needed to understand how *they perceive space and orient in it.*[22]

In spite of the theoretical evolution of the accessibility concept, traditional urban planning practice has overemphasised mathematics and statistics in its application (specially regarding transport facilities studies). It lacks a more qualitative analysis, which pays attention to the social and cultural aspects that are necessarily involved. Similarly, a restrictive focus is adopted in the application of Universal Design principles when accessibility is equated to

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[20] Peponis, John and Zimring, Craig (1998), New design technologies: using computer technology to improve design quality, *Journal of Healthcare Design, Vol. VII*, http://www.healthdesign.org/library/journal/journal8/j818.htm, consulted in 24/09/98.

[21] Ibid.

[22] A study of axial lines and isovist spaces along streets, could be useful to study the possibilities of barrier-free movement of visually impaired persons in central areas. However, such an analysis would not inform how spatial perception and orientation are made possible.

barrier-free environment. There are significant numbers of theoretical studies and practical projects in this field that share a wider view of what it means to provide accessibility to impaired persons. However, the first reaction of urban technicians or architects is still to associate impairments with movement handicap, disregarding the different characteristics and needs of each kind of disability. As a consequence, the general agreement for accessible, reachable, useful spaces is associated with 'barrier-free environments' and most of the existent specific legislation and technical norms give it recognition. Despite the importance of the 'barrier-free environment' principles, it is necessary to extend the accessibility conception beyond the mere elimination of barriers for the different groups of disabled persons, and to understand what is required for their effective and active participation.

The word accessibility involves the utilisation of two main options. First, there are the possibilities of effective use of some place or object; and second, there are the existent possibilities to attain the first ones. It seems quite obvious that isolated studies aimed at improving understanding and appropriation of desired activities, without considering the improvement of possible routes to reach them, or 'vice versa', do not satisfy the 'accessibility' attributes in full. Another important component that is often left aside is that of communication between potential users and the places/routes. A city might offer interesting events, but people have to be informed about their existence, of the means to get there, and about the existent conditions for their effective use. Studies of accessibility have then to include, qualitative and quantitative studies of the main components involved, as much as their interrelations. The strategy should aim at fulfilling general objectives of understanding, use and appropriation, in each case.

ACCESSIBILITY, IMPAIRMENTS AND INTERNATIONAL DIFFERENCES

To design accessible spaces it is necessary, not only to understand the various needs arising from different impairments, but also the levels at which impediments to the accomplishment of desired actions are situated. For instance, persons with movement difficulties can overcome their problem by using a wheel chair, but its use may not eliminate or minimise obstacles due to social discrimination, e.g. in the job market. In this case, ramps facilitating their physical access to urban environments and work places might not help to solve their employment problems. This is because, the reasons for inequality are situated elsewhere, and independent of the physical conditions of the built environment.

More important than the anthropometrical differences and characteristics that might determine specific needs between the different groups of impaired persons, are the existent social, economic and cultural circumstances. These last three factors, affect not just the actual accessibility to the built environment, but also the legislation, and regulations concerning accessibility rights. They are actually situated in the origin of the problem, thereby affecting the amount of persons afflicted, the forms of disability, and the social and age groups. Moreover, they determine the effective conditions of special education, assistance and integration, which differ from country to country.

In the industrially developed countries, some of the major problems are related to the prospects of an ageing population. There, the prevalence of disability is connected to the rise in life expectancy.[23] In countries in-development (and we might ask if this term is not an euphemism), poverty is still the major cause of sickness and disability. For example, 50% of the mortality of children up to the age of 5 is accountable to under nourishment. Despite the expected worldwide improvement in health conditions and life expectancy for the XXI century, differences between developed and in-development countries will remain. According to Hiroshi Nakajima, Director of the WHO, 'It is tragic that, even with the augment of the life expectancy during the XX century, in poor countries 3 of 4 persons still dye before reaching 50 years old'.[24]

Hence, 'Universal Design' should not be understood as the search for equal 'universal solutions', but the search for better life and equality taking into account the variety of social and economic contexts. Important measures, such as laws and even technical solutions have to be defined accordingly, adjusting to specific and perhaps contrasting needs in each case. Even if conquests in knowledge, regulations and practice attained in developed countries are important as points of reference or models to be attained, they cannot be applied indiscriminately, without a deeper comprehension of the actual, and perhaps more urgent needs of other countries. Yet, making use of existing knowledge concerning environmentally inclusive design applied to these different realities, and performing critical evaluation of the causes, methods

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[23] In the next millennium technical advances in health and better sanitary conditions in the world will result in a population that will be increasingly old and urban. It is expected for the next 25 years the increase in 88% of persons older than 65 years old (in year 1025 from the total estimated world population of 8 billion persons 800 million will have more than 65 years old). In contrast, the increase of persons in productive age will be 45%, augmenting the shift between the proportion of dependent and productive population. Data from the Newspaper 'Folha de São Paulo, 3o Caderno', May 1998, p. C1-12.

[24] Ibid.

and results in such distinct situations, might bring valuable knowledge for all countries.

PUBLIC SPACES AND VISUALLY IMPAIRED USERS- DIFFERENT COUNTRIES, DIFFERENT NEEDS

To improve public urban open spaces' accessibility for visually impaired persons means to improve their possibilities of perception, understanding and effective use of space.[25] For persons with restricted or absent vision to improve the possibilities to 'approach, enter, or use something' means, in the first place, to be able to know *what* can be approached. Secondly, it is needed to know *how to get there***,** and finally *how to use it.* The usual meaning of accessibility as equal to 'barrier-free environment' is, as stated before, not sufficient to fully provide all these very different needs. The absence, or reduction of visual information, in the case of the visually impaired, means that understanding, orientation and mobility are compromised. Consequently, to improve accessibility for this group of persons requires the investigation of the multiple factors needed for the identification of activities and places, the improvement of spatial orientation and locomotion, as well as, the specific interface design of certain urban furniture and equipment.

As mentioned in the introduction, different and somehow opposite visual perception problems related to different spatial organisations, were studied during the development of this study. In Sweden, lack of valid and useful references for the visually impaired in parks' open spaces were studied. In the case of Brazil, the study focused on central urban public spaces with well-defined spatial structures, but disorganised information and excess of barriers. Also the target groups studied and their respective needs were very distinct. While in Sweden, partially sighted individuals that lost normal vision mostly due to age problems were considered, in Brazil, the majority of the individuals studied were totally blind, and were young or of adult age. These two age groups are representative, in each country, of the most significant segments

[25] The number of people with vision impairments in the world is far greater than most people realise and it is one of the most common causes of disability. The difficulties of evaluating the dimension of the problem are not just related to the knowledge of the exact numbers of people affected. The fact that visual impairments include several forms of defective visions is contrary to the commonly held and misleading image of the visually impaired as being adult and totally blind. In fact totally blind are estimated, as 10% of the visually impaired and only a small percent of those are congenitally blind. Information adapted from Gill, John (1993*), A vision of Technological Research for Disabled People*, Royal National Institute for the Blind and The Engineering Council, London.

affected by visual impairments. This in itself reflects the differences in the nature of the problems and health conditions of the two countries described.[26]

In Sweden, like most of the industrially developed countries, most elderly persons live alone and their main problems are related to the management of their daily life and the maintenance of independence.[27] To have a visual impairment late in life also means that most of these persons have had access to most of what society has had to offer: education, work, leisure, and culture. They, usually, have a family life, a place to live, and are economically stable. Their major problems are of psychological order, related to the loss of their own identity in a new situation, and of practical order related to their loss of abilities. It is especially distressing the need to depend on others, and the consequent restriction of independent choices. The situation is often aggravated by the incapacity of older persons in conquering new abilities since the other senses can be also affected by ageing problems, like deficient hearing and touch.

In Brazil, the situation of visually impaired persons varies greatly from state to state, and within them, according to existent social, economic and health facilities available.[28] As in other countries, here too, the greater numbers of persons afflicted with visual impairments are those with low vision or partial

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[26] Due to the lack of epidemiological data, the exact number of blind persons in the world is not known. In 1994, WHO estimated the number of 38 million blind, and 110 million low-vision at risk of becoming blind. The estimated worldwide prevalence of blindness is 0.7%, ranging from 0.3% in the industrialized countries to 0.6% in China, 1% in India to 1.4% in Sub-Saharan Africa. While 9 of 10 of those who are blind live in the developing countries (where poverty and lack of basic health conditions are the main causes for impairments) in the industrialized countries most visual disability is acquired late in life (due to the increase of longevity). More than 2/3 of blindness cases could be prevented or treated with the existing knowledge and technology (for instance in Brazil, rubella during pregnancy is the cause of 9 among 10 children born deaf and blind). Data adapted from WHO Fact Sheets, http://www.who.int/inf-fs/en/fact142.html, 16/06/99.

[27] According to John Gill 55% of the visually impaired population in the UK lives alone, and 88% is aged over 60 years old, and the incidence of visual impairments is distributed as the following, 2% of the visually impaired are under 16, 10% between 16 and 59, and 88% are over 60 years old. See Gill, John (1993).

[28] It is important to have in mind the continental dimension of the country and the profound economic and cultural differences between the industrialized southeast region, and the more undeveloped northeast and north regions. Also there are remarkable differences concerning access to education and health facilities between the urbanized coast and the more depopulated in-land regions. Another important aspect is that very often the poorest segments of population are excluded from the access of educational, health and social facilities. About this later aspect see Milton Santos (1987), *O espaço do cidadão,* Editora Nobel, São Paulo, P. 12-18.

vision, rather than the totally blind (around 10% of visually impaired are totally blind). However, totally blind youngsters and adults constitute a larger group in comparison to their numbers in developed countries also due to a different age population pyramid.[29] In Brazil, even if the problems placed by ageing population are about to come in the future, actual problems are mainly due to traffic accidents, urban violence and lack of preventive health care. Only during the year of 1996, 750.000 traffic accidents happened, with tolls of 36.503 deaths, 323.000 injured, and from the latter 193.000 with permanent lesions.[30] Poor basic health services combined with low sanitary conditions, under nourishment, and in the rural areas chemical contamination using agricultural products attain chiefly pregnant women, and small children, also affecting the number of disabilities acquired during the delivery.

Consequently, a great number of disabled persons in Brazil are aged between 18 to 34 years old differing radically from those of developed countries.[31] This situation implies greater needs for special education and integration, being access to work opportunities also fundamental. This age group also tends to confront more critical situations regarding participation and integration in urban life.[32] For them access to special education and to work opportunities are particularly critical to enable them overcome social exclusion and attain a more

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[29] According to data from the IBGE (Brazilian Institute of Geography and Statistics) Brazilian population aged over 65 is 4,35% of total population. Data from the WHO (World Health Organisation) indicate a life expectancy of 63 years for men and 71 for women. This numbers are significantly under numbers of countries like Canada where life expectancy is 76 years for men and 82 for women. Data from: Censo Populacional 96, consulted in 22nd may 1999, http://www.sidra.ibge.gov.br, and the World Health Report 1999/ World Health Organization, [S.L.]: WHO, 1999.

[30] Dimenstein, Gilberto (1997), Assassinos sobre Rodas, Folha de São Paulo, 27/08/1997, p. C1-14.

[31] Due to the fact that there is no data relating age span and incidence of impairments, we can only deduce that due to a larger and younger base of the age pyramid and the lower sanitary health conditions, allied to poverty and violence, a greater incidence of disability attain younger populations.

[32] It is very difficult to obtain numeric data in relation to visual impairments in Brazil. The data from the official census of 1991 classified only the totally blind presenting total numbers inferior to 1% of the total population. If the person possessed other type of impairment *or none* it was classified as *normal*. Not only absolute numbers, but also the distinction about type and level of impairment, age span, and causes of the impairment are non-existent. However, the ONU estimates that 10% of total Brazilian population presents some sort of disability, which totalizes a number of 16 million. According to worldwide estimations that 0,5% of this percent represents persons with visual impairments we obtain the number of 800 thousand visually impaired inhabitants in Brazil. For the state of Santa Catarina this number is of 22,5 thousand inhabitants. Data from: Censo Populacional 96, consulted in 22nd may 1999, http://www.sidra.ibge.gov.br, and the World Health Report 1999/ World Health Organization, [S.L.]: WHO, 1999.

enriched citizenship.[33] The focus of the study is centred on totally blind and severely impaired adults using central public areas of the city. For this age group the use of public urban spaces means the possibility to reach: transport facilities, health and education services, commercial activities, job opportunities, leisure and social encounter.

Most Brazilian cities share the characteristics of spatial segregation described in the beginning of this chapter, especially regarding the class-based neighbourhoods. In a discriminatory society, spatial segregation follows no written rules of where one is allowed to go, or to come to in the city. However, economic and social differences do. Notwithstanding that, central urban areas are still relatively open and vital places of social and economical integration, where everyone – rich or poor, worker or unemployed – is allowed to be.[34] While being places of diversity, where social or economic impediments for the accessibility to disabled citizens are not preponderant, they present several problems for the participation of impaired citizens. Socio-economic discrimination being not a determinant factor for exclusion in central areas as in other parts of the city (like shopping centres and housing areas) the role of spatial organisation and environment design comes to the foreground.

Another ambition of this study is to concentrate attention on a field of research that perhaps due to its inherent multidisciplinary character, and to the difficulties placed by the lack of control of the variables studied, does not follow the advances achieved in high-technological research. The design of devices and services for the visually impaired, searching for innovative products to support orientation, aids for mobility and for understanding of the environment, is one of the main fields of advanced research related to engineering design. The design of instruments to support the obtaining of spatial information, through non-visual means, is a leading research area in the

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[33] Governmental and non-governmental organisations are increasing the offer of special courses for orientation and professional education in the last years in Brazil. And, in spite of the difficulties, young blind persons have greater professional ambitions which excel the offer of traditional occupations of the blind, like basket-makers, telephonists, furniture makers, massage-maker, etc. Some of them want to ingress at the university and to choose different professions. In this new context, computer training presents a very interesting opportunity for education and increasing of work opportunities for blind persons. More difficult perhaps than cultural resistance to their potentiality is sometimes the lack of financial and technical meanings to accomplish what is potentially possible. Brazilian universities and campuses are not equipped to receive a blind student, and often there is no special admission exam, which gives them equal conditions to compete with normal seeing students.

[34] About streets as essentially democratic spaces see Gehl, Jan and Gemzøe, Lars (1996), *Byens Rum – Byens Liv*, Arkitektens Forlag og Kunstakademietsforlag, Kopenhagen.

search of improving perception and orientation of visually impaired and blind persons. Technological research conquests that seemed far to conquer are already feasible in our days, even if they are still not of practical benefit. Examples of these advances are satellite navigation systems that can support pedestrian's orientation and planning of routes. And, for the first time, experimental vision substitution systems can bring directly to the brain visual information.[35] Unfortunately the progresses in high technology have not been attained in environmental interventions, these affecting not only the visually impaired but also others.

Even though many countries have regulations regarding accessibility of the disabled, especially regarding central urban areas and public services and facilities, their implementation is still incipient. This situation is partly due to social and cultural factors, regarding the integration of the impaired citizens in urban life. But other factors also play a significant part in this process, like the lack of information and specific skills of architects, designers and urban planners to handle the problem. It is no less significant the question of prioritising economic situations on real, dynamic and perhaps non-controlled public urban areas. Despite the current use of the terms 'Universal Design' and 'accessibility', the lack of specific and detailed knowledge by professionals responsible for urban design in their very field of action might still be a barrier to their achievement. The very ignorance of the diversity of problems and distinct needs might bring a lack of commitment and questioning about their own positions regarding the application of laws and norms. As a result the chances for the development of design solutions that can really match universal design intentions are reduced.

[35] See Gill, 1993.

CHAPTER 2 – GENERAL APPROACH AND METHODS

GENERAL METHODOLOGICAL FRAME

The specific aim of the investigation – to support the design of accessible public urban environments for visually impaired citizens – has several methodological implications. It requires, on one hand, the development of specific theoretical and practical studies[36] in various fields to gain knowledge of the different aspects of the problem. The design perspective, on the other hand, entails the need of studying existent situations aiming at change and, necessarily, focuses on space itself. When visual aspects are not the primary sources for perception and understanding of places there is a need of 'learning to see' space in a different way. And it is essential to distinguish 'spatial objects' and 'relations between objects and users'. These relations usually pass unperceived in the traditional architectural analysis and in the design of urban spaces. It is then necessary to develop means to relate the knowledge about how persons who suffer from visual impairments can perceive space, with what in space can constitute a source of accessible information.

The design situations developed in Brazil differ from those developed in Sweden.[37] In Sweden a single design project was developed proposing technical solutions to the studied problem. In the beginning of the second stage of the study in Brazil, both the theme and an appropriate site had to be defined as a new learning situation. As presented in the introduction of the thesis an initial project was developed giving continuity to the original focus of the study. This project, which was centred on the accessibility of a leisure open space for elderly visually impaired persons, did not propitiate the expected increase of knowledge about the problem. Furthermore, it did not match a Brazilian critical situation. In Brazil, even though in absolute numbers elderly persons are the more significant age group of visually impaired, they do not confront the same need for social and economical integration as young persons and adults do. The integration of the latter group depends on the existent accessibility conditions in central urban areas. Therefore, a shift on the focus should occur not only regarding the age group and its main needs, but also in relation to the spatial situation where the problem is more significant.

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[36] By practical studies I am referring to interviews and contacts with persons concerned within this specific field like orientation teachers, social workers, visually impaired organisations, visually impaired persons, etc.

[37] Studies developed at HDK, Göteborg University, and at the Architecture School, Chalmers University of Technology from 1993 until 1995. See a brief résumé of these studies in the Thesis Introduction, pp. 4-11.

This time, instead of working only with one design project, different design projects were developed. These projects involved other professionals, working under different constraints, to solve the focused problem. In the same way as any new situation brings novel elements that affect design solutions, the study of different design situations involving different persons was expected to enrich the possibilities of seeing the problem from different angles. The design projects were also observable regarding how the communication with other professionals, users and the situation resulted in terms of methods, knowledge and practical outcomes. Moreover, the specific design situations, located in concrete places, brought together a broad spectrum of unknown aspects regarding the understanding and use of space in a different and specific social context. In this way, the design projects became expressed examples of possible applications of the theoretical knowledge, practically observable, as well as very useful tools in the research process.

To develop means to obtain first hand information from the visually impaired was based on the need for a greater and contextual understanding of the problem. This understanding should make it possible to correctly evaluate the knowledge and results found along the design projects. Based solely on the general previous studies done about perception and my knowledge as a designer, it would be possible to develop an initial spatial analysis of the chosen site. This analysis could identify the existence of spatial elements, which might constitute potential sources of information in the absence of vision. But do the visually impaired persons in Brazil actually use them? How do they evaluate their importance for spatial orientation and understanding? And which aspects can influence these evaluations?

Three different 'design situations', located in the city centre of Florianópolis, were developed: a teaching situation, a practical design diagnosis, and a technical design supervision. I call them *design cases*.[38] They involve the study of the place and the acquisition of first-hand data, in a problem-solving perspective, including different actors with different degrees of participation. The decision to conduct the study through the development of design cases entails a complex relationship between taking an active part as a design professional, and at the same time of observing and reflecting about the design process itself. Design cases are thus conceived as 'reflective actions' where knowledge about a situation is constructed, through the design practice in the

[38] All design cases are described in detail in the Chapter 5.

situation itself.[39] Being already engaged in the discussions, analysis and design solutions within each of the design cases, I tried to observe how knowledge was constructed and how the design process evolved, in technical and social contexts. Similarly interesting is the search for 'seeing' space from another frame of reference, as I attempted to 'forget' my own spatial experience and design knowledge, based on visual information. To understand the information given by visually impaired persons independently of my own pre-conceptions was a necessary condition for the understanding of the problem.

In the search of knowledge through design cases different actions were done. These can be summarised as a combination of multidisciplinary theoretical studies, practical design methods, qualitative research methods, and reflection, as follows:

- Theoretical studies of different disciplines, conducted in the beginning and during the development of the study, with the aim of acquiring general knowledge to understand the problem;
- Practical design projects situated in the same urban location, developing spatial analysis, parameters of intervention, and concrete design solutions;
- Collection of first-hand data from visually impaired persons, developing investigation tools based on traditional qualitative methods;
- Reflective interweaving between the existent knowledge and the new information, questions and results that have arisen from the design projects and first hand data collection.

Although the three initial actions are quite easy to describe considering their specific objectives, to explain how they relate to each other in the construction of knowledge about the problem does not come in a straightforward way. There is not a strict sequential progress of actions with theoretical studies made first, followed by practical design projects and the acquisition of first-hand data, and finally development of reflection. Often the practical circumstances met in the design projects lead to a re-reading and search for new theoretical knowledge. Sometimes communication with other members of the design projects brought about the need to explain and synthesise theoretical information in a more concrete way, generating thereby an adaptation of the knowledge to the situation. Both theoretical readings and analysis of specific local situations

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[39] Schön, Donald (1983), *The Reflective Practitioner: how professionals think in action*, Basic Books Inc. Publishers, New York.

brought questions that could only be answered by the visually impaired. Even as the research gets nearer to the end, the need persists to come back and to support reflections from hearing back tape-recorded interviews, and checking partial design results.

Three interconnected assumptions influenced the choice for a more exploratory learning process while doing the design cases:

- There is a relative lack of exchange of theoretical knowledge between the specific fields of architectural urban design, spatial perception and visual impairments. In the field of architectural design and disability the state of knowledge can be essentially described as more practical and normative. And in the field of engineering design the focus is placed in the investigation of high-technological instruments to support disability;

- There is a need for developing special methods for the analysis of perception and understanding of space when vision is restricted or absent since most design analytic methods employed in architecture are based on its visual perception;

- There is a need for developing specific investigation tools to obtain first-hand information from visually impaired individuals in the Brazilian situation. This information could be related with the theoretical knowledge, to deepen the first hand data already obtained in Sweden and also to support the results obtained along the design cases.

DISCUSSION OF THE APPROACH

The approach adopted in this study can be seen under the light of more than only one research theory. The attempt of framing the study under already established currents of investigation supports a self-reflective attitude regarding the general posture adopted, and helps to situate the means utilised. Different currents were influential in different ways, being sometimes interweaved during the development of the design actions, and not always intentionally searched and employed. Consequently, after a first general framing of *design cases* under a broader perspective of *Design Theory* [40] further relations with other research theories are examined. Firstly, how to acquire basic theoretical knowledge to support understanding of the problem from various disciplines is examined showing how these disciplines are related in the study. Secondly, I explain the consequences of the decision to work with concrete places, how the

[40] Design Theory studies are mainly influenced by Donald Schön. See, Donald Schön (1993).

development of a differentiated spatial analysis was incorporated, and its relation to the architectural analytical methods. Thirdly, how to develop new tools for obtaining first-hand data is discussed and how these tools were based on traditional qualitative methods. Finally, how the reflective process of interweaving these different actions to construct knowledge from the situation, and the difficulties of communicating such a process in an academically report, are described.

DESIGN THEORY AND DESIGN CASES

A design theoretical attitude, or using Donald Schön's words, a reflective behaviour, differs from a Technical Rationality approach in the making professions. According to Donald Schön, in the model of Technical Rationality 'professional activity consists in instrumental problem solving made rigorous by the application of scientific theory and technique.[41] This vision of instrumental practice considers the existence of well-defined problems where the means utilised to reach ends are based on scientific knowledge. However, very often professionals deal with unique and uncertain situations, in which there are no definite questions and ends set from the start, situations where procedures and results can be hardly repeated, tested or proved. The properties of such problem situations are that it is impossible in most cases to know even vaguely how the solution will look like when you first approach the problem, and also what relevant theory and methods should be employed to arrive to a solution.

In spite of their inherent uncertainty, design is a powerful tool to deal with poorly defined problems or even 'wicked' problems. According to Simon, professional practice is centrally concerned with design, which is defined by him as: 'courses of action aimed at changing existing situations into preferred ones.[42] If we consider that in design actions our notion of what is preferred depends on the understanding of the existing situation, and that this understanding evolves throughout the investigation, we get a good idea of the complexity involved in such an investigation. The 'design will' towards the improvement of a desired situation meets the Aristotelian definition of *phronesis.* Aristotle distinguishes the kind of knowledge arising from the ability to discern the necessary actions for a specific situation, from the search for knowledge as absolute and neutral truth.[43] The concept of phronesis involves both the idea of learning from one's

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[41] Schön, Donald (1983), p. 21.

[42] Simon, Herbert A. (1984), *The science of the artificial*, The MIT Press, Cambridge, Mass.

[43] Toulmin, Stephen and Gustavsen, Björn (1996), *Beyond Theory: changing organizations through participation*, John Benjamin's Publishing Company, Amsterdam/ Philadelphia, p. 207.

practice, and an ethical concern towards this practice, since its final aim is the improvement of actions through increasing applied knowledge.[44] Consequently, a design theoretical approach to research, or rather the creation of knowledge through design actions, differs from more traditional research praxis both in terms of performance and final objectives. Once more we can quote Schön's words:

'When someone reflects-in-action, he becomes a researcher in the practice context. He is not dependent on the categories of established theory and technique, but constructs a new theory of the unique case. His inquiry is not limited to a deliberation about means which depends on prior agreement about ends. He does not keep means and ends separate, but defines them interactively as he frames a problematic situation. He does not separate thinking from doing, ratiocinating his way to a decision which he must late convert to action. Because his experimenting is a kind of action, implementation is built into his inquiry. Thus reflection-in-action can proceed in situations of uncertainty or uniqueness, because it is not bound by the dichotomies of Technical Rationality.'[45]

In design the knowledge creation is imbedded in a very direct way in the process itself and usually involves learning for all the participants. This is not necessarily the case in all kind of research where many participants, or objects of study, can be absolutely passive in terms of learning. In design research, both the participants and the situation changes throughout the process. This dynamic character implies that there is not really any constant situation, being future outcomes affected by present design actions. As much as the definition of the problem, the needed theoretical knowledge and methods develop all through a design situation. Very often design theories present a continuous methodological sequence of hypotheses, where each one of them lead to questions regarding the vision of the impact caused by their application in the studied situation.[46] The present affects the understanding of the past and the future, which will in turn affect the understanding of the present as well. One of the effects of this is that you cannot definitively plan the research situation in advance. Moreover, the impossibility of to set up a situation exactly like the original studied situation also impede the repetition of 'experiments', a condition which often is regarded a must for good research.

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[44] Flyvberg, Bent, (1992), Aristotle, Foucault and Progressive Phronesis: Outline of an applied ethics for sustainable Development, *Planning Theory*, 7-8, pp. 65-83.

[45] Donald Schön (1983), pp. 68-69.

[46] One of several examples of this kind of theoretical framework can be found in the work of the landscape designer Carl Steinitz. See Steinitz, Carl (1996), A framework for theory applicable to the education of landscape architects (and other environmental design professionals), *Landscape Journal*, pp. 136- 143.

Design actions in social contexts with conflicting agendas are typical examples of such situations. Thus, the design cases developed in Florianópolis can be fully situated as belonging to a design theoretical domain in their search of conducting appropriated design processes for achieving Universal Design parameters. The inclusion of diversity, a central aim of the Universal Design programme, usually includes the solution of contrasting needs in not too well known problem situations. These kinds of problems are usually of complex nature, might have conflicting social interests, and their outcomes have a strong impact on users. In Universal Design projects not only the consideration of technical design aspects is extremely relevant, but ethical aspects also take primacy. Design solutions found for one situation could be perhaps applied in other situations, but usually the kind of variables involved in the problem implies the need for learning and searching particular solutions. One example can be found in the cultural attitude regarding the kind of 'help' that is accepted by impaired persons. In Sweden, for instance, the emphasis placed in the development of assistive technology is not only derived from a better-advanced technological condition. 'Human' help is sometimes seen as 'intrusive' and feared for creating situations that can stress dependence and the handicap. In Brazil the feelings in this matter are not so clearly cut. If independence is also valued, human help does not raise such strong feelings, and in some situations a personal support is considered preferable to a 'machine device'. Very often these 'hidden' variables only arise when a design solution is presented and discussed with all participants. In this way, the wrong 'moves' of the project help to increase understanding of the problem itself and to reframe the understanding of which might be a 'preferred situation'.

I would like to examine in the next section how the decision of working with concrete situations in each one of the design cases matches the principles of Design Theory and the construction of knowledge-in-action.[47]

WORKING WITH CONCRETE SITUATIONS IN DIFFERENT DESIGN CASES

In contrast to the investigation of technological devices, in the investigation of urban environments there is no possibility of limitation, or control of the variables. And different spatial, social and economic contexts will influence and affect the possible results. To be able to design environments that are more accessible to visually impaired persons, knowledge of what in the environment can support their perception and understanding is needed. But this knowledge

[47] About knowledge-in-action and reflection-in-action, see Schön, Donald (1983), pp. 50-69.

has to be informed by the understanding of the context and of the potentialities and restrictions of each different situation.

I intentionally chose to study the problem of one place, the city centre, through different design situations. Each one of them had specific objectives and involved different levels of complexity. The choice of the place to study was due to its exemplarity. It presented the problem of excess, or pollution of spatial sources of reference for orientation, and it was actually used by visually impaired persons. Moreover, the local authorities were responsive to studies, which could support the improvement of the place's accessibility. In this case, I could develop a spatial analysis, and to investigate how the visually impaired coped, or not, with it. It was also possible to observe how the different actors reacted towards the problem and towards design diagnosis and solutions to be presented. Each design case had, therefore specific objectives, different actors involved, as much as different levels of complexity and constraints.[48] The involvement of different actors, who did not necessarily share my aims, opinions, or knowledge, brought new insights to the understanding of the problem. And the different objectives necessitated the application of knowledge in different ways. I will try to examine each of them briefly in chronological order.

In the first design case, *a teaching situation,* an urban planner[49] and myself worked as teachers for around twenty students of the last year of architecture. The course organised visits of different organisations of impaired persons to discuss their problems with the students. The students had to develop their projects based on direct observation, registration and analysis of the chosen study place. By occasion of the intermediate and final results presentations impaired persons and architects working in the city urban planning institution took part in the discussions. The course had obvious pedagogical objectives, but it was also aimed at setting a different arena where to continue my own studies and to verify the previous concepts and design hypotheses developed in Sweden. The concepts were taught and discussed with the students as tools for the development of the spatial analysis. Basic methods of investigation were taught but the students were free to adopt them, and could also study the problem adopting their own methods. They necessarily had to consider in their projects three basic design parameters for the solution of orientation

[48] These will be explained in detail in Chapter 6.

[49] The Associated Professor Vera Helena Bins Ely, Architect and PhD in Engineering.

problems,[50] but they could choose which of them to work with, and to develop new project parameters as well.

The basic theoretical concepts introduced in the course supported the understanding of the problem. Together with the suggested design parameters they made it possible to develop technical solutions in a very short time. However, the design parameters suggested could not be fully applied in the Brazilian situation. The greater complexity of the urban setting, with the increase of functions and human activities demanded the search for particular principles and solutions to each one of the streets and places studied. The learning experience also showed that the direct contact with the users and with authorities was fundamental for an adjusted evaluation of needs and constraints.

The second design case, *a practical design diagnosis,* aimed to support future actions of technicians in the planning institutions to solve accessibility problems in public urban areas. The study was developed in co-operation with the local planning institute. This co-operation with an official institution offered the opportunity of examining the problem from a different perspective, and to extend the forum of discussion. The actors included in the process – visually impaired organisations, technicians, politicians, and the press – had also different visions and engagement towards the problem. The fact that the discussions were held at an institutional level brought about the very possibility of implementation of otherwise only design suggestions, or theoretical evaluations. The presence of different interlocutors brought the need to develop new ways of communicating concepts and analytical results. Furthermore, during official and informal discussions the opposing interests at stake became evident. The support given by the urban planning institute made possible a detailed observation and register of the place of study as much as its analysis and diagnosis.

The more relevant aspect though, besides the need of adapting theoretical knowledge to share with other participants, was the framing of a chain of basic principles of design aiming to solve real situations in concrete locations.

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[50] On the whole the project parameters suggested to improve orientation and accessibility were the following: (1) To create special centres of information (informing about transport system, city urban organisation and main activities); (2) To create distinct path design structures - distinguishing the streets hierarchy and creating continuous lines of safe and free-barrier areas; (3) To create local points for orientation – marking the position of centres of interest, and providing spatial information and descriptions about the urban activities.

The third design case, *a technical design supervision,* aimed at the development of specific design solutions, and of a new law proposition, based on the previous design parameters developed. The solutions were proposed and discussed with the architects responsible for the project, as well as the visually impaired. The specificity of the design solutions provided another platform of discussion and evaluation, since it materialised knowledge in a very concrete form. These solutions were partially implemented in a 'pilot project', even though not in conformity with the original project. This project concretion made possible to evaluate design solutions, regarding their usability from both research and technical points of view. It was also possible to reflect about the reasons for their failure and success in a concrete spatial and social context.

The most important lesson taken from this last design situation was about the importance of some of the general parameters developed in the *practical design diagnosis*. Especially after being implemented some of the project solutions had been extended to other areas of the city in a punctual form. The non-examination of the performance of the technical solutions, allied to the partial implementation of the solutions took away an essential trait of any 'pilot project', that is to be tested and evaluated. The opportunity of verifying in practice design solutions, and the whole principle of establishing communication channels between technicians and users was also lost. The absence of dialogue between technicians of different institutions, and their lack of knowledge of the problem situated in the origin of the proposed technical solution were the main factors responsible for this situation.

TO ACQUIRE THEORETICAL KNOWLEDGE IN STUDYING THE PROBLEM

There is a consistent exchange of theoretical and practical knowledge in the fields of engineering and telecommunication regarding technological research of innovative products to support actions and social integration of visually impaired individuals. There is also consistent theoretical investigation of the perception of the visually impaired and blind individuals in psychology and ergonomics. The greater amount of 'applied' knowledge existing in the field of accessible urban design for the visually impaired consists mainly of technical norms and regulations plus isolated good examples of architectural design. The last ones are not representative of the general situation encountered in public urban spaces, which usually lack improvement of their accessibility. Moreover, there is not so much cross-disciplinary investigation in the field of architecture relating attained design results of these special projects with more theoretical studies of spatial perception.

Studies on the spatial perception of visually impaired persons in urban environments necessarily needs to draw together diverse material from different fields – environmental and perceptual psychology, ergonomics, geography, and architecture. Most of this literature has its own traditions, presenting differing theories within the same field, and there are very limited cross-references between them. And with the exception of specialised studies about the perception of the visually impaired, most of these theories are essentially visually based. It was not my intention to make an overview of different theories, or to discuss the basis over which they stand. I rather opted to make use of the pieces of knowledge that could bring me a better understanding of the problem, and I tried to connect these different pieces in the light of a *phenomenological approach.*[51] This might seems in contradiction with the choice of some of the theories selected. A phenomenological study of spatial perception stresses the *human understanding and interpretation of reality*. I also made use of theories though, which are based on the *reality of the facts of perception.*[52] The use of opposing philosophical concepts was informed under a design perspective, which is to study the reality of the world aiming at its change. For me, it was equally important to achieve knowledge about *how the reality of the world is perceived by each sense*, as well as, *how this reality can be interpreted in different circumstances.*

Especially in my own field of knowledge, architecture, it was necessary to discuss and to extend the concepts traditionally adopted for the study of the perception of urban spaces. Since they are usually defined from a visual standpoint of perception it was necessary to re-examine their meaning, studying similar concepts from other disciplines. Their further discrimination was also necessary to support an analysis of urban spaces from a non-visual basis. The adaptation and merging of the concepts used to support understanding of this differentiated urban analysis, and the effort of classifying spatial elements, which did not fit to traditional classification, generated new knowledge in the situation. Further reflection over the new concepts searched to extend their application to other kind of spatial analysis within broader frames than visually ones. Again the general phenomenological frame helped to promote understanding of a complex situation, where *not knowing how things are, make*

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[51] Mainly supported by readings of Merleau-Ponty, Maurice, (1945), *Phénoménologie de la perception*, Éditions Gallimard, Paris.

[52] Namely the ecological theory of sense's perception proposed by Gibson, James J. (1966), *The Senses Considered as Perceptual Systems,* Houghton Mifflin, Boston.

it necessary to be more attentive towards whatever can be observed.[53] This is exactly the situation met when we try to understand how space can be perceived in the absence of vision, and what is usually non-considered suddenly gain relevance.

KNOWING THE PLACE THROUGH A DIFFERENT SPATIAL ANALYSIS

The development of the spatial analysis necessary for the evaluation of problems and potentialities of the place for orientation in the absence of vision could only be partially based on the traditional methods of architectural analysis. The essentially visual classification of spatial elements for orientation did not cover the variety and the different nature of the spatial references employed by the visually impaired. The different scales, which were necessary to examine the place and the need for an essentially qualitative evaluation, were supplementary difficulties for the use of the traditional architecture tools. The observation and study of the place itself brought the need for a different classification of its spatial elements, and for an adaptation of the architectural tools to the intended aims of the study. I will describe in the following how the spatial analysis proceeded, and by which means.[54]

In the beginning of the investigation I had no exact idea about what to observe in the place, or how to register the information. The first decision was to try to know the place from the place itself. As a consequence, the first method employed was to make *exploratory walks* in the city centre. These consisted of aimless walks downtown, while trying to observe carefully, and to discuss, the impressions of different places concerning their accessibility and ambience.[55] The walks were aimed at seeing the space in a different way, and also at

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[53] Several of the examples presented by Merlau-Ponty are based on the observation of situations of exceptionality. For instance, to reflect about the spatiality of the body he examines different cases of persons who have problems with their intentional and non-intentional movements. See Merlau-Ponty, Maurice (1945), pp. 122-137.

[54] As the detailed description of the proceedings of the place analysis is presented in Part II, Chapter 4, I will here concentrate on the description of the reasons behind the choices of the instruments.

[55] I had the help of an architecture student as a research assistant during the development of the spatial analysis. She joined me in all the experiments and tools application. We permanently discussed and evaluated the results obtained from our observations and registers, as much as their shortcomings. During the application of instruments she was responsible for collecting and registering data (by writing and drawing), while I concentrated in the observation and in taking photographs.

identifying the basic space elements that we needed to observe, and to register, in a more systematic way.

We met three main difficulties to register and to analyse through maps and drawings. The first difficulty was related to the fidelity of the urban maps available.[56] The fact that they were 'old' made them less precise, since Brazilian cities demonstrate constant changes in their physical setting. The second difficulty was their lack of precision. The maps we had were in the scale of the whole area (varying from 1:10.000 to 1:1000). But for our analysis we needed to examine from the scale of the whole area, down to the scale of the street, block by block, reaching the scale of the 'objects' within blocks, and their detailing. A third difficulty was related to the nature of the spatial elements to be registered, since many of the information sources are essentially dynamic. Trying to solve these difficulties of registering the place a *special card* was designed. It included a map of the street to the scale of one block, and a list of all spatial elements that could be found in the street. The only initial distinction made between them was if they were permanent or dynamic, in time/space. Qualitative notes could be taken and supplementary drawings made if needed. A detailed *photographic record* was made for each block.[57]

The amount of data collected was significant. It had to be used both to illustrate the problem to others, as much as to help to classify the spatial elements according to their role for orientation. In the *diagnosis*, which follows the data collection, the main concern was to develop criteria to support the classification of spatial elements as obstacles, or potential sources of information. At this moment it was crucial to draw theoretical knowledge from different fields, to discuss it with others (the student and the technicians), and to interpret and apply the knowledge obtained directly from the visually impaired.

The need for communication with others helped to adapt the concepts to the situation. But another problem was how to communicate the results obtained in the analysis. They should be clear enough, and not too theoretical, since they were aimed at different kinds of readers (technicians, politicians, the press, and the visually impaired). To communicate effectively with them *quantitative* means were developed, giving numbers and concrete facts about the problem

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[56] We had different large-scale maps, showing different things within different dates: satellite-photographs from late 80´s, detailed block by block maps from the beginning of 90's but drawn over an older urban structure, actualised digital maps covering only a fraction of the studied location.

[57] About maps and ways of mapping the city see Pinder, D. (1996), Subverting cartography: the situationists and maps of the city, *Environment and Planning A*, vol. 28, pp. 405-427.

(graphics). Also *qualitative* means were used to bring identification with the problem through the selection of descriptions and images that illustrated the problem (slides, oral descriptions and illustrated written reports).

Also *isolated individual experiences* were made in different spatial situations, walking with eyes closed for short periods, and paying attention to what I could perceive in those moments and at that place.

TO OBTAIN FIRST-HAND INFORMATION FROM VISUALLY IMPAIRED PERSONS

In the Part II, Chapter 5 a very detailed description of the tools developed to obtain first hand data will be presented. Here I will focus on the basis on which these tools were developed, on some aspects regarding their application and evaluation, and on the significance of the data obtained.

It is important to emphasise that the term 'visually impaired' covers a variety of different possibilities of visual perception. These can range from partial vision or low-vision where there is a reduction of visual information, to a total lack of vision in the case of the blind. Among these, it is also important to distinguish those who are congenitally blind, and those who still possess visual memories and/or visually based knowledge. The development of the tools did not aim to drive generalisations, to prove, or to systematically compare and interpret, how different types of visually impaired persons could perceive space. *Their main objective was to obtain information that could help me to understand as a designer, which spatial elements they use to orientate, and how they obtained the information*. I had already conducted several *focus-group interviews*[58] with visually impaired persons in Sweden. These interviews were focused on the orientation of 'low-vision' elderly persons in leisure open spaces. This time, I was more interested in obtaining knowledge about how blind persons could orient in central urban areas. Several *open interviews*[59] were held in the beginning of the investigation in Brazil. However, the results obtained did not

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[58] Folch-Lyon, Evelyn & Trost, John (1981), Conducting Focus-Group Sessions, *Studies in Family Planning,* 12, pp. 443-449; and Basch, Charles E. (1987), Focus Group Interview: An underutilized research technique for improving theory and practice in health education, *Health Education Quarterly* 14 (4), pp. 411-48.

[59] Around ten interviews were held with different individuals and persons who work in visually impaired organisations (most of them blind). The interviews usually did not have a previous organisation of the questions. They were more 'free' and exploratory. Different questions and discussions proceed aiming at knowing how the visually impaired could cope with the use of the city centre of Florianópolis. In most of the interviews only written notes were taken, and some of the interviews were tape-recorded.

bring any new ideas from what I had learnt in books, and during previous interviews in Sweden. The persons interviewed were more interested in explaining the problems they encounter in orientation, than to explain their own individual ways of obtaining spatial information. And very often they tended to reproduce techniques of orientation instead of reflecting on how one orients. A more complicated aspect is that even if blind persons are more conscious about their process of orientation, they do not easily relate their own processes with the concrete use of spatial elements as sources of information easily. On these shortcomings, and on the previous knowledge and experience of applying focus-group interviews I could base the development of new tools.

As a result of this need to understand how visually impaired *could orient* in the centre of Florianópolis, two new tools were developed. The first one, '*Exploratory walks'* was inspired by a previous designed experiment to walk with blind persons in Sweden (that never materialised). It is perhaps important to stress the intentions of making these walks as they defined the choices of both *whom* should be the 'conductor', and *where* to walk. The information most difficult to obtain was about *positive sources of information*, in particular how blind persons could use and combine permanent and dynamic sources of information in a successful way. Consequently, the person should be experienced in orienting in the city centre, and should be willing to communicate his/hers own procedures of orientation. It was also important that the walks *followed concrete purposeful routes*. These were defined in accordance with the interviewed. The conversation during the walk was tape-recorded and photographs of the most significant aspects pointed out were taken. Full transcriptions of the tapes were made afterwards and the photographs were classified in two different ways, to illustrate sequence of the route, and to illustrate specific situations met along routes.

The way in which the situation evolved, during the application of the instrument, orientated the proceedings of obtaining the information. During the 'Accompanied walks' both situations and the spatial elements present along the route influenced the aspects that were described. I could 'feel' and compare the novelty of the information obtained during the walk, with my previous knowledge from interviews with other visually impaired persons, and from the readings of books and manuals of orientation and mobility. Three walks were made with only one person, but the amount, the novelty, and the quality of precision of the information obtained excelled what I had expected. This information was later compared and confirmed with the information obtained from other visually impaired persons in the 'Word's game'.

The second tool, 'Word's game', was a new approach for the realisation of focus-group interviews.[60] The idea of making a 'game with words' instead of an 'interview' was aimed at bringing a more relaxed attitude, both to the interviewer, and to the interviewed. The main characteristics of focus-group interviews, which are unity of interests among group members, absence of rigid procedures in the application of questions, tape-recording of the whole session, and selection of similar subjects while analysing tapes, were maintained. *The groups selected shared some form of unity.* Four different groups were organised: one group with three blind adults with experience in orientation; one group with four older blind adults with and without orientation skills; one group with five visually impaired adults with different degrees of residual vision, and orientation experiences; and one group of four congenitally blind teen-agers starting to learn orientation techniques. *The game application did not follow any rigid procedures*. The sequence of words to be read, and discussed followed the participants interest. The lack of knowledge of some words, for instance, eliminated a family of words, or suggested others. Interesting discussions and related subjects were not interrupted when introducing relevant information. *All interviews sessions were tape-recorded*. And in the evaluation of the written transcriptions of the tapes *a selection of relevant subjects was made to compare different interviews.* The *interpretation of the data was directed at the main investigation questions defined previously*, that is how they orient and which spatial elements were used with that aim. A final evaluation of the first-hand data was done comparing the written transcriptions obtained in both instruments. In this evaluation I tried to construct an understanding of which were the spatial elements employed for their orientation, and how information was obtained.

The seeking of knowledge in design situations is therefore different from seeking general facts. First we restrict the understanding that depends on our beforehand understanding of what is relevant. We have to find methods of acquiring knowledge where the situation talks to us rather than that we question the situation from the point of departure of what we think is relevant information. Examples of such methods are the Accompanied Walks and the

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[60] Focus group interviews are currently used in applied social sciences with exploratory, clinical, educational and phenomenological approaches. Usually different discussion groups are organised with persons sharing similar problems or interests that belong to a same age/sex or social group. Examples of such groups can be male teen-agers presenting alcoholic problems, or elderly women who became visually impaired. An important trait of the interviews is that they not only provide first hand information to the researchers, but also that discussions developed by the group support them to understand and overpass the problems they confront. See, Basch, Charles E. (1987), and Folch-Lyon, Evelyn & Trost, John (1981).

Word's Game. The knowledge acquired from these two situations were no doubt relevant for the situation at hand and the result proved the methods to be usable in design situations. To get more information several walks and sessions of word games could have been done, not to prove the relevance of the findings from the first sessions, but to get even deeper knowledge of the situation.

TO REFLECT IN AND OVER A SITUATION

I have presented how through different actions, knowledge about a problem was found in the development of 'design cases'. It is important to stress, once more, that the main intentions of this study are not, to apply different theories in practical design cases. Neither is it to collect, nor construct 'ideal technical design solutions', or formulas, that could be applied indiscriminately in different situations. The aim is chiefly *to provide understanding about what to consider in the analysis and design of different spaces aiming its use by people with different needs.* In the final reflection of the design cases I tried to relate the studied theoretical knowledge, with the knowledge acquired in the specific situations studied. This effort was extended attempting to further develop concepts that could be used in the analysis and design of similar situations, following Universal Design principles.

How to communicate such a design process represents another difficulty that has to do with the configuration of the report. The traditional way of reporting in research is to define the problem, to present the relevant theory that the research is founded on, to develop a discussion of choice of the methods, to report the empirical studies and finally to present discussion and conclusions. Mostly research is not carried out this way and should, if we focused on truth rather than configuration,[61] be reported otherwise. In most cases however the truth does not suffer too much from reporting in this way and it is certainly a convenient way to follow a research process. Important is that the contribution to knowledge and the most interesting information is mostly reported in the last part of dissertation in what we call the result. In design the understanding of the problem, the choice of relevant theory, the methods used and the empirical situation in itself changes all through the research. This is to a lesser degree

[61] How to reach a balance between the needs of truth and configuration in the description of the research actions is discussed by Törnebohm, Håkan (1983). He means that the account should give 'as historically correct a description of the research as possible' however trying to attain 'the ideological consistency of the scientific texts.' (Quotation in *Studier av kunskapsutveckling,* Doxa, Karlshamn, pp.26-28, in Granath, Jan Åke (1991), *Architecture, technology and human factors: Design in a socio-technical context*, Chalmers University of Technology, School of Architecture, Industrial Architecture and Planning, Göteborg, pp. 28-29.)

true in all research but refereeing to Schön's distinction between technical rationality and reflective behaviour, what is regarded as a core part of reflective design behaviour is regarded an inconvenience in research based on technical rationality.

Therefore, the whole process, from understanding the problem to conclusions, is the result of this investigation. This means that a linear reporting of such a learning experience is far from true as all its components changes through the process. However, the conventional way of reporting has its virtues in terms of configuration. For the reader it is important to notice that I have changed the 'conventional layout' to underline the design perspective. Consequently, study results are not only to be found in the last chapter but from the first page of the report all through the text. Moreover, since the knowledge found is contextual, it cannot be isolated described in itself but has to be accompanied by the description of the specific situation to make sense. This importance of learning with particularity and of relating the knowledge from one situation to another is very well expressed by the Brazilian geographer, Milton Santos, who says: 'When I work with the world, I use all its variables in a certain moment. But no place can have all or the same variables, neither the same elements, not the same combinations. For this reason, each place is singular, and one situation is not similar to any other. Each place combines in a particular way variables that might, very often, be common to other several places.'[62] This is a good description of the research situation of this study. Knowledge from such situations often have a wide relevance in other situation that are similar but can on the other hand not be regarded as general knowledge for a certain type of situation.

Very often I confronted myself with this difficulty while developing the investigation. Especially when writing the thesis, which was last instance of reflection about what I have done, I strived to reach a configuration that could reflect the working of design. The complexity of the concepts studied, the interest and variety of the information obtained, and my own urge to tell all the details contributed to the search for truth. All these factors do not necessarily contribute to the fulfilment of the need for a good configuration. However, in different occasions (defining design parameters, evaluating the first-hand data, and developing initial classification of spatial elements) a configuration was being 'sketched', even though I was not consciously intending to do it.

The final thesis configuration is made of four parts. The first part, situates the general problem, and sets the study approach and methods. The second part

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[62] Santos, Milton (1988), *Metamorfoses do Espaço Habitado*, Hucitec, São Paulo, unauthorised translation, pp. 58.

describes the three different stances of knowledge - theoretical studies of perception, analysis of concrete places, and learning from the experiences of visually impaired persons. The third part explains how knowledge was combined in each one of the design cases. The fourth part presents the thesis conclusions based on the reflection and interweaving of all the different stances of knowledge. Especially in the conclusion of the thesis an effort is made not only to draw the knowledge acquired through different actions, but also to present possibilities of extending this knowledge to other design situations. In this way, reflection-in-action and reflection-on-action supports design actions in the field of accessible design for the visually impaired, which could also contribute to an architectural design approach considering all our senses.

PART II

CHAPTER 3
KNOWLEDGE OF SPATIAL PERCEPTION

CHAPTER 4
KNOWLEDGE OF SPACE

CHAPTER 5
LEARNING FROM THE EXPERIENCE OF VISUALLY IMPAIRED PERSONS

CHAPTER 3 – KNOWLEDGE OF SPATIAL PERCEPTION

If it were possible to find 'limits' of spatial perception most probably these would be confounded within the 'limits' of our visual field. Space limits perceived through vision are variable in size and quality, and suffer dynamic changes according to lighting conditions, our movement and attention focus. Our visual 'window' to the world can be enlarged in one moment to the horizon, and on the next shortened to the dimension of our shoes moving on the pavement. It can have vague and almost absent surroundings 'around' the page of a book we are reading, and it can even disappear and be substituted by 'visions' from our imagination. Since it is possible to reach very distant things like the stars, the clouds, the line of the horizon with our vision it is commonly assumed that our 'field' of visual perception, even when limited by near physical obstacles, is potentially more extensive than the reach of our physical body. Notwithstanding that, when reflecting about improvements to visually impaired persons' perception of space, and especially, for those who are blind from birth, there is a tendency to imagine that their spatial perception is very limited. In fact, not beyond what they can actually reach, and touch, while moving. Like a world that is always closing itself around a person. But how can we know, we that can see, in which ways a blind person has his spatial perception possibilities altered or reduced? How is it possible to reach an understanding of a different spatial perception from the vantage point of those who get information about the world from essentially visual ways? And how could this understanding support the challenging design work of creating places for someone who bases his/her spatial perception on other senses than vision?

It is very important, from the onset, not to confound different notions, like space itself with spatial perception, and with the human biological sensory limitations into obtaining spatial information. It is true that all our senses work between a certain span, and that beyond thresholds information cannot be obtained. It is impossible, for instance, to hear too low or too high frequency sounds. We cannot see without the presence of light, and too slight pressure upon our skin are hardly detected by passive touch. In this sense the spatial attributes perceived by a visually impaired person, or a blind individual, are certainly not the same. For the case of the latter, there is a reduction, or total lack, of information provided by the visual system. In reality, especially for blind persons, a different reflection about the limitations they might have in their spatial perception process has to be done. After all, perception of space based on visual information is not the same that which is based on other

sensory information.[63] And surely, the 'limits' for obtaining information experienced by blind persons do not depend on the limits of obtaining visual information. A deeper and wider reflection has then to be made if we want to increase the possibilities of spatial understanding for the severely visually impaired and the blind.

The investigation of the visually impaired person's perception not only serves to increase the necessary understanding about a different spatial perception process in itself. This knowledge is also central to support the investigation and reflection of the design procedures, which are necessary to use in such a complex design situation. Such a stance should be based on an understanding of how and in which ways spatial information can be obtained from other attributes rather than solely from environmental visual attributes, thus affecting the way in which space itself is studied. This should be applicable not only when vision lacks, but especially, when considering the synchronic functioning of vision with the other senses. To achieve this knowledge it is necessary to understand how a differentiated spatial perception process occurs. Information from psychology would answer questions regarding *how human beings perceive space.* Since this study is directed at professionals, students and researchers responsible for the creation of new places,[64] a central concern is placed on the investigation of, *which are potential sources of information in different places.* How differences in the physical and human environment affect the perception, understanding, and use of space for persons with and without visual impairments? Which, and in what ways, different spatial elements convey useful information? How they support and inform about different spatial structures and organisations? And how they bring meaning to space, transforming them into places, and extending possibilities of action? Finally, how this knowledge can be used in different contexts to support the development of universal design solutions?

The spatial elements that can provide accessible information to blind persons are not necessarily different from those used for the orientation by other citizens in the public spaces of a city. However, different spatial elements can play different roles, on an isolated or simultaneous form, for the spatial understanding of a place. While some elements might be responsible for the very understanding of the place's structure, others might be essential for the

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[63] Merleau-Ponty, Maurice (1945), pp. 259-260.

[64] By 'new places' I am also referring to any transforming of existent places into desired ones.

recognition of the places' identity. And still others might offer useful bearing as regards the relative position of the person while moving in the space (and throughout places). Some familiar urban elements can also pass unperceived while others might constitute obstacles for orientation. It is important to consider that spatial perception is a complex process that develops at simultaneous and interconnected levels – the level of direct experience, the level of memory, and the level of knowledge. To consider all these levels might help us to understand this process. An attempt will be made at distinguishing them without loosing their interconnected perspective.

The main concepts of spatial perception, orientation, and the consequences brought about by deficient visual perception are presented in this chapter. As has been indicated from the onset, theoretical studies are essential for the understanding of the problem, the definition of investigation methods, and the development of spatial analysis and practical design projects. In architectural design the analysis of physical, psychological, social and functional aspects of human spaces is almost always conducted in a problem-solving perspective. It is not within the design 'reach' to change individual, social or cultural actions. However, even if different qualities of spaces cannot determine human actions, they influence human perceptions, feelings and uses of space.[65] Consequently, it is from a perspective of supporting the understanding of relations between human spatial knowledge and physical aspects of urban human environments that main concepts are studied.

The main theoretical frameworks of the study that support conceptions of the dimensions of reality, perception and spatial knowledge are sustained by Merlau-Ponty's phenomenological approach, and James J. Gibson's ecological theory of the senses perception. Other materials are utilised. Among them, are the socio-historical and geographical approaches of David Harvey and Milton Santos, respectively, and Kevin Lynch's study of urban images. In psychology, Spencer, Blades and Morsley's overview of the development of spatial knowledge is of invaluable importance since they also include other disciplines, such as geography, and planning, and have a special chapter dedicated to the child with special needs. Among readings about spatial perception of the visually impaired the work of Gunnar Karlsson about spatiality of the congenitally blind occupies a central place. In this specific field valuable information was also obtained in different 'practical books'. These are usually edited by visual impaired organisations aiming to support with basic and

[65] Rapoport, Amos (1969), *House Form and Culture*, Prentice-Hall, Englewood Cliff.

practical knowledge visually impaired persons and their families.[66] They also address recommendations to different professionals, as schoolteachers and designers, aiming to broaden their understanding regarding the importance of their roles to alleviate the problems of visually impaired persons.

[66] Among these books were very important the following: Edman, Polly K. (1992), *Tactile Graphics*, American Foundation for the Blind, New York; Ford, Margaret and Heshel, Thena (1991), *The In Touch 1991/2 Handbook: BBC Radio 4's guide to services for people with a visual handicap*, Broadcasting Support Services, London; and Webster, Richard (1980), *The road to Freedom: A parent's guide to prepare the blind child to travel independently*, Katan Publications, Jacksonville.

3.1 RELATIONAL SPACE

> 'L'espace n'est pas le milieu (réel ou logique) dans lequel se disposent les choses, mais le moyen par lequel la position des choses devient possible. C'est-à-dire qu'au lieu de l'imaginer comme une sorte d'éther dans lequel baignent toutes les choses ou de le concevoir abstraitement comme un caractère qui leur soit commun, nous devons le penser comme la puissance universelle de leurs connexions.'[67]

We can perceive space because we recognise 'objects' and we can relate to them in time and space. If the meaning of an object is always related to the reality of the object itself, the understanding of meaning is always dependent on the relations between the object in its context and the perceiver.[68] Changes in the context, as much as, the grade of attention, interest, physical and psychological capacities of the individual affect the very perception of the object. Forms, sizes, textures, colours, weight, sounds, smells, movements, are spatial elements' attributes that constitute *potential information*. These attributes in turn assist in the distinction of meaning. The recognition of an object's identity depends then on the possibilities and conditions of perceiving the information given by its attributes. This in addition to the relation between this information, the individual intentions, and the cultural meaning that is attributed to the object.

Different relations can occur between spatial elements and individuals in space.[69] The roles that elements in space do have regarding the possibilities of the individual to locate himself in it and to relate with it are of particular interest for this study. To know where we are and to understand the world is always dependent upon recognising what the elements we perceive are. And which attributes of urban elements can, from the perspective of a blind person, furnish accessible information for recognition of places? To distinguish which

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[67] Merleau-Ponty, Maurice (1945), p. 281.

[68] Merleau-Ponty, Maurice (1945).

[69] From now on an attempt will be made to avoid using words like 'things' and 'objects', since they are usually associated with the idea of concrete permanent components of the landscape. The chosen alternative is a more general denomination of space components as 'spatial elements'. These include all sorts of natural or artificial components of space that might constitute information sources for the perception of urban space and urban spatial organisation. Following this logic a wider group of spatial components might be included in the analysis that otherwise are disregarded.

these elements are, it is important to reach some sort of general classification about the roles they play for orientation and understanding of space. But to start with a classification based on urban systems, the scale of the elements, or on different families of elements might, in this case, represent a risk. This is because, different relations might be established between the urban context and a perceiver that cannot see. Therefore, the key to the development of some sort of classification is dependent more on our definition of *what* we want to understand, *where,* and under *which conditions,* than following traditional categories of urban analysis. Usually these categorisations are done from a rationalistic standpoint, where mainly functions and physical attributes (usually perceived by vision) are the sources of distinction. The examination of how a different spatial perception is related not only to the physical space but also to cultural and social aspects overpasses these traditional urban methods and theories.[70]

If we are in a city, and just look around in a street trying to name everything, one might have a long list of different elements belonging to different categories and scales. I saw, for instance, the following sequential scenes in a street of Florianópolis city centre. An employee from a clothes shop places an empty paper box on the pavement besides the entrance of the shop. A woman comes by collecting paper boxes placed by other shops along the pavement. She places them on a pile in the middle of the pedestrian street. It is the middle of the afternoon, and other people walking in all directions do not seem to bother or to 'see' the pile of paper boxes. Later on, a young boy pulling a big 'paper car', through the middle of the street, collects this pile among others from different spots in the city centre.

If we are studying the city informal system of urban paper collection all these facts are interrelated. But for the persons who are walking in the street the paper box, the piles of paper, and the 'paper-car' are just unexpected objects and obstacles. For a blind person they are a nightmare since the piles of paper boxes are moveable objects whose location cannot be memorised. However to

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[70] The work of Alexander, Norberg-Schulz and Rapoport are examples of qualitative approaches towards the understanding of urban spaces and use of space, where visual information is not the central focus. Even though, for an analysis of the perception and understanding of space when visual information not available, the development of special studies and methods are still needed. See, Alexander, Christopher (1967/1965), A city is not a tree, in *Arkitektur* 1967, Stockholm, Norberg-Schulz, Christian (1985), *The concept of Dwelling*, Electa/Rizzoli, New York and Rapoport, Amos (1982), *The meaning of the Built Environment: a non-verbal communication approach*, Sage Publications, Beverly Hills.

be able to improve the comfort and safety of orientation for blind and normal citizens it is necessary to establish relations between sometimes apparently disconnected elements of the urban environment. Our initial question then is a little more precise. And a meaningful classification of urban elements, should distinguish their role as *sources of positive information,* or *hindrances to orientation and understanding* and not only classify them as belonging to one or another category, or urban system.

LANDSCAPE AND SPACE

A geographical definition of space is as a group composed of inseparable parts. The group is made-up of geographic objects, natural and socio-cultural objects on the one hand. And on the other, it is life that animates them, in other words, society in movement.[71] Since the social contents are not independent of the space forms, each built form contains traces of the past and crystallised structures of actions, possessing historical and social dimension. Another important geographical concept, which can help us to distinguish between different components of space, is that of 'landscape'. Traditional landscape's definitions conceive it as all that can be seen, 'the domain of visible'. This basically being the relatively fixed materiality of space, formed by natural and artificial 'objects'. Milton Santos presents a more recent and wider conception of landscape including not only its visible domains, but also the dimension of whatever can be perceived by an individual, including sounds, smell, textures and all possible sources of stimuli to the human senses.[72] It is of course an abstraction to describe the space of potential actions without actions. Hence we can never confuse landscape with space. For, while landscape is essentially the 'materiality of the world' that supports and contains social actions, space is always made-up of the relations between its forms and contents.

In this study, the traditional distinction between a concrete-material landscape made up of geophysical objects and the life and movement that animates it cannot be applied in its entirety. Our analysis of urban space cannot be restricted only to the classification of 'material elements' as potential sources of information. After all, life and movement itself are also fundamental sources of information. Similarly, classical architecture studies, like the perception of urban images proposed by Kevin Lynch,[73] even if influential, cannot be

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[71] Santos, Milton, (1988), *Metamorfoses do espaço habitado,* Hucitec, São Paulo, pp. 26-27.

[72] Ibid, pp. 61-62.

[73] Lynch, Kevin (1960), *The Image of the City,* The M.I.T. Press, Cambridge.

absolute models of classification for this study. Though his work was employed for the development of this study since I could relate my own observations about the spatial elements that supported orientation of the blind with his classification of the visual elements that structure image of a city.[74] But precisely because Lynch focused on the study of the *visual forms of the city*, they did not entirely support the intended aims of classifying sources of information other than visual ones. The focus here is on the perception of a relational space, where built forms of the city and natural/social events necessarily became sources of 'material' information about the world.

Hence the analysis of urban components of space, taking into account issues of perception, has to be done differently. The analysis of spatial elements and their role as sources of information will always be informed by the perspective of how individuals can orient and understand space 'as structural and always relational between the landscape and the life that animates it'.[75] Further and more detailed distinctions have to be made regarding the character of spatial elements depending on their roles as information sources, in time and space. Moreover, it is necessary to review traditional architectural definitions of urban physical elements regarding their roles in orientation and understanding based on visual attributes.[76] However, it is not possible to consider other attributes and functions, and to develop finer distinctions, without previous understanding of the *processes of spatial perception*.[77]

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[74] The basic distinction of the different roles played by landmarks, paths, limits, crosses and neighbourhoods to structure spatial perception as proposed by Lynch is in its majority valid to understand how space can be perceived when vision is absent as well. This because, the basic process of orientation does not change when references are obtained from the other senses. The concept of 'landmark' is still central for structuring spatial perception even if 'visual landmarks' cannot be perceived. The same applies to the concepts of 'paths' and 'junctions/crosses' which are fundamental in the study of blinds person's orientation. The recognition of 'limits' could be examined not only as tactile physical limits guiding movement (as borders of pathways or walls) but also in which ways distant limits can be identified. The concept of 'neighbourhoods' presents more difficulty, even if it can be related to the study of how the recognition of larger areas or place's identity could occur.

[75] Santos, Milton (1988), unauthorised translation, p. 26.

[76] Like the concepts of visual landmarks, proposed by Kevin Lynch.

[77] Merleau-Ponty stresses that individual's perception always depends on the context. In this way, there is no fully generalised knowledge about perception that can constitute a general basis for design. This implies that it is necessary to find methods of design that can grasp the essential context properties and the interrelation between the individuals and context.

3.2 HOW DO WE PERCEIVE SPACE?

The origin of all possible reflections about the relations we establish in space and within space is rooted in our human condition. We cannot analyse human perception outside a time-space context, anymore than study space from any contingence other than human. In the effort to understand these relations different categories can be distinguished. Different disciplines study human perception from different vantage points. This fact, only underscores the need to study the process in its general complexity, which justifies some of the basic concepts adopted in this work.

To be able to perceive the multiple and complex qualities of space does not only mean to be able to locate the self in time and space. It also means to establish meaningful relations between this and other places, existent objects and human activities. The following reflections in this paragraph are informed by Merlau-Ponty phenomenological approach to perception.[78] According to him, the qualities of objects are in the domain of the reality of the world. To perceive something in the world always means to relate an object with other objects of the world. In an absolutely neutral environment there are no possibilities of obtaining any kind of information. Perception, after all, depends on the recognition of change and constancy of attributes. Similarly, we can only see an object if there is contrast between it and its background. The sight of a colour of an object cannot be disassociated from its qualities, anymore than the size and material of the object, or the existent light in the place. Nor can it be disassociated from intention, and personal and cultural knowledge. Consequently, the red colour of a red woollen carpet is not the same as that of a red cotton one. These differentiated meanings of 'red' related to the identification of specific objects, however, do not interfere with the constancy of the colour red. Knowing that the carpet is red we will see it as red even if particular light conditions change its hue to wine or orange.

Since we all perceive, and live in the world, we take for granted our abilities to understand our spatial environments. However, this implicit knowledge about our own capacities is not enough to support a deeper comprehension of how our senses work to do so. Nor is it sufficient to a comprehension of how we perceive different spatial organisations and how they influence our feelings and understanding. When the act of design is leaded chiefly by functionalistic and visually esthetical conceptions of space, it is not just the totality of our sensorial

[78] Merleau-Ponty, Maurice (1945).

perception that is unconsidered, but also the interplay between the context and the individual perception. And it is precisely this knowledge that should constitute a fundamental basis, which guides any professional responsible for creating or altering human spaces.

THE HUMAN SENSES OF PERCEPTION

The original Aristotelian classification of the five senses – vision, hearing, touch, smell and taste – as channels of sensations, relates different kind of stimuli from the external world to a corresponding organ. We see with our eyes, we hear with our ears, we touch with our hands and skin, we smell with our nose and we taste with our mouth. However in this classification there is no room for our sensations of movement, pain, or pleasure. Furthermore it does not distinguish between actively searched sensations and passive ones.

In 1906, Sherrington proposed a theory of perception where three types of sensory receptors correspond to different types of sensations originating from: the external world; our own movements; and our internal organs. The eyes, ears, mouth, nose and skin are considered as the basis for perception of external sensations, or *exteroceptors*. The end organs in muscles, joints, and inner ear are considered as responsible for the awareness of movement of the body, or *proprioceptors.* And the presumed nerve endings in internal organs are responsible for feelings (like pain) and emotions. In his neat conception, perception is only associated with sensations provided from the external world. And each sense has its corresponding specialised receptor that excites a corresponding sensory nerve. The inputs received by the receptors are then transmitted to the brain where they can be processed and 'interpreted' as information about the external world, our own movements, and our internal organs. However, in his theory the impulses in the sensory nerves could not specify the original stimuli, but only the specific sensory receptor. For this reason it can be said that to each specific receptor corresponds different kinds of information.[79]

Other theories about the perception process have been developed since then, and it might seem unnecessary to understand Sherrington's foundations. However, his conception still permeates the common understanding of percep - tion oversimplifying a complex process of getting sensory information. This

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[79] Sherrington (1952/1906), *The integrative action of the nervous system,* Cambridge University, Cambridge. In Gibson, James J. (1966), pp. 33-34.

reductionism underlies and influences the practice of design. The tacit acceptance of specialised organs as conductors of one kind of stimuli, therefore, induces mistaken assumptions of the perception of space and of spatial qualities.

A great number of architects and designers usually think that dimensional and aesthetic visual attributes of space are what really count for places' perception. Vision is certainly the main channel of getting spatial information. And visual attributes are instantly and simultaneously perceived. But the usual reduction of space, as merely 'visual space', leaves out other important attributes for its perception. Conversely, designing places for blind persons, a first common reaction is to design on the basis of tactile attributes alone. The state of being blind equated to ones having eyes closed (and perceiving no visual attributes). It is subsequently assumed that blind persons have to search to obtain other spatial attributes through another preferential channel, in this case 'touch'. Consequently, a common assumption is that blind persons 'orient' in space mainly using their hands, or a cane, to explore the openness and to protect themselves from obstacles.[80] In reality, most people are amazed that blind persons *can orient* based on the belief that their spatial perception might be extremely 'limited'. It seems even 'correct' to presume that they 'cannot' *really perceive space.*

How can a different conception of the functioning of our senses, not based on the existence of unique specialised channels for each different stimulus, affect the understanding of spatial perception process? And how can this conception influence the understanding of the spatial perception of the visually impaired and blind persons? Moreover how can this understanding act upon our attitude of what is needed in terms of knowledge and methods to achieve a universal design practice?

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[80] Here the meaning of the word 'orient' is the common language usage as 'finding a way to', which does not necessarily include 'understanding' about places.

GIBSON'S THEORY OF PERCEPTUAL SYSTEMS [81]

> 'For millions of years our animal ancestors lived with the earth, the sun, the sky, gravity, solid bodies, volatile and chemically reactive bodies, vibratory events, and with the squirming, moving, warm, odorous, light-reflecting, and noisy bodies of their fellow animals. For thousands of years – relatively few – men have been living in a physical environment having the same constants and the same cycles, but which they have profoundly modified. They have paved and straightened the solid surfaces, altered the vegetation, regulated the paths, subdivided the places, eliminated dangers, provided islands of light during the night, and of comfort during the cold. They have subordinated the lives of all other animals to their own social life without limit. Most strikingly, they have flooded the environment with shapes, sounds, and visible patterns which have meaning only to themselves. All these things, the oldest and the newest, are sources of stimulation. All beings, animal or human, detect them by sensitivity to such stimulation. How they do so is the problem of perception.'[82]

In 1966, James J. Gibson contested the earlier physiologically based theory of sense's organs as passive receivers, or receptors, and proposed a different theory based on an ecological approach. One of the arguments of his theory is that perception is not based on having *sensations*[83] but on detecting *information* from and about the world. The world where we live in is the world to be perceived. And the human environment is the source of all stimulation.

Gibson distinguishes between two ways of obtaining information: passive and active. The input of the sensory nerves constitutes then basis only for passive sense impressions, which are independent of the observer attention or will. More often the individual pays attention and reacts to stimulus from the environment – we turn our head in the direction of sounds, we select

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[81] This subchapter is based on readings of Gibson's book ' The senses considered as perceptual systems'. There are other perception theories, complementary or opposed to Gibson's theory, which contribute to the increase of knowledge in this field. It is not my intention to submit an overview of these, any more than intending to make a full résumé of Gibson's work. I will try to concentrate on the basic aspects necessary for the understanding of spatial perception processes considering the restriction or total loss of the vision. A very significant part of Gibson's theory gives attention to visual perception, but only some of its aspects will be considered here.

[82] Gibson, James J. (1966), p. 29.

[83] Merlau-Ponty affirms that there are no pure sensations since there are no 'pure impressions'. Perceptual experiences are always relational to a 'field' of perception where meaningful relations can be established from the real qualities of the objects of the world. Isolated 'sensations' imposed on the individual are possible only in experimental and artificially constructed situations.

information with our eyes, and we explore objects with our hands. Input information depends then on output reactions – movement, exploration, and orienting of the senses. The classical concept of organs of perception as passive receivers of information, like the classical comparison of the eyes as a photograph camera, is then substituted by a comparison to tentacles and feelers that are part of a perception system. In Gibson's words:

> 'The perceptual systems, including the nerve centers at various levels up to the brain, are ways of seeking and extracting information about the environment from the flowing array of ambient energy…Instead of supposing that the brain constructs or computes the objective information from a kaleidoscopic inflow of sensation, we may suppose that the orienting of the organs of perception is governed by the brain so that the whole system of input and output resonates to the external information.'[84]

A system of perception based in the obtaining of information instead of sensations solves the problem of how persons can get invariant perceptions despite different sensations.[85] We can recognise a unique object despite the different sensations of pressure while exploring it with the hands. A tree is a tree in a sunny or rainy day and despite the different sensations of light. The sound of running water in a fountain is always the sound of a fountain even if we perceive louder and weaker sounds depending on our distance from the source.

According to Gibson, our senses respond to the *constants of our terrestrial environment*. These constants are:

- *The rigid forms of* the earth that furnish support for movement and permanent spatial relations between 'objects' allowing us to perceive locations, shapes and sizes;
- *The gravity* that conditions our upright position and movements, and establishes the basic horizontal and vertical plans of the environment;
- *Electromagnetic radiations*, responsible for temperature and light establishing the basic cycles of day and night and seasons to which we respond in our behaviour (sleeping-waking rhythms of men and animals);

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[84] Gibson (1966), pp. 105.

[85] An interesting parallel can be drawn between Gibson´s proposition of the senses working as 'active searchers of information and the basic phenomenological concept of 'intentionality' which leads the individual perception.

- *Light* itself that describes all surfaces trough reflection, 'broadcasting' structures of information. It also 'divides' the environment in two hemispheres of ambient light and radiant light. Ambient light is connected to the cycles of day and night. Its 'lower' and 'upper' hemispheres are anchored to gravity, since the intensity of light of the sky is always greater than the intensity of light on the earth surface;
- *Air as a medium* permits not only independent movement and displacement of objects in space but the flow of environmental information (flux of light, transmission of vibrations and diffusion of volatile substances).

Based on the effects of the constants of the terrestrial environment Gibson classifies the 'senses' according to their modes of activity to obtain ambient information.[86] Potential ambient information present in the physical environment consists of the following:

- The mechanical contacts with the environments, which cause temporary differential pressure and deformation of tissues allowing us to orient and locate encounters;
- The compression waves from vibratory events, in which the kind of wave train specifies both the kind of mechanical event and location of the source (sounds);
- The diffusion of volatile substances specific to its source;
- The chemical contacts with the environment through selective ingestion of food;
- The perspective projections of an object 'broadcasted' by reflected light furnishing the preconditions for vision.

Therefore, senses as perceptual systems are classified as *basic orienting*, *auditory*, *haptic*, *taste-smell* and *visual systems*. Gibson makes a distinction between the different *modes of attention* of each system. These include general orientation, listening, touching, smelling and tasting, and looking. The corresponding *organ activities* are body equilibrium, orienting to sounds, exploration, sniffing/savouring, accommodation/pupilary adjustment/fixation, convergence and exploration. What is central in this classification is that each mode of attention corresponds to different stimuli existent in the environment. A résumé of each perceptual system is included in the subsequent paragraphs. This résumé, gives more attention to the three initial systems, in recognition of

[86] It is important to mention that Gibson considers for his classification not only information from the physical 'natural' environment but also from the animated and cultural environment.

their importance for spatial perception when vision is absent or reduced. For a better understanding a table of perceptual systems is here reproduced.

TABLE: THE PERCEPTUAL SYSTEMS

Name	Mode of Attention	Receptive Units	Anatomy of the Organ	Activity of the Organ	Stimuli Available	External Information Obtained
The Basic Oriented System	General orientation	Mechano receptors	Vestibular organs	Body equilibrium	Forces of gravity and acceleration	Direction of gravity, being pushed
The Auditory System	Listening	Mechano receptors	Cochlear organs with middle ear and auricle	Orienting to sounds	Vibration in the air	Nature and location of vibratory events
The Haptic System	Touching	Mechano receptors and possibly Thermo receptor	Skin (including attachment and openings) Joint (including ligaments) Muscles (including tendons)	Exploration of many kinds	Deformation of tissues Configuration joints Stretching of muscle fibers	Contact with the earth Mechanical encounters Object shapes Material states Solidity of viscosity
The Taste-Smell System	Smelling	Chemo receptors	Nasal cavity (nose)	Sniffing	Composition of the medium	Nature of volatile sources
	Tasting	Chemo- and mechano receptors	Oral cavity (mouth)	Savoring	Composition of ingested objects	Nutritive and Biological values
The Visual System	Looking	Photo receptors	Ocular mechanism (eyes, with intrinsic and extrinsic eye muscles, as related to the vestibular organs, the head and the whole body)	Accommo-dation Pupillary adjustment Fixation, conver-gence Exploration	The variables of the structure in ambient light	Everything that can be specified by the variables of optical structure (information about objects, animals, motions, event, and place)

Fig. 6 – Table of the perceptual systems. Source: Gibson, James J. (1966), p. 50.

The *basic orienting system* is responsible for the detection of the stable framework of the environment, i.e., to the main basic directions of up and down related to the planes of the ground. The inner ear or labyrinth works as a 'statocyst'.[87] This organ is specialised in constantly detecting the forces of

[87] A statocyst can be compared to a bag filled with fluid in which hairs that are sensitive to movements are immersed. When the fluid moves due to body movements the hairs also move and register the different positions in relation to rest vertical position. To further details of the working of statocyst see Gibson, James J (1966), pp. 60-66.

gravity and the displacement of the whole body. The basic orienting system is responsible for the maintenance of an upright position and of balance. It is also responsible for the feeling of the body position in a three dimensional space and co-ordinates the position of the head, trunk, and limbs (up-down, right-left, front-back) with the general external directions in space. The gravitational input covaries with touch thus doubly registering the ground.[88] The orienting system co-operates with all the other systems setting a stable platform for the other senses.

The *auditory system* evolved from the primitive statocyst and responds to the vibrations of the air. The inputs specify the nature of the original vibratory events. This in turn orients the ears to the direction and location of the source for a finer perception.[89] What the auditory system makes possible is to *listen.* And to be able to listen, two important adjustments exist. The first is *oriented locomotion*. This guides us towards, or away, from sources of sound when maintaining a central position in relation to the waves front. The second is *selective listening,* which is the capacity to orient towards a desired sound source selected from many different waves of sound. The auditory system does not only propitiate knowledge about the external location of sounds but also about the location of the individual relative to the sounds. It is a system that is simultaneously *exterocentric* and *propriocentric* (hearing of own voice as 'here' and other voices as 'there'). The distinction between the concepts of 'propriocentric' and 'exterocentric' information is very important for the understanding of the quality and spatiality of the individual perception. 'Propriocentric' information is centrally related to the individual's own body while 'exterocentric' information is perceived as exterior to the body, related to the 'outside' environment, like information obtained by vision or hearing.

The *haptic system* consists of a complex intermingle of subsystems with no specific 'sense organ'. Receptors located in the tissues and joints co-operate. This co-operation turns the whole body an active organ of perception. Haptic system is responsible for the perception of passive and active touch, for

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[88] The ground deforms the skin in forces perpendicular to its relative position. When the ground is flat the pull of gravity in the statocyst and the push of surface have a similar direction with opposite senses. When the ground is sloping the pull of gravity and the push of the ground have different directions, and by covariant inputs information about slope of the ground is obtained.

[89] Vibratory fields have concentrically waves around the source. The wave's train and front are responsible for the identification of the nature of the event and its discrimination and position in space respectively.

temperature distinction, and for distinction of ones owns movements. These simultaneous inputs can specify a large variety of facts from the world, which are usually attributed only to conscious perception through vision. When combined, touch and vision provide a double guarantee input of information.[90] The haptic system co-functions with the orientation system. And the angular position of each bone in relation to the body frame is anchored to the direction of gravity and to the plane of the ground. Cutaneous touch provides simultaneous information both about the layout of environmental surfaces in contact with the body and about the disposition of the body parts. We feel the shape of a pen as we feel the shape of our fingers grasping it. The haptic apparatus then yields three-dimensional information of objects and not only the two-dimensional information, such as texture.[91] This extremely complex and elaborated system can be subdivided into different subsystems – cutaneous touch and dynamic touch, and touch-temperature and touch-pain.

The combined use of nose and mouth to obtain information about food constitutes the *taste-smell system*. Taste is also combined with the haptic system since we *feel* consistency, texture and temperature of the aliments. The knowledge of orientation process through identification of the sources of smell is limited, as it is about the strong relationships between smell and memory.

Environmental information is obtained through the combination of all perceptual systems. But the *visual system* usually *overlaps* with all the others systems since it register, instantly and simultaneously, forms, depth and distance. Vision also controls movements of objects and individuals in space, conveying information about the spatial layout of the environment, its changes and about the individual in the environment. Moreover it is the only perceptual system that detects variables of colour, and transformations in light. Vision is necessary for the performing of many human actions, as reading, looking and recognising. Further than that it is essential to orientation in space, and it is the only sense that permits us to 'foresee' both distant and close objects in space.

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[90] It is a common gesture to touch something to obtain further information about texture, consistence or weight.

[91] For more information about the functioning of the haptic system see Gibson, James J. (1966), pp. 104-135.

PERCEPTUAL SYSTEMS AND SPATIAL PERCEPTION

Gibson's theory of senses as perceptual systems have very important implications for the understanding of the ways in which information about spatial organisation is obtained. The conception of different perceptual systems co-operating in different forms to obtain meaningful environmental information, through redundancy or discrepancy, is essential. It enhances the understanding of how spatial perception is possible when vision is absent, and explains the co-operative roles of the other senses in this case. However, spatial perception, with or without vision, means more than obtaining information. It means identifying, and recognising, objects and individuals in space and their interrelations in that space and with the individual. Consequently, it is important to combine the knowledge about the integrated work of our senses, with a phenomenological understanding of information interpretation. Recognition of meaning depends on the individual's memory and knowledge about the spatial elements in space. After all, we cannot recognise what was never experienced, or known previously.

Imagine a cornfield on a summer day, and the multitude of exuberant stimuli to the senses. The changing forms, textures and colours of the road, the field and the sky. The movement of crops gently fanned by the wind, the sound they make while moving and their particular smell. The sounds made by our own steps. The warmth of the sun and the pressure of the wind against our body. We can distinguish the feelings of going up or down and the texture of the sand and the small stones of the road. And a kaleidoscopic landscape in visual array corresponding to our movements and orientation. All these information are strongly interconnected and accordingly even if subtle. They are essential for the perception of the *total quality of that road* even if we might be more aware of its visual aspects. In this particular instance, or other situations, the usually dominant information picked by the visual system gives place to other information as soon as 'incongruent' stimulus occurs. The sound of a car approaching, or the smell of fire, would instantly turn our attention towards them.

We also know from physiological and psychological studies about the importance of senses co-operation and the problems posed by opposing stimulus and contradictory information. As passengers in a car we draw visual information about a changing landscape in movement. Our orienting system feels the differences in accelerated movement and stops. These, by their turn, are not connected with movements caused by our own body. The contradictory information obtained by these two senses is responsible for the sensation of

dizziness experienced sometimes. Looking at the horizon, thereby diminishing the rhythm of visual changes and consequently reducing the sensation of movement speeds can alleviate such sensation.[92] I could observe other more recent and common situation of contradiction between sensory information, arisen with the advent of 'virtual spaces' in interactive computer games. In this games finger movements 'correspond' to actions in space provoking sounds and real changes in the 'visual array' of the screen. They bring even more extreme contradictions between the information provided by our senses than passive movement in a moving vehicle. A child playing computer games can be sitting for hours just staring, hearing and moving hands and fingers. The orientation and haptic systems give information about this near static situation in space. But the visual and auditory systems tell of the child that he is running, jumping, rolling, twisting, walking in different directions, diving, talking, screaming, and shooting. No wonder dizziness, vertigo, visual alteration and even convulsions can arise when children play with interactive games for too long.

If we accept the Gibson's theory of the co-operation of the senses, why should the perception of the blind work any differently? Understanding of space is affected by different modalities of perception when vision is absent.[93] But in principle, depending on the situation and the stimuli available, exploratory touch, selective listening and oriented locomotion are the main channels of getting spatial information for the blind in a co-operative form. Without overlooking the importance of exploratory touch as basic source for the understanding of spatial forms in the absence of vision, it is possible to say that spatial understanding for blind individuals is also based on the combination of all systems. And that in a similar complex and interrelated process, as when the visual system is operating, final meaning depend on the redundancy or discrepancy between stimulus and resultant information obtained through the different senses.

PERCEPTION OF TIME

It has been said that it is not within the scope of this study to overview the different theories of perception, nor to present a detailed discussion of the

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[92] These examples illustrate the fact that it is easier to understand complex processes by their exceptions. Several studies in perceptual psychology seek to understand more about the working of one sense studying the disturbances, which affect this sense.

[93] These will be presented in more detail in the section 3.4 of this chapter, 'Spatial perception and visual impairments'.

corresponding classifications of the human senses. However, it is necessary to present some notions that are about the perception of time, due to the significance they have for the blind. According to Weil- Barais review about time perception,[94] to perceive time implies the individual's reaction towards a present situation, which has a very short duration (around 2 or 3 seconds). In other words, it is the minimum interval of time necessary for the perception of changes that belong to the same unity, which is qualified as *psychological present*. Accordingly, if human beings did not have this capacity of perceiving present time it would be impossible to perceive rhythm or melody. Perception of the psychological present is not the same as the measure of time in seconds, minutes and hours. The perception of time duration depends on the development of events, and of memory estimations, in relation to events facilitate distinction of past, present and future. Psychophysics has two traditional questions regarding the perception of duration. First, which is the minimum limit for a stimulus to be perceived? (Absolute time threshold). And second, which is the minimum difference that can be perceived between two events? (Differential time threshold).

To be able to understand the minimum duration of an event it is important to distinguish between perception of an *instant* event and *simultaneity* of events. For instance vision of an isolated and brief light flash seems to have no duration and belongs to the dimension of *instant*. If the light remains for a short while it starts to have some duration in time. To find out an absolute time threshold is to know the least transition period that makes an event pass from instant situation to duration in time. If we have two sources of light éclairs at the same time they are perceived as simultaneous. But if they are not exactly synchronised in time they can be perceived as sequential. *Time threshold* is then the minimal time duration of events that makes to distinguish between *simultaneity* and *succession of events*.

Time thresholds are dependent on the sensorial modalities of perception. For the *visual* distinction of sequential stimulus the time interval and the distance between the events is fundamental. Two light flashes placed in the same site are perceived as simultaneous if their interval is shorter than 16 ms. Between this interval and 100 ms or 200 ms there is a sensation of palpitation, and after that, of a succession of events.[95] Two *sounds* presented in one ear at an interval

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[94] Weil-Barais, Annik (1993), *L'homme Cognitif,* Presses Universitaires de France, Paris, pp. 173-177.

[95] Cinema images projecting 24 images per second take advantage of this fact since we cannot perceive intervals between images, and movement is recreated.

shorter than 1ms are perceived as simultaneous. Succession of sounds in an interval of time between 1ms and 10ms are perceived as crepitation. If two different sounds are aimed successively at either ear until an interval of 60ms there is a perception of sound movement but not of sequence. Two slight *touches* made on the same place of the body are felt as simultaneous if their time interval is not more than 1ms. Between intervals of 1ms and 10ms, vibration can be perceived, and after intervals of 10ms succession is perceived. If the touches in an interval up to 10 ms are produced in different places of the body there is sensation of relative movement. After this interval, succession is perceived depending on the distance between the two stimuli.

The perception of regular intervals of events' duration is called *rhythm*. As we will see in more detail in the final of this chapter, memorisation of temporal sequences while moving in space, i.e., the perception and recalling of rhythm of movement and events, is very important for the orientation of the blind. And the interpretation of forms, volumes, distances and directions in space, by reflected sounds, depends on both the perception of the direction of the sound, and on the time that it takes to be reflected.

3.3 WHAT IS ORIENTATION?

Orientating in space can take different forms: walking straight ahead, controlling the senses of direction and distances; searching and recognising significant elements in space, planning/executing/recalling and changing of routes, interpreting maps and verbal information, recalling and imagining different places. But fundamentally, to orient is a purposeful action that means more than independent mobility.[96] It means to know where one is identifying places, possible routes towards desired goals, and taking decisions. In the words of Karlsson and Magnusson:

> 'Orientation-comprehension involves a comprehension of spatial context. One must know that "I am at place A which stands in a special geographic relation to space B". Without knowledge of the spatial context, the person will not be able to perform a purposeful movement. If we proceed from the most fundamental feature in human experience, namely experience which concerns the dimensions of time and space, we can establish that it is not enough to comprehend that right now I am at place "A". I must also know how place "A" is located in relation to other place. If that knowledge is not at hand, one can say that a "disorientation" is at hand.'[97]

To fully understand orientation process, it is necessary to develop concepts that explain the different stages of spatial understanding. This involves perceiving location in the domain of space and present time. It also involves the ability of associating instant perceptions with previous spatial experiences and knowledge. Therefore, orientation depends on two different interconnected spheres between the world and the self. These are:

- Sphere of the individual – personal frames of reference
- Perceptual conditions – what is perceived and how by each perceptive systems – provide information about environment spatial organisation and own movements in space;
- Spatial knowledge – based on experience and cultural learning – enables interpretation, identification, and understanding of environmental information in order to act;

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[96] Independent or autonomous mobility is the possibility of the individual to go for one place to the other without help to attain intended goals. For blind persons it means that they have to know how to maintain directions and learn a place or a route to be able to move alone without help.

[97] Karlsson, Gunnar and Magnusson, Anna-Karin (1994), A phenomenological-psychological investigation on blind people's orientation and mobility. *Reports form the Department of Psychology*, Stockholm University, no. 783, pp. 6-7.

- Purposeful actions – personal intentions, exploration and social acts.
- Sphere of the world – structure of environmental information - supports the understanding of meaning and relations between 'objects' and places in space
- Spatial configuration of permanent and dynamic elements - organised according to natural laws, and cultural values are potential sources of information with specific attributes;
- Relations in space – human actions organised according to cultural meanings, social norms and rules.

INDIVIDUAL SPATIAL FRAMES OF REFERENCE

The individual possibilities of moving in space and controlling ones own movement in space depend on the recognition of directions and positions (both of the individual, and of the individual with the world). This recognition is dependent on visual, vestibular (basic orienting system) and propriocentric inputs (haptic system). They constitute the individual spatial frames of reference. Usually this three-dimensional axis of co-ordinates references is reduced to a main spatial direction from which the two others are constructed.[98]

These frames are:

- The *visual frame of reference* - visual axis responsible for large orientations observable in the visual field;
- The *gravito-inertial frame of reference* – gravity axis responsible for orientation towards the substract and horizon, related to the acceleration of the body;
- The *egocentred frame of reference* that runs through the head and feet when standing, responsible by the knowledge about positions of all parts of the body.[99]

In normal conditions, these three spatial reference frames produce redundant information. When walking, for instance, we can be constantly aware of the positions of our body in space, the directions of our movement in relation to

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[98] Joceline Roger, Spatial reference frames and driver performance, *Ergonomics*, 1996, vol. 39, no. 9, pp. 1134-1145.

[99] Gibson stresses that the egocentred reference frame or 'body image', with its positions (standing and lying) and main axis (left-right, front-back, head-foot) is a set of possible poses. This should not be confused with the gravito-inertial frame, which depends upon the constants of the environment. In Gibson, James J. (1966), p. 59.

ourselves and towards the environment. We can distinguish right and left, front and back, up and down and act accordingly. When information given by one spatial reference frame is different from others, interpersonal differences appear depending on which reference frame the individual is more dependent on. A typical case of 'disorientation' due to conflicting information of frames of reference is found in 'mirror houses' or standing upside down.

It is also important to mention the role of *selective listening* for blind persons to propitiate knowledge about the location of the individual relative to reflected sounds produced by him.

SPATIAL KNOWLEDGE

Some authors in the field of psychology make clear distinctions between 'perception of space' as at the human biological level, and 'spatial cognition' as culturally dependent. It is not within the scope of this study to make such distinctions. Here, *spatial knowledge is considered as a process dependent on individual perception, concrete experiences in space, and on cultural knowledge.* In the sphere of the individual the level of spatial experience is fundamental for the construction of spatial knowledge. Alterations in the perception of the world, and limitations of movements deeply affect the possibilities of understanding of space, because they limit individual experiences in it. Under these conditions spatial concepts can depend more on cognitive process. Even though, they could not amount to the quality of the concepts attained through the combination of experience and cognitive levels.

According to Faiga Ostrower, before acquiring a cultural language, all human beings share a *universal 'perceptual language'* in the construction of the self. From developmental psychology we know that since birth, the baby starts to move and begins a process of 'internalisation' of his experiences. The baby follows forms with the eyes, reacts to sounds, smells and tastes, and starts to focus on persons and objects, following them as they come near or further. A baby explores all possible objects using all senses: he/she holds, presses, throws, bites, tastes, and hears, to ascertain the attributes of an object. Later, when he/she starts to sit and crawl, objects move around with him/her as a centre. And notions of relative position, size, distance, and directions start to be a conscious reality and symbolic. Things start to have a 'life' of their own, and it becomes possible to imagine and think about them. Our basic self-spatial references are built while moving in space. And even though, they vary between individuals they are essentially part of our 'trans-cultural' human nature. 'In this first stage of consciousness, the basic references are the same for all, as

is the language, because the spatial forms constitute, the *'environment'* and the *'mode'* for our understanding, simultaneously. Bringing the *images for our imagination*, space is the mediator between experience and expression…being the ultimate referential for all languages.'[100]

THE SENSES AND THE INFORMATION THEY PROVIDE

This section will focus on an examination of the ways in which the information provided by the different senses affect the possibilities of attaining spatial knowledge. Even when our senses co-operate in the acquisition of meaningful information about the world, each sense works in a specific way and provides different types of information. While seeing, or touching 'objects', is directly related to their existence in the world – we see this cup, we touch that pen – the same does not occur with the other senses. To hear the sound of 'a car' is not the same as which seeing 'this car'. Nor is smelling bread the same as the bread itself. Merlau-Ponty asserts that the tactile field can never have the same amplitude as the visual field,[101] and that the tactile object is never entirely present in each of its parts as the visual object is.[102] And Révész claims that it is impossible to talk about acoustic space in itself.[103] For if we are able to recognise objects and spatial organisations through sound sources or sound reflections it is because this recognition is based on earlier visual or haptic experiences.

Vision is the only sense that can provide instant and simultaneous information about the 'inner horizon' and 'outer horizon' of an object.[104] This fact makes it a fundamental sense to the perception of space. The *inner horizon* of an object is relative to its form, construction and function. If we see for instance a china cup, from any point of view, we know about its form, colour and shape. The

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[100] Ostrower, Faiga (1998), A construcão do olhar, in *O Olhar*, organised by Adauto Novaes, Companhia das Letras, São Paulo, unauthorised translation, pp. 172-173.

[101] Merleau-Ponty, Maurice (1945).

[102] Even if a visual image is not the same as a tactile image, Gunnar Karlsson found in his studies with congenitally blind individuals that they could form an integrated image of objects that they could explore by touch in their entirity. In Karlsson, Gunnar (1996), The experience of spatiality for congenitally blind people: a phenomenological-psychological study, *Human studies,* no19, pp. 316-317.

[103] Révész, G (1937), Gigt es einen Hörraum? *Acta Psychologica, 3*, pp. 137-192, and Révész, G. (1950), *Psychology and Art of the Blind*, Longmans, London, in Karlsson, Gunnar and Magnusson, Anna-Karin (1994), p. 10

[104] Husserl (1977/1925), *Phenomenological Psychology,* Martinus Nijhoff, The Hague, in Karlsson, Gunnar (1996), p. 328.

outer horizon of an object (or its context) is always relative to the object and its meaningful surrounding structure. If we see a door as an object, its outer horizon can be the house where it is. Depending on our *attention,* and our changing position in space, the house can be included in a vaster background of a street scene, and the street into a neighbourhood.[105] Exploratory touch can also provide information about the inner horizon of an object, but when vision is lacking the individual has to reflect and to relate information provided by the other senses in order to 'construct' an image of the object's outer horizon.[106]

ENVIRONMENTAL REFERENCES

In the environment all categories of 'objects' co-exist and relate to each other. Some are more relevant to orientation than others. Some are more reliable than others are. As seen in the preceding section, perception and understanding of spatial organisations and of their meaning depend on the individual perception, abilities, cultural knowledge and experience in space. On the other hand, the disposition and structure of the landscape, and the human activities in it constitute the domain of reality to be perceived. To understand which and why some spatial elements can constitute spatial references for orientation and understanding of space, it is necessary to develop a series of interrelated concepts.

Concepts of Routes and Landmarks

Some psychologists assert that individual spatial knowledge of novel environments is progressing through successive stages of recognition of landmarks, routes, and 'mini-maps' and then evolving to an understanding of the environment (articulation of landmarks, routes and different 'mini-maps'). Others argue that environmental spatial knowledge does not necessarily have fixed stages. And that it can be based on the memory of a continuous sequence of environmental scenes. According to Spencer, Blades and Morsley, different individuals might use different strategies to select appropriate information from the environment, but these necessarily involve the recognition of *routes* and *landmarks* even if not in a sequential order.[107]

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[105] It is interesting to compare the concept of outer horizon with the concept of 'sequential views' by Gordon Cullen (1971), *The concise Townscape*, Architectural Press, London.

[106] Karlsson, Gunnar (1996).

[107] Spencer, Blades and Morsley (1989), *The Child in the Physical Environment: the development of spatial knowledge and cognition*, John Wiley, Bath, pp. 9-11.

But what are routes? What distinguishes paths and streets from routes? *Essential to the concept of route is the intentionality of movement in space.* A route has always a starting point and a final end. It has three central space-time dimensions of *direction, distance and duration* between the point of *departure* and that of arrival at a desired *goal*. Along a route the individual intentions and different events can change the initial choices pertaining to the attainment of the goal, affecting its directions, distances and duration. The physi<cal unfolding characteristics of the landscape and the human activities along the route will be the elements that enable an appreciation of its special identity and allow its recognition. A route can be represented in an abstract form by a line of dynamic movement, which is punctuated by stops, and changes of directions, between two main points of 'start' and 'goal'.[108] It is important to remark that without the time representation it is impossible to know for sure the duration of a route, since it depends not only on the actual distance and directions but also on dynamic events.

The recognition of single routes does not suffice towards an understanding of the spatial relations between different spatial elements, and places in the urban space. We should be able to distinguish the identity of spatial elements in space, in relation to other spatial elements and to routes and places. To orient satisfactorily it is not enough to 'know' one route. We have to be able to relate this route with others and to locate its relative position in a bigger space. The recognition of spatial relations between objects, routes and places depends mainly on the existence and perception of *landmarks.*

Landmarks in the definition of Spencer, Blades and Morsley 'are not only orienting guides for the traveller, but according to much research, the points from which separately experienced aspects of space are articulated into a coherent schemata.'[109] Also according to them, landmarks can be more individualised, thus being objects or places that are of particular interest or importance to the individual. As such, a funny looking red stone that can be a landmark for a child in a route can pass unperceived by an adult. Depending on the interests and attention placed by different individuals different features may become landmarks. The meaning of landmark in this sense is much vaster than its definition by Kevin

[108] Ibid., pp. 29-37.

[109] Ibid. , p. 09.

Lynch as 'an external physical object that due to its singularity detaches from other objects and can act as a reference for orientation.'[110]

In spite of the existence of personal variations, certain elements in space, due to their *attributes distinctiveness*, *functions*, and *special location* will constitute potential landmarks allowing the articulation of different spatial elements into a coherent structure.[111] Distinctiveness of attributes, functions and location are usually interconnected. Very often, a visual landmark is also a functional landmark, occupying a privileged location in space. It is important to remark that this distinctiveness of physical attributes of visual landmarks does not necessarily imply 'architectural aesthetic beauty'. Very often it is more significant the contrast of attributes – like the small-old-historic house surrounded by skyscrapers, or the granite-and-black-mirror-window façade of the national bank in the historical centre. The scale of dominance of functional landmarks depends on the degree of privacy and importance of the activities they host. In a city for instance, local functional landmarks can range from the simple ice-cream cart in the corner, the neighbourhood primary school, the central post office, to the city hospital. Very often the dimension and function of public activities determine their location in central or strategic places. Also their formal treatment is special, and they often become recognised visual landmarks.

Spencer, Blades and Morsley also distinguish landmarks as *permanent* or *dynamic spatial references* depending upon their *constancy in time and space*.[112] It is then *the extent of change* of their location and/or attributes that will affect their *reliability* in orientation and understanding of places. In a commercial street, for instance, the presence of temporary stands during summer can constitute a landmark that distinguishes this street from others, even if the stands will be gone in the autumn. Buses and local trains can also constitute dynamic landmarks, in spite of the irregularities of traffic during day and night time. In my Licentiate dissertation I suggested a further distinction of landmarks as *cyclical landmarks*.[113] In countries in the temperate climate zones, the seasons can affect the attributes of natural elements and the whole landscape undergoes radical changes. For the evaluation of the character of a

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[110] Lynch, Kevin (1960), p. 48.

[111] I tried to discriminate the reasons of spatial elements of being landmarks considering not only their visual aspect but also their function, importance and position in space.

[112] Spencer, Blades and Morsley (1989), p. 101, and pp. 123-125.

[113] Dischinger, Marta (1995), pp. 20-21.

landmark as permanent, cyclical or dynamic, the frequency and extent of spatial experience of the individual in the environment plays an influential role.

In general *permanent landmarks* are those physical elements (natural or man-made) that have been in a location for a relatively long time, without any significant interference or change in their appearance and attributes. It is this longevity and permanence, which allows for the identification and recognition of a place. Examples of such landmarks are natural elements (like mountains, rocks, vegetation, stars, etc.) and artificial constructions (harbours, bridges, towers, monuments, buildings and other similar structures).

Cyclical landmarks are those elements that have permanent or periodical location in a given space, and undergo significant periodical changes in their appearance and their features. They allow orientation and identification of places but not necessarily their recognition, with the latter sometimes depending on the period and nature of the transformation. Typical examples of this sort are natural elements that are affected by the different seasons of the year, and landmarks that are affected by the cycles of day and night like illuminated-outdoors.

Dynamic landmarks include natural and/or artificial spatial elements that are for a relatively short time (periodically or not) in a given location. Their presence might affect the features and characteristics of a place and allows, or hinder, its identification and/or recognition. Examples of dynamic landmarks might be vehicular traffic, sound events, sun and wind, and human activities. Even if dynamic landmarks are less reliable than permanent and cyclical elements in the recognition of a place, they might be crucial in defining a place's character and identity, and should therefore be taken into consideration.

Notions of Distance and Direction

Let us examine in more detail how the individual perceives, recalls and controls directions and distances in space. Perception of *distance* depends basically upon the *individual's body movement and frontal visualisation of space* in close consort with time perception.[114] A short route filled with interesting events, for instance, might seem longer than an actually longer, but uninteresting route. The degree of difficulty of movement also affects distance evaluations, and

[114] Spencer, Blades and Morsley (1989), pp. 15-19.

going up or down a slope can create different feelings about similar spatial dimension.[115] When there is a restriction, or lack of visual information, the feeling of distance of a route depends highly on the recollection of ones own movements, and on the sequence of stops in space and time.

Feeling of *directions* is double bounded to the perception of the individual body frames in relation to the environment, as well as the visual perception of objects and places in relation to other objects and places. Orientation in the environment depends mostly on the possibilities of establishing relationships between routes and between external landmarks. So a person walking in a forest can be aware of the presence of a river to the right, thus relating direction between the individual and the external landmark. But he/she can also relate the direction of the river with the path in terms of two external landmarks. The knowledge of relative positions between routes depends mainly on the relationship of their intersections (perpendicular, oblique, etc.). Faced with the reduction or lack of visual information, feeling of direction will depend mostly on the individual's propriocentric frames of reference (orienting and haptic senses), and the possibilities of recognition of external landmarks. Sounds will be one of the most important exterocentric sources of information, followed by smell to a much lesser degree.

IMPORTANCE OF IDENTIFICATION OF SPATIAL STRUCTURE

For orientation and spatial understanding, it is not enough to recognise the element's identity through the perception of its unique attributes. It is also necessary to establish meaningful relations between different constituent units and their context. It is interesting to quote Lynch's definition of components of image, even if he is chiefly concerned only with its visual aspects:

> 'An environmental image may be analyzed into three components: identity, structure and meaning. It is useful to abstract these for analysis, if it is remembered that in reality they always appear together. A workable image requires first the identification of an object, which implies its distinction from other things, its recognition as a separable entity. This is called identity, not in the sense of equality with something else, but with the meaning of individuality or oneness. Second, the image

[115] It is important to remark that I am always referring to personal feelings and estimations of distances, which does not necessarily coincide with the physical dimensions of space. Individuals also make evaluations of distance based on cognitive process. If we know that along a route blocks have approximately 50 meters, we can say that a route, from the pharmacy to the bookshop, is around 400 meters or 8 blocks.

> must include the spatial pattern relation of the object to the observer and to other objects. Finally, this object must have some meaning for the observer, whether practical or emotional.'[116]

In the understanding of spatial structure as ' the organisation of the parts as dominated by the general character of the whole',[117] physical, functional, and cultural dimensions are necessarily included in different grades of the scale and complexity. From the definition above it is clear that understanding of spatial structure depends on the understanding of its meaningful units (or the 'inner horizon of objects'), as much as the relations and organising principles with and within its context (or the 'outer horizon'). This analytical look has to distinguish what is primary from what is accessory, as well as what helps to brings order or meaning to space and space use.

SPATIAL IMAGES AND MENTAL SPATIAL REPRESENTATIONS

Throughout this chapter the term 'spatial image' or 'image' has been sometimes employed, especially when quoting. But I would like to make further distinctions with respect to its usage in reference to individual mental representations of space. Spatial images are usually associated with 'visual mental images'. The usual notion of mental image is, especially for architects and designers, deeply dependent on the vision of space and on the perception of what is visible. Kevin Lynch develops this conception of the word in his book 'The Image of a City'. He connects perception, understanding and recognition of city identity, structure and meaning with its particular landscape and life. His definition of 'city image', based mainly on its visual perception, is still influential in the ways that studies, methods and concepts about city space are developed even today. In his own words:

> 'Environmental images are the result of a two-way process between the observer and his environment. The environment suggests distinctions and relations, and the observer – with great adaptability and in the light of his own purposes – selects, organises and endows with meaning what he sees.'[118]

Another tendency links the idea of 'mental image' with the idea of a 'mental map' or a 'cognitive map' inside the head of a person. To ask different

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[116] Lynch, Kevin (1960), p. 08.

[117] Merrian-Webster's Collegiate Dictionary, Encyclopaedia Britannica on Line, consulted on 03/11/1999, http://www.eb.co.uk:180 .

[118] Kevin Lynch (1960), p. 06.

individuals to draw 'mental maps' of known physical environments is a current procedure employed both by psychologists and architects to study individual's environmental cognitive knowledge. There is a tendency to compare these 'mental maps' with cartographic representations, comparing 'individual drawing skills' with a standard and highly symbolic way of representing space. In this case there is no correspondence between a very rich 'personal mental representation' of a place and its expression as a very poor drawing. But what is more significant is that, in the very act of selecting elements for a 'map like' representation, there is no strict correspondence between the real inner dynamic 'mental image' of a place and its formalisation.[119] It is interesting to compare this idea of 'mental image' with Vermersch's concept of 'private thinking'. Private thinking, according to him, does not aim at communication with others, on the contrary it is a private and individual act of knowledge that is used during and for the accomplishment of cognitive actions.[120] 'Mental images' are also private mental cognitive processes employed by the individual to orient and perform desired activities in space. They are not explicit, do not aim at social communication, are not totally conscious, and for this reason not spontaneously verbalised and described.

Considering the above, I opted to use in this work the term *'spatial representation'* trying to avoid the strong visual connotations borne by the word 'image'. It is easier to connect spatial representation with the idea of individual mental concepts that can be constructed through the different senses as well as cognitive processes. Contrary to the idea of 'a mental map', or a 'picture' of a place, 'mental spatial representations' are more related to the essentially dynamic and operational qualities of inner reflections that does not necessarily have definite contours or predominant physical qualities.

Spatial representations of open and closed urban spaces

A special consideration has to be made concerning the way in which spatial representations of larger urban spaces are constructed related to their formal configuration and permeability. These spaces are usually distinguished as *open* and *closed spaces* chiefly regarding both possibilities of visualisation and movement throughout them. The concern here is to understand how the

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[119] Spencer, Blades and Morsley (1989), pp. 21-24.

[120] Pierre Vermersch (1991), Pensée privée et répresentation dans l'action, CNRS SDI 6322, *Document EPHE* Laboratoire d'érgonomie cognitive. GREX Groupe de recherche sur l'explicitation.

possibilities of movement only throughout these spaces affect their possibilities of orientation and understanding.

In the same way as in the perception of routes, the perception of 'surfaces' of space is strongly connected to our possibilities of visualisation, and movement, inside and alongside those spaces. Even when it is not possible to obtain an above ground, or sequential view, of long routes and large open spaces, it is still possible to construct their spatial representations. Walking on a beach, for instance, we can encounter vast expanses of surfaces of water (that we can see but only partially explore), sand dunes and rocks. Even if we cannot have a visual overview of the whole extent of the beach at once, we are able to make a mental representation of the whole. It is possible to connect the perception of its smaller parts through landmarks. And to relate the sequential views with the dimensions of distance, direction and relative position of objects perceived while moving along the beach. In the total absence of vision, a different perception process will occur. But, even in this case, the possibility of movement throughout the beach is what can facilitate its perception as a whole.

But do we, who can see, really have 'images' of the impenetrable, or partially permeable, spaces of a city centre based exclusively in our direct experiences in space? Are the perception of its exterior surfaces and unity enough to construct images of the city blocks, when there are no possibilities of visualisation of their inner surfaces? Are central urban blocks perceived just like visual 'border walls' of routes, punctuated by intersections, visual landmarks, and 'penetrable' functional landmarks? And how important, really is, the existence of representation of these 'masses' for orientation in central urban areas? For instance, if between two streets bordered by a continuous wall of high skyscrapers there is a commercial gallery, how is the 'tunnel' image of the gallery in our minds, connected to the routes and the 'mass of buildings' that surround the gallery and are enclosed by the streets?

It is difficult to be precise about how much of our notions of the forms of urban surfaces and volumes, or 'built masses', are dependent on the existence of secondary sources of information such as maps, aerial photographs, films and drawings. We might also suppose that, in the absence of vision, the representation of these impenetrable volumes surrounding the open spaces of streets is even more difficult based on perception only.

3.4 SPATIAL PERCEPTION AND VISUAL IMPAIRMENTS

> 'All that I needed to do was to allow my hands follow their own will. I had nothing to teach them, and since they had started to function independently, they seem to anticipate everything. Unlike the eyes, the hands explored carefully, and whatever direction they touched an object, they grasped it completely, testing its resistance, touching its mass, and registering every irregularity of its surface. They measure its height and depth, registering as many dimensions as possible. First of all, learning what fingers are, I used them in a completely new way… if my fingers felt the round form of an apple, each one of them applied a different pressure, and soon I couldn't tell if it was the apple or my fingers, which were heavy… As soon as my hands came to life, they placed me in a world made entirely by the exchange of pressures. These consolidated into forms, and each form had a meaning. When I was a child I spent hours leaning against objects and letting them touch me. Every blind person can confirm that this gesture, this exchange gives a deep satisfaction that is hardly possible to translate into words.'[121]

The importance of the haptic and orientation system for spatial perception when vision is absent is a well-known fact described in different psychology studies. Exploratory touch (basically using the hands) can bring information about forms, volumes, consistency, weight, texture and the temperature of an object. It is also more commonly assumed that it is the main channel for blind people to access information about forms in space. Indeed, orientation for blind persons depends to a higher degree on propriocentric frames of reference, combining information given by both the haptic and basic orienting system. The haptic system provides constant information about the body's positions and the different surfaces of contact while the orientation system registers and relates the body with the basic permanent external frames of the environment, informing the blind about own direction of movement.

However, environmental exterocentric information provided by the auditory system also plays a very important role for orientation and understanding of space. It is the main system, which can bring distant spatial information for the blind.[122] The reflected sounds produced by ones own body movements, or by a white cane, and the sounds coming from other sources in space *describes* for the

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[121] Lusseyran, Jacques (1963), *Et la lumière fut*, Edition Les Trois Arches, Chatou, unauthorised translation, p. 36.

[122] Smell to a certain extent can also bring distant information.

blind, not merely the spatial configuration of places but also the nature and location of the sound source. The understanding of how blind persons can perceive space through attentive listening is once more supported by the words of Jacques Lusseyran:

> 'Every Sunday morning, an old beggar used to play three melodies with his harmonica, in the inner patio in front of our apartment building. This music, so poor and rough, mixed at intervals with the metallic scratching sound from the trams on the rails in the avenue – all these in the silence of a lazy morning – conferred a thousand dimensions to space. It was not only the vertiginous fall towards the patio and the parade of avenues down there, but several wanderings between the houses, and from the patio to the roofs, as much as my attention was capable of learning.'[123]

IMPORTANCE OF ACCESSIBLE INFORMATION

In the preceding sections we saw how important the perception of visual information for orientation and understanding of space is. With a defective vision both the number and quality of spatial information are altered and there is a significant reduction of usable accessible information. In spite of this, even congenitally blind individuals are capable of identifying objects and places, to orient in space and to structure spaces mental representation using their remaining perceptual senses to obtain valid information. As we briefly saw in the Chapter 1, to improve their possibilities of orientation and spatial understanding, basically three different spheres are involved:

1. Special education of the individual improving his/her abilities both in being more effective in the use of perceptual skills and in developing orientation techniques, as increasing their knowledge regarding the construction of spatial concepts. This enables them to recognise different spaces, places and 'objects' in space;

2. Development of special instruments or devices that can help to access spatial information;

3. Environmental design improving the accessibility to existent spatial references, creating new sources of information when needed, and eliminating barriers or interference.

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[123] Lusseyran, Jacques (1963), unauthorised translation, p. 34.

The focus of this study is on the third sphere. However, without the understanding of the problems brought about by a defective vision, and what might be valid information for the visually impaired, it is difficult to know how to make environmental changes to improve their conditions of perception, understanding and action.

Also in Chapter 1 I referred to the two opposite spatial situations that create extreme difficulties for orientation when visual information is restricted or absent as:

1. Open spaces that lack appropriate information – difficult to identify goals and routes, and to control feeling of distance and direction, in the absence of differentiated paths, intersections and accessible landmarks;

2. 'Polluted spaces' with non-accessible information – 'interference' or obstacles preventing the perception of potential valid information.

VISUAL IMPAIRMENTS AND BLINDNESS

Even if this study is mainly focusing on the problems blind persons encounter in open urban public spaces, it is important to recognise the differences that exist within the group classified as visually impaired. 'If there are no doubts about the condition of blindness which agree to imply a total lack of visual information, it is not easy to have a clear picture of what kind of visual images the various other eye conditions can cause. The totally blind constituting only a very small number among the visually impaired makes it particularly important to understand the diversity of problems created by different visual impairments and specially the resultant defective visual perception of the so called partially sighted. Among the visually impaired a minority can distinguish light but nothing else, some have no central vision while others have no lateral vision. Some see everything blurred and indistinct; others see a patchwork of blanks and defined areas. Some can read because they can see at short distance or have central vision, but cannot cross a street. An important distinction is that of whether they can distinguish contours or not, including circumstances where the impairment makes it difficult to recognise definite objects or features e.g. a face.'[124]

In the design of environments more accessible to partially sighted persons, light conditions, colour contrast, sharp edges, reduction of visual pollution and reflection are very important raising their possibilities of obtaining visual information. However when considering the problems of totally blind individuals, two very different situations have to be considered. These

[124] Marta Dischinger (1995), p. 14.

situations depend on when in life a person looses sight, on the residue of visual memory and of the individual's space concepts based on previous visual experiences. The fact of being congenitally blind, or of loosing sight very early in life, implies in an absence of visual perception experiences. This might means a different process of construction of spatial concepts. In this case the problem to solve is not only of providing spatial information through non-visual sources for orientation, but also of considering which spatial elements can increase spatial experience and understanding of the spatial structure.

For a better understanding of the consequences of that, we should examine in more detail how congenitally blind persons form their spatial concepts.

SPATIAL REPRESENTATIONS OF CONGENITALLY BLIND INDIVIDUALS

For congenitally blind persons the construction of spatial representations is dependent on the extent of spatial experience, the possibilities of receiving first hand information from the remaining perceptual systems, and on the verbal, or instrumental information, received always through mediation. This last category includes conceptions of the sky, stars, the moon, roofs or even ceilings, the inner part of urban blocks, and many other things.[125] Gunnar Karlsson distinguishes three different modalities of spatial concepts' comprehension of in the experience of spatiality of the congenitally blind. The first one is obtained through direct sensory experiences (comprehension in terms of image-experience). The second depends on partial sensory experiences complemented by cognitive processes (comprehension in terms of notions). And the third refers to comprehension in terms of knowledge.[126]

His definition of image-experience distinguishes between three situations; '(i) visual image experiences that require a relatively intact visual sense; (ii) "image-experiences" based on former or very weak visual impressions…(iii) image-experience of congenitally blind people who never had, or have never been able to use visual remnants.'[127] The difference between the second and third forms of image-

[125] To form mental representations of 'objects' that we cannot directly see (like the solar system) through drawings, films, maps, models, or descriptions, is a common experience of most people. However, persons who have never had access to visual information do not experience the same situation. And their concepts of 'objects' from which they cannot obtain any direct sensory information are only received through other people's conception of reality.

[126] Karlsson, Gunnar (1996), pp. 312-325.

[127] Karlsson, Gunnar (1996), p. 312.

experience is that the latter one is based only on exploratory tactile experiences and orientation-haptic information. In this case, the image-experience of, for instance, a glass of water depends on different tactile experiences over time, of holding, filling and drinking water, and the form, texture, temperature, and weight of glasses of water within these different situations. To attain an image-experience of an object it is necessary then to proceed from perception, to a mental representation of the object. Also according to Karlsson, the individual has to employ cognitive processes to complement only partially direct perceptual experiences for the comprehension of spatiality 'in terms of notions'. He gives an example of a woman who describes her image of the outside walls of her own house which she cannot touch, which she, nevertheless, can compare with the other walls that she had touched. Finally his definition of concepts in terms of knowledge refers to comprehension that is not based on sensory experiences, but depends on descriptions offered by other persons.

What is more important in his proposals is that congenitally blind individuals are capable of constituting the wholeness of objects by synthesising their different sensory impressions. However their possibility of immediate perception of the 'inner horizon' of objects, the perception of the object context, or its 'outer horizon' will be always dependent on cognitive processes relating their previous experiences and /or knowledge obtained from other sources.

INDEPENDENT ORIENTATION, ATTENTION AND MEMORY

To successfully orient, blind persons have to remain consistently alert to be able to obtain sensory information from the environment, and to relate this information with a sequence of memorised route and events.

We have seen in the beginning of this chapter how time can be perceived through the different senses. The notion of time related to our own movements and memory of sequential events is very important in estimating distances when visual information is not available. The 'body memory of movement', together with the haptic and orientation systems inform how far we are in space and in which direction. And the rhythm in which spatial references can be found along a route is very important for memorisation and orientation.[128] Blind persons seem to explore this ability, more intensely, along familiar routes. They

[128] It is memory of movements in time that can make us experience the 'feeling' that we should have reached a place already, even if we do not recognise its references.

memorise not only the sequence of intersections, landmarks and events along the route, but also ‘know’ and control the memory of their rhythm and duration in time while moving along learnt directions. It is because of this reason that interruptions in the movement of blind persons disturb their orientation. In this case they are not only diverted from their original intended direction but also because their rhythm of movement is interrupted.

CHAPTER 4 – KNOWLEDGE OF SPACE

ACCESSIBILITY IN BRAZIL'S URBAN CENTRAL AREAS

The central urban areas of Brazilian cities usually present conflicting forces of growth and historical preservation, inadequate or outdated planning and legislation, which are allied very often with a lack of space control. The hectic rhythm of urban growth, and the differing interests led by, on the one side the private capital, and on the other social needs, prevents the emergence of more organised spaces. Therefore, the very first images of the centres are that of confusion and structural collapse. The lack of maintenance of public spaces and the increasing number of marginal economic activities hosted in the streets accentuate this image. On the other hand, Brazilian central city areas are traditionally 'public spaces'– full of people, activity and life, and offers 'space' for all segments of society. Despite their apparent physical chaos they are vital places for social and economic integration, offering opportunities for social encounter and job chances. They also give access to commercial, service and leisure facilities, and to the urban public transport systems.

Notwithstanding their apparent 'openness', the very deterioration of the physical structures of the cities, and their disorganised use, hamper and restrain their accessibility for a large segment of the population. Those who are more constrained by this are elderly persons, small children, pregnant women and persons with some sort of disability. For them, city centres become places of segregation instead of appropriation, despite the existent potential for integration in social, economic, and spatial contexts. And besides the cultural, social and economic discrimination, are other difficulties caused by a physical design, which does not support understanding, movement and effective use of open public areas.[129]

In the last decade of the XX century several Brazilian cities went through processes of revitalisation of their historical and central areas. For the first time, the accessibility and integration of citizens were considered parameters for intervention. This 'new' attitude, regarding the traditional urban goals, plans, and actions did not arise from nowhere. Different non-governmental organisations and public institutions have been fighting for the preservation of natural

[129] Regarding the exclusion of disabled people see Kitchin, Rob (1998), 'Out of Place', 'Knowing one's place': space power and the exclusion of the disabled people', *Disability & Society*, Vol. 13, no 3, pp. 343-356.

and historical patrimony, since the 1960's. And some very important actions and historical revitalisation projects took place in several Brazilian capitals.[130]

More recently, a growing concern with the rights of disabled persons, the accessibility of public spaces to them and their participation in the city life, is being added to this process. This new disposition emerged due to practical actions and claims made by associations of disabled persons, and a stronger presence in the media. Despite the results already obtained – most of which concerns the creation of specific legislations – effective changes are still lacking.[131] Laws have to be feasible and accommodating to different physical and social contexts to be effectively applied. And tangible solutions for daily accessibility problems have to be more than isolated examples. Moreover, it is important to bear in mind that the conception and implementation of projects for improving accessibility, as well as their maintenance, do not depend only on appropriated design solutions. It is fundamental that public institutions and public interest's groups recognise their potentiality in improving public open spaces to different social segments and to extend benefits for all city inhabitants. And, it is also of crucial importance to increase the awareness of urban planners and designers regarding their own role as important actors in the effective integration of disabled citizens in urban public spaces. It is within this wider context that the conditions of accessibility of the city centre of Florianópolis, capital of the state of Santa Catarina, situated in the island of Santa Catarina in the south region of Brazil, are examined.

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[130] Some examples are: Projeto Corredor Cultural, and Projeto Largo do Pelourinho, historical preservation projects in the cities of Rio de Janeiro and Salvador; and Projeto Rio Cidade, projects for the improvement of the image and accessibility conditions in different neighbourhoods of Rio de Janeiro.

[131] Dischinger, Marta and Binz Eli, Vera (1998), Accessibility as a learning subject for architecture students, unpublished article.

Fig. 7 – Streets as places of social integration where different activities and social encounters are possible

THE CITY OF FLORIANÓPOLIS

Florianópolis is considered a small city by Brazilian standards.[132] Its city centre is a smaller reproduction of the social dynamic of other bigger urban central areas. Notwithstanding the wearing down of its commercial and social activities, and the poor offer of cultural activities and events during the last ten years, the centre is still a dynamic and *open place* for all its inhabitants irrespective of their economical, social or cultural circumstances. It is this remaining condition of Brazilian public spaces as socially accessible that is essential to maintain and

[132] Florianópolis possess around 300 thousand inhabitants, while other capitals of the south region, like Curitiba and Porto Alegre, posses approximately 2 million inhabitants each, not to mention São Paulo that counts with approximately 18 million inhabitants.

to extend for disabled persons living in a discriminatory society.[133] Consequently, it is necessary to really understand how existent problematic situations can be improved. To achieve this we have to study and analyse, not only what undermines accessibility in public areas of the city, but also to scrutinise how we can create the favourably conditions for all embracing integration.

DESCRIPTION OF THE PLACE OF STUDY

Florianópolis, as most Brazilian cities, has a centralised model of development. This model is accentuated by the particular historic occupation of the territory of the island. Even if nowadays the city's growth has transformed 'independent' localities into neighbourhoods with their own local centres, the 'city' of Florianópolis still refers mainly to the regions around its oldest historical areas. The geographical localisation of the centre on the island, the presence of the two bridges that connect the island to the continent, and the centralised public transport system also contribute to its nuclear position. All these factors help to reinforce the concentration of commercial, institutional, and services functions in the old centre strengthening its status as the primary centre of the city.[134]

The space use and formal features of the centre are structured both, by the natural landscape and by the Portuguese colonial design. Among its most noticeable features are; the chess designed streets situated between the north bay and the hill chains, the regular blocks divided in long and narrow parcels, the central colonial square, and the remainder examples of historical buildings among the new 'modern' structures. The old colonial square – Praça XV – is situated in front of the Cathedral and surrounded mostly by public buildings and private banks. In the urban setting, the square being one of the strongest places of the city and its true heart articulates the whole historical centre. The square also divides the lower part of the centre in two different spaces. The first one, on the left side of the square, is a space with strong urban life and identity. In this space most of the 'centres of interest' as well as urban landmarks of the historic centre are concentrated. The second area, on the right side of the

[133] Like many Brazilian cities, since the 80's, several commercial activities have been transferred from downtown to shopping centres located on other neighbourhoods, and some other cultural activities also disappeared (like cinemas). The city centre is not any longer the favourite place for encounter of the local bourgeoisie. However, it is still a place for the realisation of a large series of urban activities, and a dynamic social centre for a large segment of the city population.

[134] It is important to note that both the island and the city do not host industrial activities.

square, has fewer pedestrians and less urban landmarks. It has a less defined image for the city inhabitants and 'quieter' streets that lead to the new administrative area of the city.[135] The existence of the two local and one interstate bus terminals at both ends of the first left area, creates a main axis of movement, which helps to reinforce the use of this part of the city centre. Along this axis are located the two important pedestrian's precincts, 'Conselheiro Mafra' and 'Felipe Schmidt', where both popular, and exclusive commercial activities take place.

All the three design cases focus on a section of the central area of the city, which coincides, with the left part of the historical centre located between the two bus terminals. In spite of the area importance its present physical structures do not support its intense use. The selected area combines a high level of architectural homogeneity and functional identity as a historical city centre, with a very intense human use of its public spaces. Its narrow streets and corners still function as points of encounter, hosting formal and informal commercial activities, and important functional and architectural landmarks. Finally the area was chosen because it is highly representative of impaired citizen's accessibility problems. In the first place because it is an obligatory area of access to work places, public services, transport system, commercial and social-cultural activities. Secondly because it is in fact intensively used by impaired citizens. And finally because its accessibility is jeopardised by its complexity, physical deterioration and neglected state.

[135] The newly designed part of this second area, even though geographically situated 'in the centre', cannot be considered as such. Its isolated modern high-rise buildings, parking areas, empty gardens, streets full of vehicles and almost empty pathways substitute the strong and close relation which exists in the narrow streets chambered between walls of buildings of the historical centre. If in the old centre streets can be described as the pedestrian's domain (even if cars are passing *slowly* almost everywhere), one gets the feeling of not belonging in the administrative area, place of 'nobody', or territory for vehicles only.

Fig. 8 – Map of South America and the island of Santa Catarina. Source: http://www.lib.utexas.edu/Libs/PCL/map_collection/americas/South

Fig. 9 – Map of the island of Santa Catarina showing the central position of the city centre in relation to the other localities, and to the connections with the continent, and satellite photograph of the island. Sources: Alina G. Santiago (left picture), and Landsat-5 (right picture).

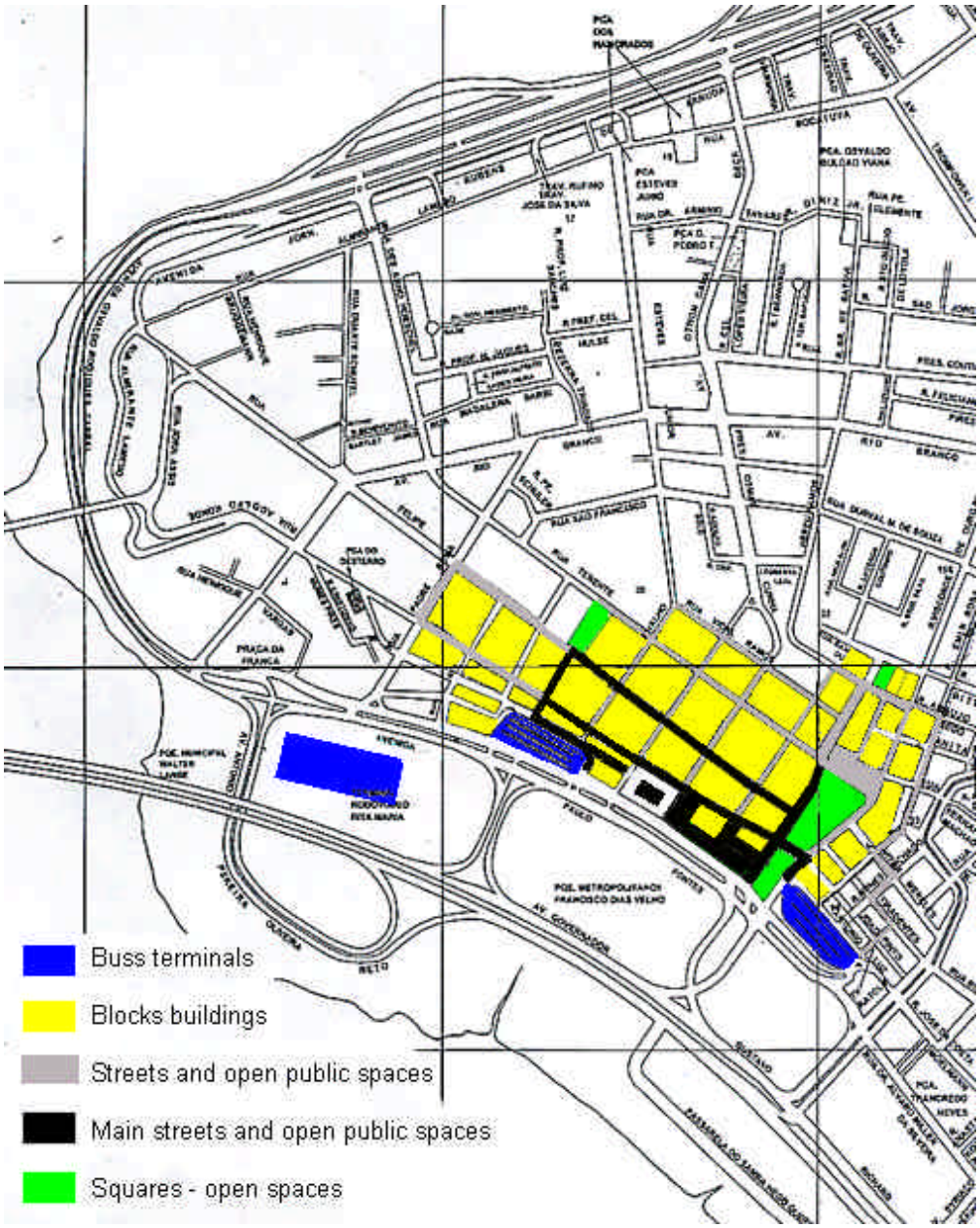

Fig. 10 – Map of the city centre showing the selected area for study. Source: IPUF.

Fig. 11 – Satellite photograph of the city centre showing the selected area. Source: IPUF.

Fig. 12 – Photograph of the area between the two local bus terminals. Source: student's analysis work.[136]

[136] Students: Eduardo Giovanni, Evandro Andrade, João B. Rocha, Luis A. Mendonça, and Ricardo Pauletti.

ACCESSIBILITY IN THE CENTRE OF FLORIANÓPOLIS

An examination of the physical situation of the historical centre regarding its accessibility for movement-impaired citizens, as an example, we could easily conclude that their access to it is almost impossible. The narrow colonial streets and pathways are overcharged with urban equipment. The steep topography is associated with irregular pavement and there are only few ramps for wheel chair crossing of the streets.[137] There are no accessible continuous routes and a few offer of proper parking areas. All these factors together create a situation in which movement impaired citizens cannot manage without help from others. The problems they confront, being physical barriers, even if easily identified, are not in the least solved in a satisfactory way. Wheel-chair users are almost never seen downtown. In their own words, 'they have to dedicate a great deal of time and effort making very detailed plans in order to perform any activity in the centre.'[138] Equally important is the lack of commitment (due to ignorance or recklessness) from both the general population and the public institutions responsible for urban space construction and conservation to ease their integration.

Contrary to the prior described situation, and in spite of the bad accessibility conditions, visually impaired persons can be seen in great number in Florianópolis central streets, especially in the last ten years. The state capital offers, through different institutions, rehabilitation services on mobility and professional training courses, it being a regional centre for the whole state of Santa Catarina.[139] The great majority of visually impaired persons coming from the hinterland prefer to stay in the capital due to the better job and social integration opportunities.[140] For them the use of the centre is fundamental not only due to the existence of the public transport system, but also because most

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[137] It is important to note that this analysis holds true for the first period of the investigation, and that some urban changes had occurred since, especially during 1999 (with the construction of ramps, pavement improvement in the sidewalks, and elimination of the electricity poles in some central streets).

[138] Information obtained during the interview with the association of movement-impaired persons, AFLODEF, held at the university during the urbanism course, in 1997.

[139] The governmental institution 'Fundacão Catarinense de Ensino Especial' (State Foundation for Special Education) offers regular education and special courses for children and teenagers; and a non-governmental association 'Associacão Catarinense para Integracão do Cego, ACIC' (State Association for Integration of the Blind) offers orientation and professional courses for adults and teenagers.

[140] From the 300 visually impaired adults registered in the state, around 200 live in Florianópolis.

of the public and health services are located in the centre and its adjacent areas. Plus, the streets are still a place for work and for social encounter for some of the visually impaired.

Fig. 13 – Locomotion impaired persons downtown

Most of the accessibility problems mentioned by visually impaired persons concern physical barriers, and their inherently dangerous situations. Holes in the street without proper or safe signalling, irregular pavement, narrow pathways crowded with urban equipment are the commonest. Another sort of problem encountered by the visually impaired refers to the human and dynamic space occupation of the streets. These comprise, among others, of the street vendors who change places everyday, and the lack of special sound traffic lights for safe crossing. Some of the problems are of mixed origins like the excess of noise coming from the vehicular traffic, or the shops' music and sound advertisement. At the same time, there is a total lack of spatial information devices attuned specifically to their needs. There are no tactile or Braille maps, totems, or any specially designed apparatus that might inform them about the activities and services available or existent problems to look out for on the streets.

Fig. 14 – Examples of some of the problems confronted by blind persons in central streets of Florianópolis

Considering the above, design projects that seek to improve accessibility for the visually impaired should involve much more than the mere elimination of physical barriers. To distinguish the nature of the different problems is perhaps the first and essential task. Without understanding how they obtain spatial information during movement in different places, how could one know what are likely to be valid references that can increase their perceptual possibilities? And consequentially, what helps and what disturbs their orientation and safety?

It is important to stress that the very concept of accessibility means augmenting possibilities of use and appropriation for all persons, and not the creation of exclusive designed environments for a certain group. Accordingly, it is necessary to thoroughly capture and communicate the character of the centre to the visually impaired. And also to ensure that proposals of intervention take into consideration problems of all users as well. The definition of design parameters for environmental interventions can only arise from a detailed and sensible observation of how the physical environment communicates its meanings,

identifying the different sources of information, pinning down actual and potential valid references, as well as the obstacles for understanding, safety and use of public spaces. This understanding of the meaning of space, and of specific places, is fundamental in order to create conditions for opening-up access to those who cannot fully perceive it.

To attain this comprehension it is important to commence with a detailed study of the present situation, and also to examine how observed changes evolved in time. It is necessary to evaluate how formal changes in history led to the creation and destruction of the centre's most important links with its natural environment and main landmarks, changing spatial uses and images. This knowledge is vital, not only as a basis for defining design accessibility project parameters, but also for defining the role such a project can play in the revitalisation of the historical centre and the reversion of present existing situation of decline.

THE PLACE AND ITS HISTORY

Brazilian process of urbanisation started from the year 1500, with the arrival of the Portuguese, and the establishment of a colonial policy of territorial occupation. The creation of a few cities on the coast served the Portuguese bureaucratic colonial structure and constituted the first urban nucleus. Their primary economic activity was the exportation of the colonial goods, produced through slave work in the big plantations and mines of the hinterland. Contrary to the Europe experience, Brazil does not have an urban network of small towns and villages situated around main cities. Since the very beginning, the urbanisation process involved only a few and rather populous cities, isolated in the territory, and connected to the international circulation of goods. In the south of Brazil this process of territorial occupation and urbanisation occurred later (around the XVII century), since this part of the colony was a source of dispute between the Portuguese and the Spanish Crowns. Among the southern region's capitals, Florianópolis has a different trajectory dictated both by its geographic situation and its historical evolution.

The island of Santa Catarina was known since 1514 with the beginning of Portuguese exploration of the Brazilian south coast and the discovery of the 'Rio de la Plata'. The island is situated midway between the important coast route linking the colonial cities of 'São Salvador' and 'Rio de Janeiro', and the 'Plata Delta'. The first cities of the east coast provinces of the Spanish Crown (Buenos Aires and Assumpción) were situated in the delta. During the first half of the XVI century, due to the belief that silver mines could be reached from

the east going up the 'Rio de la Plata', the island was more visited by the Spanish and Portuguese expeditions. After the 'discovery' of the Inca Empire by the Spanish Crown coming from the Pacific Ocean the island lost temporarily its geographic importance. In the subsequent years there were mostly Portuguese slave trader's expeditions from the 'Capitania of São Vicente' (actual São Paulo state) who arrived to the island. Already in 1580 they had exterminated the original native inhabitants of the island, the 'Carijó' Indians, but did not established a permanent settlement. Notwithstanding its geopolitical importance, the quality of its natural harbours, and the abundance of native wood for repairing ships, the city, which is known today as Florianópolis, was founded only in 1673. At this time a settlement, named 'Desterro'[141] was created on the west coast of the island of Santa Catarina, 'at this point where the continent and the island come very close, forming two bays, north and south. These bays being natural harbours, and well situated for defence, they gave the island a strategic position in the Portuguese occupation policy of the Brazilian southern territories.'[142]

The initial settlement, which was sparsely populated,[143] could not guarantee an effective occupation and defence of the south Brazilian territory, nor even of the island. With this weakness in view, the Portuguese Crown elevated the administrative status of the settlement to a 'Vila' in 1726, and in 1738 transformed the island to 'Capitania de Santa Catarina' along with a military force and a Governor. Four large fortresses were built and a recommendation made to increase immigration on to the island. It is only during the first half of the XVIII century, with the arrival of colonisers from the Azores Archipelago, that an effective occupation of the island and the beginning of agriculture, fishing and commercial activities could be commenced. By 1783, the island's population had already reached 3000 inhabitants and 400 houses, situated both in the original 'Vila do Desterro' and in several small villages dispersed on the island territory.

The spatial structure of the Vila was dictated both by the natural location and by the already existing initial settlement organised around the harbour, the main square and a small church. In 1747, the Portuguese Crown enforced very

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[141] The original name of Florianópolis, 'Desterro', means expatriate.

[142] Oliveira, Liseti A. (1997), *'Florianópolis – Uma cidade à beira-mar',* FAU-USP, São Paulo, unpublished paper, unauthorised translation.

[143] In 1711 lived in the island a small community of fishermen counting with approximately 147 white men, a few indians and some black men, in Oliveira, Liseti A. (1997).

detailed rules for the territorial occupation of the whole island, giving instructions for land distribution, street design, the due position of public squares in relation to churches, public and communal places, and even for the localisation and construction of private houses. These dispositions, together with the local geography, marked and structured both the urban designs of the dispersed localities spread on the island as well its main urban nucleus. To date, the main square, the narrow and long parcels, and the chessboard streets are some of the main features of the historical centre.

The most important elements, which generated the growth of the city, were the harbour and the main square, known today as 'Praça XV'. The harbour defined the establishment of commercial and housing activities in the streets, which run parallel to it ('Rua do Princípe', today 'Conselheiro Mafra' and 'Francisco Tolentino'), and the design of the perpendicular streets, 'Travessas', which came down the hills towards the bay. Two main buildings situated by the harbour, the Public Market and the 'Alfândega House', are still important landmarks of the city centre. The square, 'Praça XV', which hosted fairs and religious events occupies the slope of the mountain down to the coast. On its highest side was located the cathedral and around the square were built the 'House of Parliament and Jail' and the Government House. Even today, it is in front of the cathedral that political manifestation and carnivals are held.

The growth of 'Vila do Desterro' was slow. The majority of the island's population was dispersed in isolated and distant localities that could only communicate with each other by the sea. However, commercialisation of agricultural products and goods has developed enough to give life to the harbour and to local commerce. In 1823, the Vila attained the status of a City condition. During the XIX century new centres of development based on agriculture activities sprang up in the south region of Brazil, especially in the new settlements of Italian and German immigrants. These new economic centres naturally preferred to export their goods from harbours situated on the continent. This fact, and the weak local economy, led to a stagnation of the city during the XIX century. However, despite its geographical isolation and its lack of importance in the regional and national economy, Florianópolis maintains its bureaucratic and administrative functions as capital of the province of Santa Catarina.

During the period between the end of XIX century and 1930 the city experience another cycle of transformation, in the words of Lisete Oliveira:

> 'The efforts of the local élite during the 'First Republic' (1889) were responsible for a period of great transformations in the city to maintain its status as a state capital. Sanitary, hygienist and embellishment reforms were done as in other cities of Brazil (Santos, São Paulo and Porto Alegre). The city is redesigned and urban networks of water supply, public light system and other urban reforms are done under the paradigm of health and hygiene, key words for the press and local élite. These reforms will mark the city reorganisation and expansion, but the city maintains its relation with the sea, reinforced by the construction of a New Market and the reconstruction of the old Alfandega.'[144]

In 1926 the bridge 'Hercilio Luz' was constructed to connect the island to the continent. The bridge changed the main route to the city, which used to be the harbour in front of the main square. Despite this new route and the gradual diminishing of the harbour's economical importance, the public life of the city remains connected with the sea. This connection happens through the intense use of the main square, 'Praça XV', the commercial activities of the streets bordering the harbour, and the construction of a buss terminal.

> ''The image of the city is almost intact between 1930 and 1960. From the sixties a different landscape is defined by an acceleration of the urban evolution. During this period of growth the urban landscape reflects the enormous expansion of the city. The city centre increases its density and extends its area through peripheral and tentacle like expansions. These facts are reinforced by a new formal urban structure. In this, stand out new traffic system and roadway connections. The augmenting of medium class population creates new housing areas, and the emergence of skyscrapers, which borders the new avenues.'[145]

This late growth of the city[146] had its origins in several different actions. On the one side it depended on the consolidation of a new national roadway system, which reinforced the status of the city as state capital through the construction of a national highway, the BR 101. And a new modern bridge, Colombo Salles, was constructed to improve the crescent urban traffic connection with the continent. The creation of the Federal University of Santa Catarina and of the airport augments the numbers and importance of the tertiary sector. The

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[144] Oliveira, Liseti A. (1997), unauthorised translation, p. 12.

[145] Popini, Nelson Vaz (1991), *O Centro histórico de Florianópolis – Espaço público do ritu*al, Ed. da UFSC, Florianópolis, unauthorised translation, p. 33.

[146] In comparisons with the growth period of other southern capitals, which started in the 1930's and 1940's.

establishment of the headquarters of the ELETROSUL[147] foster boost the city importance. The city, which had already extended its urban area to the continent, was also expanding its growth in the island. A significant occupation of the neighbourhoods close to the university occurred, while some of the isolated beaches and small localities were transformed into residential neighbourhoods.

From the 1970's the city has undergone an accelerated growth of its population mainly due to internal immigration into the new public services created in the 1960's. However, the centre of the city situated between the hill chains and the sea had very limited possibilities of growth and could no longer support vehicular traffic. The adopted solution was a recovery of parts of the bays, and the old harbour, and the creation of a roadway system, which decisively separates the historical centre from its major point of reference – the sea. From this new area it also became possible to construct a third bridge since the first, Hercilio Luz, was closed to vehicular traffic, and the second, Colombo Salles, was ill equipped to face the increase of traffic between the island and the continent.

Fig. 15 – Aerial photographs showing the centre and the land conquered from the sea. Source: Fundação Franklin Caescaes.

Another related factor can be added to explain the city's growth. The new and better connections with the continent, and the immigration of technicians and professionals from other states to work at the University and at ELETROSUL headquarters, has intensified the 'discovery' of the island as a 'natural paradise'. Further, a new profile connected to tourism was defined for the city and for the whole island. In the last 30 years the more important events in the

[147] ELETROSUL is the national institution, which is the body responsible for the administration of Brazil's southern region hydroelectric system.

urban evolution of the city centre were: the break of the strong links between the city landscape and the sea, the destruction of some parts of significant historical references, and the construction of an increasing homogeneous architecture. In addition, the creation of shopping centres outside the traditional centre, plus the unilateral emphasis placed by tourism on the beaches, contributed to a relative decay of the centre and to a reduction of its importance.

The 'ideals' of progress, modernity and speed dominated most of the last changes. They led to the expansion of the roadway system and to the substitution of historical buildings by modern skyscrapers. These changes covered both the centre and the bordering new avenues created in the areas reclaimed from the sea. In the latter area in particular, the model image led to a re-creation of 'Copacabana'.[148] The result is the construction of an almost continuous 'wall of buildings' facing the sea, replacing old houses and gardens. In the historical centre this substitution of the old urban tissue occurs in a very fragmented way. Skyscrapers, with 12 or 20 storeys, interrupt the old colonial skyline, of two or three storey houses. In this area only the two traditional streets parallel to the sea, 'Francisco Tolentino' and 'Conselheiro Mafra', still maintain their architecture intact. On the other hand, there was no similar intensification of land use in the areas newly reclaimed from the sea situated in front of the historical centre. The reclaimed areas' relative distance from the centre, and the intense high-speed vehicular traffic between this area and the old centre represent barriers for the pedestrians. But it is especially the lack of commercial, cultural or administrative activities that causes an under-occupation of this piece of land. The construction of the inter- state bus terminal in the area in 1981 did not lead to a reversal of this situation. Rather, its bad connections with the historical centre, and the other buss terminals, only seemed to increase its distance and the discomfort for pedestrians.

It is important to stress that the higher population density of the centre is not supported by an equilibrated development of infrastructure, such as sewage and subterranean electric systems. The centre 'swells' over an already insufficient urban network with an accumulation of cars, noise, visual pollution and people and its growth is aggravated by the abandon of the public spaces by the authorities.

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[148] 'Copacabana' is the most famous neighbourhood of the city of Rio de Janeiro. Its line of skyscraper bordering the seaside constitutes a 'model' of urbanisation for coastal areas all over Brazil.

Fig. 16 – Aerial photographs of the new modern residential areas in the North Bay. Source: Alina G. Santiago.

In spite of the changes, the historical centre has remained the heart of the city. Its geographical situation has been relatively decisive for the existence of few linear connections between its different neighbourhoods, the centralised public transports system, and the concentration of urban services and activities. The main square, 'Praça XV', is still a meeting point of the most variegated type of people, from 'hippies', to religious fanatics, older persons playing domino and chess under a centenary fig tree, or just sitting to watch passers-by. Religious parties and public concerts still take place in the square. And in the summer, costume-dressed people dance during the four days of carnival occupying the whole centre. Everyday in traditional corners of the pedestrian's streets people meet to discuss politics and drink coffee. The public market is still a place of congregation for all sectors of the society, buying and frequenting its small shops and bars. And it is also in the downtown that the growing number of dispossessed population has opportunity to develop marginal commercial activities. Contrary to other Brazilian urban centres urban violence is not yet noticeable on the streets. And the centre is still a place where people can informally meet.

Fig. 17 – City centre public spaces as places of social encounter and marginal activities.

MAIN OBJECTIVES OF THE SPACE ANALYSIS

There are two basic objectives for the development of a detailed analysis of the city centre. The first is to make possible a deeper comprehension of accessibility questions in public spaces in the central area of Florianópolis. The second is to support the future definition of general accessibility design parameters, and through their application the development of practical design projects. For the realisation of these central objectives it was necessary, in the first place, to define a representative area in the centre for a detailed study, identifying and evaluating existent problems both quantitatively and qualitatively. The choice of the city centre is well detailed in Chapter 1 as a significant place for the accessibility of visually impaired citizens, and a detailed description of the site of study is made in the beginning of this chapter. For the success of future design projects it was also fundamental to detect which sectors of the society were implicated in the problem, as well as, their respective grades of participation and responsibility.

In short the study of the place had three different 'fronts' of observation:

- Observation and register of the physical spatial reality – distribution and relations between permanent and dynamic spatial elements;
- Observation of human activities and movements in space;
- Detailed observation of space-use by a special group of citizens - how the visually impaired manage to orient and act in public spaces.

Studying the place: defining what to study[149]

Florianópolis' central area is intensively used by visually impaired persons. Knowing that, we had to assume that they already possess some spatial experience and knowledge of the city centre. But the fact that visually impaired persons can 'manage' to orient and use public open spaces and equipment does not necessarily imply that this is an easy task. Nor could we assume knowledge of the extent to which the existent spatial disposition facilitate or hinder their access to it. To begin the study of the problem, it was important then to detect: which places of the city centre are used by visually impaired persons and also their 'preferential routes'. Knowing the places they prefer and frequent it would be possible to know at the same time those which they do not frequent or avoid,

[149] I conducted the spatial analysis with the help of an architecture student Nadia Khaled Zurba. For this reason in the following sections it is employed the pronoun 'we'.

and to investigate the reasons for both preferences. It was also necessary to relate the physical characteristics observed in those 'negative' and 'positive' spaces with different theories of spatial perception to detect why and how different spatial elements could be perceived and their values for orientation.[150]

The place analysis started with some very basic initial questions – What do people usually do in the centre of the city? Which are the potential centres of interest and activities? Which are main axes of movement? How does appropriation of different places happen?[151] The answers could provide a 'knowledge map' of the centre's use, from which more detailed queries could arise. To answer to these firsts group of questions, referring to all users observation and registration of the place, study and elaboration of maps, and reading of the existent literature about the city history and appropriation of public spaces were done.[152]

Other more specific questions are aimed at conducting the observation of visually impaired individuals' conditions of accessibility – Which are the existent and potential positive spatial references, which support dislocation, recognition and appropriation of public spaces? Which are the main problems of access to places of work, public services, commercial and leisure activities? How are access conditions to public transport system regarding the connections in the city, and in the island and continent? And finally in which grade they participate and integrate in the urban life? However, for the second group of questions, related to the perception and use of the place by visually impaired users, a more detailed study of the spatial elements of the chosen area had to be done. At the same time it was fundamental to try out specific instruments of

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[150] The main theories utilised are: Gibson's ecological theory of perceptual systems -to relate the physical sources of information with the possible channels of perception; and a combination of the orientation theories proposed by Spencer Blades & Morsley, and orientation and spatial concepts of the blind by Karlsson and Magnusson - to detect in the observed urban organisation the existence and roles of spatial references.

[151] These questions are mostly informed by a phenomenological view of perception and orientation were the intentionality of actions directs perception itself and the belief that visually impaired persons do share the same social needs and aspirations as other citizens. The identification of activities as sources of attraction (centres of interest), the possible routes to reach them and the conditions of safety, comfort and orientation along these routes, is based on a combination of traditional geographic studies of accessibility (see chapter 1) and spatial perception studies (see chapter 3).

[152] Main authors for the study of the city history and present appropriation utilised are, Veiga, Eliane Veras da (1993), Oliveira, Liseti A. (1997), and Popini, Nelson Vaz (1991).

investigation to obtain first-hand data from visually impaired individuals. These instruments and the results obtained, due to their specificity and complexity, are described in the following Chapter 5.[153]

General space analysis

The results of the initial overall space analysis were represented through a descriptive text, a thematic collection of slides, and three thematic maps, which are reproduced in the following pages.

Fig. 18 – Map 1. Source: IPUF

Map 1 – Urban structure and functional zoning – represents the urban network distinguishing pedestrians (in grey) and vehicular traffic (in black) along the

[153] In this chapter the focus is placed on the description concerning the investigation of space. It is important to observe though that the overall and detailed studies depended from each other. Here the overall is described first followed by the more detailed space analysis even if they were done together.

main routes; public transport terminals (represented by black and grey stripes placed in the left and right bottoms); and the location of commercial (in yellow), service (in orange), administrative and financial institutions (in red), education (in purple), cultural (in blue), religious (in dark blue), and squares/ and larger open spaces (in green).

In this map it is observable how the spatial distribution of activities stress the existence of two main axis of movement:

Parallel axis to the seashore, which establishes the connections between the public local and interstate transport system. Along this axis are situated the streets with more significant commercial activities (Felipe Schmidt, Conselheiro Mafra and Francisco Tolentino);

Perpendicular axis to the sea, which establishes the connections between the centre and adjacent neighbourhoods.

Fig. 19 – Map 2. Source: IPUF

Map 2 – Urban spatial references – represent both permanent and dynamic (in yellow) urban references. The permanent spatial references are distinguished as essentially functional landmarks (in red), essentially visual landmarks (in orange) and functional/visual landmarks (in brown).

The identification of activities that are centres of interest (public services, schools, shops, bars, etc.) is important for the definition of routes and places of concentration. The visual permanent landmarks and functional landmarks are of fundamental importance for the orientation and understanding of the urban structure. However their use by visually impaired still had to be verified. The dynamic spatial references represented are human activities that give identity and character to the urban places but do not have a permanent location over time. They do not necessarily have physical structures to support the activity, like some of the informal commercial activities held in the streets.

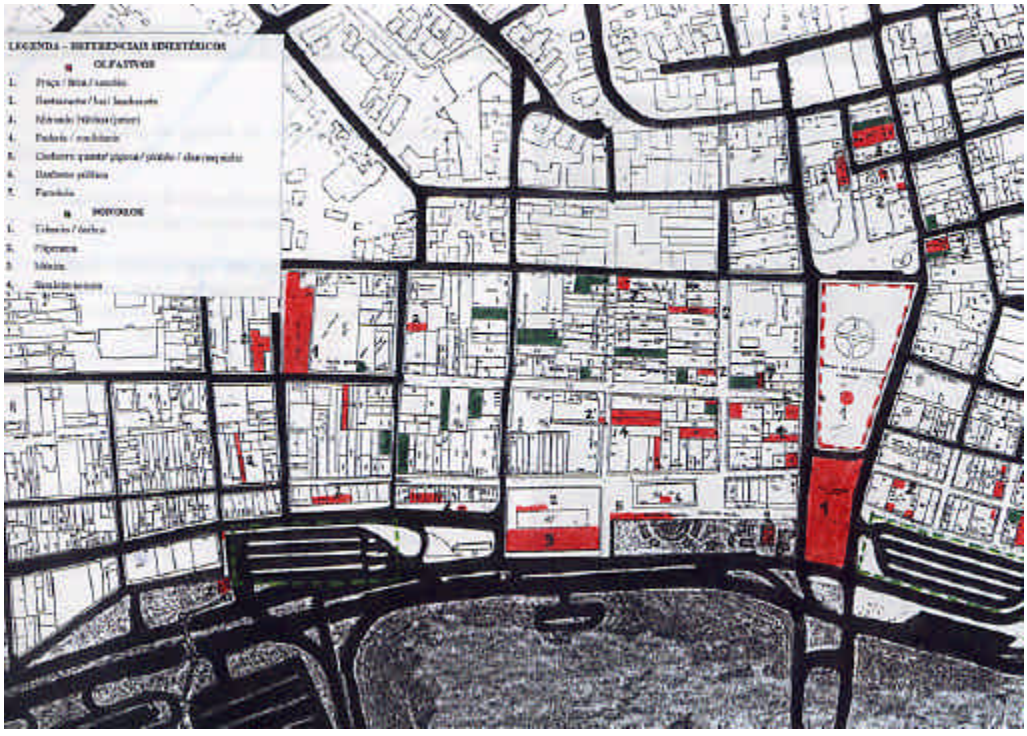

Fig. 20 – Map 3. Source: IPUF

Map 3 – Sound (in green) and smell referential (in red) – represents the initial identification of non-visual sources which could convey information about their

own functional identity and help to support orientation thus confirming a relative position in space (like bakeries, coffee shops, pharmacies, and fish market). Even if the actual use of these potential sources of information had to be confirmed by visually impaired persons, their identification was very illustrative of a different way of evaluating the accessibility of orientation references in space.

Detailed spatial analysis description

The initial spatial analysis was done from the combined study of urban maps, literature studies about the city and local observation of the place. While working with the maps we started to make random 'free' exploratory visits, to use and observe public spaces of the centre. This observation was basically done in the streets and squares. The main objective of the observation period was to identify and register the spatial elements, which might structure and support perception, understanding and use of space, when vision is restricted or completely absent. However, as we did not know which ones are used with what function, any initial classification and selection of what to observe and study would involve the risk of discarding valid references as barriers, or vice-versa. Moreover, I was not sure how to separate the study of all observed different human activities from its physical traces. How could we observe and consider movement itself, without losing the fine grain of its complexity? So, we decided that in the first observation moment we should register whatever was possible to register by its own 'name', all that we could identify along the streets. From this first disorganised register a special card was designed to assist in organising the observation and data register. A first model card was tested, and we observed what was missing in the card.

We made a large distinction of observable elements in two basic categories: *permanent, and dynamic spatial elements*. The inclusion of dynamic elements as potential spatial references is based on the psychological studies of orientation already done, and in the need of considering the different nature of perception of the blind that has to make use of essentially dynamic sources of spatial information.[154] Moreover this large separation had two objectives in mind. Firstly, it made possible to distinguish between the physical structures and their attributes that have permanence in space and time (as streets, buildings, and all

[154] The consideration of dynamic landmarks in orientation is proposed by Spencer, Blades & Morsley, and specific studies of congenitally blind individual's perception is developed by Karlsson. See chapter 3 for more details.

sort of objects that are traces of actions), and other spatial elements that are essentially transitory in space and time (as human actions, natural events, sounds, etc.). Secondly, this large classification did not imply a prejudgement about the importance, or the use, of the observed elements as carriers of meaning for orientation.

After several visits and discussions about *what* to study and *how to register* the studied area, we concluded that the observation should have a more objective quality than a subjective one.[155] This trait was decided when I realised that when I explained the intention of studying how a different perception of the city centre could occur, this intention was interpreted as a study about the 'images' that different kinds of urban users could have. It was assumed that I intended to compare the city image that a person born in the city could have, with that of a tourist, and these with the images that visually impaired persons could have. Visually impaired persons do might have in principle a different spatial representation of the city centre. This representation though, would be difficult to be compared with the predominantly visual image of other city users.[156] Further, I was not interested at that stage in interpreting the mental and more subjective images of the city centre by its visually impaired users. What I needed to know first was how they *could perceive the place,* and this question is prior to how the place is mentally represented. A more concrete and objective vision of the spatial elements that constitute the information sources for perception was precisely what was missing to the understanding of the problem.[157] Consequently, the focus of this investigation is not on the different spatial representations or 'images' of the place, but on the study of the spatial elements, which might facilitate spatial perception for all senses.

As a result from these discussions a card was designed containing a map of each street block, and a list of aspects to be observed in each square. Together they should propitiate the collection of neutral and detailed data material for future qualitative and quantitative analysis. It should be possible to record in the card

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[155] Apart from the research assistant, Nadia Khaled Zurba, I would like to mention the influence in the discussions of the architect Lisete de Oliveira.

[156] It was evident in the discussions that when people talked about 'urban image' they were employing the concept very much as Kevin Lynch defines it. Some architects even suggested me on how to compare 'maps' made by normal seeing persons with 'models' that could be made by the blind.

[157] Once again Gibson's theory is the basic theoretical support for the study, since I wished to relate what in the environment could be a potential source of information considering the active senses in the absence of vision.

the *position* of all permanent and dynamic elements placed in the sidewalks and streets, their *formal spatial characteristics* and their relations with the surrounding space, and their *spatial attributes* that could affect orientation, comfort and safety of movement.

Together with the filling-in of the card, drawings, notes and a detailed photographic record should be made simultaneously to record the local scenes along each block. While filling-in the card we could observe if it would be possible (and meaningful) to develop specific signs for the different sort of spatial element observed.

A detailed list of the spatial elements' attributes to be observed and registered is the following:

1. The form, dimensions, conditions and qualities of the physical support and basis for movement and action provided by the streets, sidewalks and the more open areas, like squares (as the sidewalk's widths; pavement material and its conservation, presence of holes, etc);

2. The forms, conditions and qualities of permanent structures as sources of action and interest (identification of functional activities, and of architectonic landmarks);

3. The fluxes of movement of vehicles and pedestrians and all the existent factors regulating this movement (lines and directions of movement, traffic-lights and signs, physical obstacles, etc.);

4. The forms, conditions and qualities of all dynamic human actions and their 'physical traces' (meeting points, good's sellers the place they occupy and their 'equipment', etc.);

5. The temporary and permanent physical obstacles placed in the sidewalks (urban works and constructions, light poles, urban equipment, etc.);

6. The disposable urban information and its legibility, depending on the possibilities of visualisation and the relation between information, function and typology (streets' signs, traffic signs, public transport information, etc.);

7. The characterisation of dynamic commercial, cultural or social events constituting centres of interest according their degree of permanence (frequency, time schedule, routines), and importance for orientation

(noting when they are landmarks not just as physical elements, but also by use or sound, smell values);

8. The main impression and character of the place identifying which are the physical elements that contribute to this feeling (noisy, visually polluted, socially alive, physically degraded, etc).

The cards were firstly tried out in a test, which was conducted on a Friday afternoon between 16:00 and 17:45 hours. The observation and register of the first street-block took more than one hour to be accomplished, and the second block took around 30 min. I guided the assistant on how to fill the card, take notes and make drawings, while I took several pictures of the main features observed. After filling two cards, we reached the conclusion that the list of features to be observed in the first page of the card worked very well as a 'reminder' of what to observe.[158] For example, when we checked the list after the finishing of all the drawings and notes about a public square, we read the word 'statue'. We had not seen or registered any statue in the place, but I had a vague memory of seeing a statue in a model of the square at the city council. After a while, looking more carefully, I saw a statue of about 5 meters height placed just in front of us. We started then to discuss why we haven't seen the statue before. We concluded that the place was so visually polluted that it was impossible to see it. Also we found that there was no apparent order in the urban furniture disposition or visual axis in this place.

[158] The features to be observed are the same as the points listed before. They were organised in a more synthetic form and divided in five blocks: vehicular traffic (1); pedestrians traffic (2); urban information (3); barriers (4); street dynamic occupation (5). In each block a detailed list of elements and attributes to be observed was included.

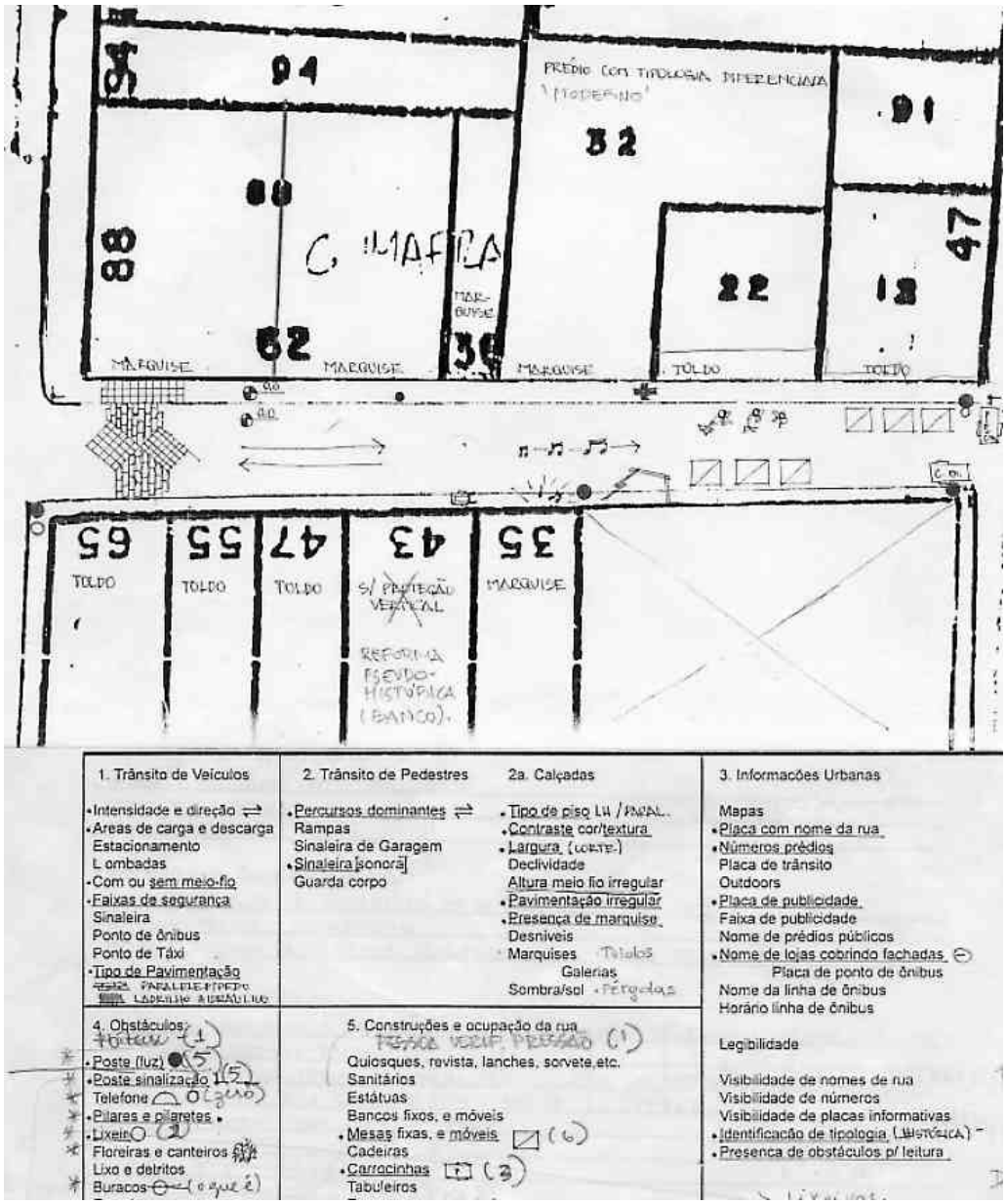


Fig. 21 – Reproduction of the first page of a card showing the detailed register of a street block

The three maps done in the first stage of the overall space analysis were important as an introduction of the study to other actors involved in the design

cases (public urban planners and architects, visually impaired persons, and politicians) because they synthesise, in a different form, known aspects about the city centre. They show where different kinds of activities were concentrated, the more frequented routes determined by these activities and the transport terminals, and they distinguish visual architectonic landmarks, functional landmarks (dynamic or permanent), and visual/ functional landmarks. They also introduce some 'new' concepts, or at least aspects usually forgotten in urban analysis. The distinction between permanent and dynamic spatial references, and the more subtle division between visual and functional landmarks, is fundamental for the understanding of a different spatial perception process, such as when vision is absent. An obvious illustration of this difference is represented in the third map where initially identified potential sources of information other than visual ones are obtainable. In fact, these first diagnosis maps are too synthetic, and more detailed maps that could represent the knowledge acquired during the investigation in a better way, were not developed.[159] Furthermore, as any other urban map, their possibility of truly representing spatial life and complexity is limited due to the restrictions brought about by technical graphic representation. Steep streets or flat ones, streets full of people and shops, and others full of cars and traffic signs, calm and empty silent places, and noisy lively ones, are all represented on almost equal footing. It was only the joint use of the descriptive written data contained in the cards, the thematic photograph slides, and fundamentally the personal

[159] In fact, the further design of a kind of 'sensible' map was aimed both at communicating with others and at developing better instruments of analysis. At the time of the space analysis we had no time to develop them due to the complex investigation necessary onto how to represent three-dimensional and dynamic attributes in a readable form. The study of Appleyard, Lynch and Myer 'The view from the road', made at the time, was an example of the effort necessary for a representation of this kind. In the study a whole set of symbols are developed to represent how car drivers perceive different dynamic views from the road. For me, as a reader of these 'sign maps', it was very difficult to remember what each sign meant, and how they did relate to the photographic images of the road views presented in the study. And it is important to note that the signs do have visual or logical resemblance with the intended meaning. It is my private opinion that for the researchers the signs' design was one of the most important parts of the study, since it required the classification and ordering of whatever they observed and registered. Similarly to my own situation, it was the deep personal knowledge of the place that made it possible to perform such a spatial analysis. The time to be invested in such a complex investigation (on how to synthetically visually represent non-visual information in a map) represented a real change on the future focus of the research. Moreover, I feared that the developed representations would be only readable for me. See, Appleyard, Donald, Lynch, Kevin & Myer, John R. (1964), *The View from the Road,* The M.I.T. Press, Cambridge.

knowledge obtained in the place while doing the observation that allowed us to 'see' and to make others 'see' in the maps more than what they actually represent.

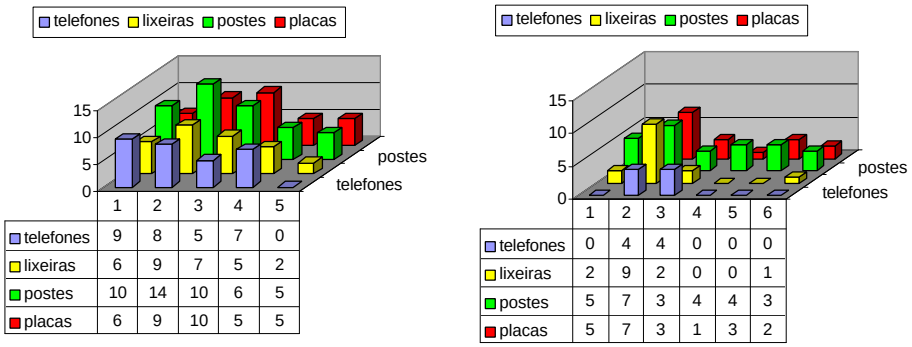
Analysis of initial data

The mix up character of what we saw, photographed, heard (the impossibility of reproducing sounds in a book is a real loss), and have drawn, made it difficult to separate and classify. Also, the way in which we registered, like an 'observation portrait', did not make it easy to undertake this task. Different elements and actions with different scales and levels of importance were registered in each block and along blocks. We had, since the very detailed observation with the itemised account of sounds of each street block's, irregularities in the pavement, minor events and urban furniture, until the large scale observation of fluxes of movement of pedestrians and vehicular traffic, landmarks, and centres of interest of the entire area. We also had different levels of the aspects to consider, like the existence or absence of information system, and the spatial formal organisation. Even elements that were easy to classify as barriers for movement, like piles of cardboard boxes on the streets, were also physical traces of a whole network of activities that usually pass unperceived. Streets are physical and social space. As such, they support and generate movement and events related to the social life of the city at different scales and levels. Physical elements and human activities are very often entangled and interwoven, not only in the specific block they were located, but as part of the whole urban life.

Fig. 22 – Goods distribution and paper collection in the central streets

As already stated the data analysis had to fulfil two main objectives. First, it had to support the understanding of the problem through a diagnosis of the accessibility conditions in the city centre. Second, to suggest the definition of design parameters of design intervention. We had registered all that we could observe without making a detailed qualitative evaluation. This does not imply

on a lack of opinion, about how 'good or bad', the observed spatial elements were. But, criteria were needed to justify a qualitative evaluation of the collected data. We had also noticed during earlier discussions with others technicians that our judgements were more easily accepted if supported by quantitative data. The reactions were more intensive when we said, for instance, that we have counted 56 different items of urban equipment along the sidewalks of one block, than when general attributes to accessibility were presented. Consequently, even if the diagnosis is essentially qualitative it searches when possible to include quantitative data. The numeric data gave also provided scale and dimension of the problem with very concrete information about accessibility conditions. In reality, most persons involved in the study, as urban planners and the visually impaired, were aware of problems like overcharged vehicular traffic, lack of safety for pedestrians, irregular pavement of pathways, etc. But a more systematic and objective evaluation was needed to



	1	2	3	4	5
telefones	9	8	5	7	0
lixeiras	6	9	7	5	2
postes	10	14	10	6	5
placas	6	9	10	5	5

	1	2	3	4	5	6
telefones	0	4	4	0	0	0
lixeiras	2	9	2	0	0	1
postes	5	7	3	4	4	3
placas	5	7	3	1	3	2

show the connections between problems that usually were seen as isolated.

Fig. 23 – Reproduction of graphics comparing the numbers of public equipment along blocks in two pedestrians' streets of the city centre, 'Felipe Schmidt' and 'Conselheiro Mafra'

The apparently easy classification of spatial elements as barriers was not so effortless considering the specific orientation process of visually impaired persons. On a first sight light poles placed in the middle of a narrow pathway, or a one-meter depth hole in the pavement, are clearly obstacles for movement, as well as threats for the safety of blind persons. However, these very light poles could also carry positive references for orientation (they could be counted, or to be placed in front of a desired activity). The fact that one of the frames of reference for oriented movement of blind individuals is memory of movement itself is crucial to develop such a classification along a route. It is

important to keep track, between memorised directions and time duration, in relation with the position and rhythm of local spatial landmarks, and the actual movement in space.[160] According to this understanding, barriers met along a line of intended movement on a route, could cause deviations on the speed, rhythm or direction of movement, causing disorientation. Moreover, these changes in the route could bring the impossibility of finding memorised landmarks. That is, it could prevent the access to useful spatial information. Not only physical permanent obstacles could prevent the access to information. Excess of noise, human activities, rain or wind, could be factors that impeded the access to dynamic or permanent references as well.

Consequently to be classified as barriers, spatial elements should interfere with movement, perception, understanding, and use of space according to the following:

- Preventing, restraining or disturbing comfort and/or safety of movement along routes, and places;
- Preventing, restraining or disturbing the perception and understanding of potential sources of spatial information and consequently, impeding the effective use of places and existent activities.

In the more detailed analysis of the elements placed along routes or 'inside' places (squares and 'largos') we adopted the principle that no spatial element 'per se' can be considered as a barrier to accessibility, since they had to be considered in their phenomenological context.[161] Consequently we searched to define criteria identifying the reasons that transform them into barriers. These criteria supported the evaluation of each kind of situation and to develop parameters for intervention, relating and comparing the observed problems within their specific contexts.

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[160] Once more the understanding of this process in the place is based on a combination of different theoretical studies, and information given by visually impaired persons. Main theories employed are Weil-Barais, Joceline Roger, Spencer, Blades & Morsley, and Karlsson and Magnusson. See chapter 3, Knowledge of special perception, for a more detailed description of the orientation process.

[161] It is informed on Merlau-Ponty phenomenological approach to perception, and according to my interpretation, that I could understand that depending on the spatial situation and the specific relations established by the individual one spatial element could be considered either as a barrier or a landmark for orientation.

Specific criteria for evaluation of spatial elements as barriers were the following:

- Lack of rhythm in the distribution of urban equipment and furniture creating physical obstacles (unnecessary superposition, random localisation), and making difficult the memorisation of their localisation;
- Absent or inadequate equipment necessary for the realisation of activities in urban areas preventing their use (lack of functionality, short durability, non-adapted to disabled users)
- Deteriorated equipment with prejudice of its performance or compromising its utilisation (broken benches or pavements, broken traffic lights);
- Disorganised and conflicting activities disturbing movement along routes, and preventing access to information sources;
- Lack of safety of urban equipment, or lack of safe signalling and protection of urban works;
- Non-existent, non-accessible, or inadequate information about urban structure and/or public facilities and transport system.

Categories of problems for accessibility

The future definition of recommendations and parameters of intervention should arise from the study and analysis of the collected data (street cards and photographic record),[162] and its quantification, and systematisation into categories of problems. The developed spatial analysis was also compared with the information obtained from different groups of impaired persons and organisations. The presentation of the problem in different categories was intentional. We aimed to counterpart the idea that the mere elimination of physical architectonic barriers could solve the accessibility problems. On the contrary to attain accessibility in full terms is fundamental to understand not only which might be barriers to it in different contexts, but also which spatial

[162] The motives of the photographs are intentional, however their later examination can reveal unexpected aspects, which were not perceived during the observation of the place. They were used as instruments of analysis of the problems, and also employed to illustrate, and furnish 'visual evidence' of the observed aspects and diagnosis to others.

qualities makes accessibility possible.[163] As an illustration of this principle also some drawings were made at this early stage representing the actual situation and the existent accessibility problems, and the possible design solutions that could improve the place situation.

Four categories of problem were defined: the conditions of pedestrians' movement, the impact on accessibility of dynamic human activities, the location of urban equipment and utilities, and the existence and quality of urban information. These were illustrated by the joint use of descriptive texts and photographs. They are reproduced in the following paragraphs as examples of an analysis that support understanding of design interventions.

The conditions of pedestrians' *movement* along the existent main routes were identified by the intensity of pedestrian's traffic and by the location and/or concentration of centres of interest. This observation was done during different times and days of the week during the period of recording of the cards. Along the routes were also observed the relation between the intensity of traffic with the physical conditions as support to movement – distances and directions, declivity, surfaces quality, changes in level (ramps and steps), existent obstacles, and safety of crossing.

In the street 'Felipe Schmidt' the numbers of pedestrians reflected the concentration of commercial activities The importance of the street could also be observed in the better quality of its pavement, and in the excess of urban furniture. For visually impaired persons the absence of level in the street, and the abstract design pattern did not furnish a 'physical limit' to follow. The intensive traffic of pedestrians, and the excessive number and random disposition of the urban furniture increased the difficulties to orient. It was possible to compare this street to a forest of physical obstacles.

The two other main streets, 'Conselheiro Mafra' and 'Francisco Tolentino' are the shortest way between the two local bus-terminals, and host several popular commercial shops. In spite of the intensity of the pedestrian's traffic the pavement presented very bad conditions of conservation (irregular surfaces and unlevelled). The number of urban equipment as public telephones, postal boxes, etc. was insufficient, and the very narrow pathways were overcharged

[163] Previous to the existence of 'barriers' the very lack of desired activities is a restriction to accessibility, as much as the lack of information regarding its existence.

with light and sign poles.[164] To these factors are added the occupation of the streets by informal commerce and other dynamic activities in conflict with the pedestrians flux. In spite of the presence of these permanent and dynamic obstacles the street 'Conselheiro Mafra' is a preferential route employed by visually impaired persons, since they learnt to orient in it in their mobility courses.[165]

Fig. 24 – Different problems are found along the streets 'Felipe Schmidt' (picture 1), 'Conselheiro Mafra' (picture 2) and 'Francisco Tolentino' (picture 3 and 4)

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[164] The bad quality of execution of the pavement, and the general lack of maintenance of the public equipment in the more popular streets reflects the Brazilian institutional attitude of treating the poor as 'less citizens' than others.

[165] Since this street connects the two local bus terminals, and the headquarters of the ACIC (Association for Integration of the Blind) was located there until 1998, it was the first route taught in the orientation courses.

Special attention was given to the observation of the spatial elements that control movement – traffic signs, traffic lights, safe cross zebras, ramps, sign entries of parking and garages – observing its localisation, safety and legibility. We observed that there were no sound signals in the pedestrians' traffic lights,[166] and that the traffic signs often could not be read hidden by advertisement signs. Almost all crossings presented safety problems with conflicts between vehicles and pedestrians due to the absence of traffic lights. The irregular parking of vehicles over zebra crossings disturbed the orientation of visually impaired persons who could not follow intended directions.

The impact on accessibility of dynamic human activities was also examined. We distinguished two main groups of dynamic activities. The first ones are the public works of repairing and maintaining of the urban network or infrastructure services. The second ones are constituted by informal commercial and service activities. The urban repairing works usually lacked safety and their protective 'walls' were often absent or inadequate. A correlated problem was that the final quality of repair works often did not maintain the material of the original pavement. The informal activities assumed different forms: commercial activities (selling food or the more diverse goods); service activities (fixing knives, cleaning shoes, etc.); performances (music, shows); and distribution and collection of goods and rubbish. Commercial informal activities, and performances, were very popular, and were located in the locals of greater pedestrian movement. Both groups of dynamic activities changed constantly their physical forms, location and had no fixed times. Their extreme 'mobility' represented a great difficulty for the safety of visually impaired persons since they cannot possibly memorise their positions in space. At the same time they were sources of information about the place's identity and character.

[166] The only traffic light that had sound signals (street crossing between the 'Felipe Schmidt' street and the 'Praça XV') was broken. A blind man told us that the taxi drivers 'destroyed' it, because its 'noise' was too disturbing.

Fig. 25 – Examples of dynamic activities and obstacles

The location of urban equipment and utilities deserved special attention. Aimed to improve the quality of public areas they were sometimes transformed into permanent barriers due to their random localisation, or their excessive number. The concentration of electricity poles, traffic, light and sign posts, public telephones, 'flower vases', banks and tables, rubbish bins, poles for advertisement, etc. not only disturbed the pedestrian traffic, but also contributed to urban visual pollution. A lack of rhythm was also observed. Excess of equipment was found in the more 'exclusive' blocks near the main square (especially on the 'Felipe Schmidt' street), while their lack was observed in the 'popular' streets, or blocks with less pedestrian's traffic. The irregularity in the distribution of the equipment made it difficult to evaluate their utilisation. Very often the real function of the equipment was subverted. A clear example was the existence of advertisement at the top of rubbish dump

and signs posts. The original function was ignored and their number and localisation was dictated by advertisement reasons.

Fig. 26 – Lack of rhythm, bad positioning and lack of uniformity are some of the problems presented by the urban utilities.

The existence and quality of urban information was the last category considered in the analysis. Urban information did not constituted an integrated system for the city as a whole. Access to information regarding the public transport system was particularly bad. It was very difficult, in the local bus terminals, to find signs giving information about timetable and directions. For visually impaired users there was no accessible information in sound devices, Braille texts, or tactile maps. General and local information concerning public services (especially public institutions and health facilities) was almost absent in a city that receives people from the whole state. Tourist and cultural events also had a very incipient integrated information system in the so-called 'south capital of tourism'. On the other hand, the lack of information was more than compensated for by visual pollution caused by advertisement, outdoors and signs covering walls and even historical facades.

Fig. 27 – Examples of visual pollution and difficulty of access to urban information

CHAPTER 5 – LEARNING FROM THE EXPERIENCE OF VISUALLY IMPAIRED PERSONS

DEFINING INVESTIGATION INSTRUMENTS

Design studies, which aim to improve visually impaired persons' spatial perception of public urban spaces, have to focus on the ways different spatial organisations can offer accessible information. In the first place then, it is necessary to understand the places' physical and human identity through a detailed spatial analysis. Such a study can identify basic urban functions, channels of movement, existent activities and centres of interest, spatial references and barriers. The spatial analysis can provide very important knowledge about how the urban environment informs about its own spatial organisation and functioning. However, it does not provide much knowledge about how this information can be obtained when vision is absent or restricted. In this case, the question of from which spatial elements as information sources is especially a pressing issue. Even if theoretical knowledge can provide information about the processes of spatial perception of visually impaired persons, the relations between individuals and places will be established in distinct ways, according both to spatial configuration, and local social cultural factors. How can we take design decisions then – creating new valid referential, or eliminating barriers to the perception of existent ones – if we do not know which spatial elements do really act as references for visually impaired persons in the place of study?

In the preceding chapter, we saw how complex it was to achieve some sort of classification of spatial elements as positive sources of information in such a spatial analysis. Furthermore it was stated the necessity of extending this knowledge to examine in which ways different spatial elements inform about the place's identity, structure and content, thereby supporting not only oriented movement but spatial understanding. Consequently, there is a need of including in the spatial analysis different sources of spatial information and meaning other than solely visual ones. At this point emerges the need to search for complementary investigation tools to support future design actions, since the traditional methods of study and observation of urban spaces are essentially based on vision.[167] These tools should help to detect in the studied environment, valid spatial references for persons who perceive and form their spatial representations using other senses than vision. Moreover, such tools should make it possible to distinguish the different roles of spatial elements for

[167] Perhaps the 'most visual' of spatial analysis methods is found in the field of architecture. However wider in their analysis many studies of spatial perception in psychology also base their observation on the visual perception of space.

orientation, making a distinction between local and structural spatial references, as well as identifying barriers to perception.

A significant part of the required information could be obtained only from visually impaired persons. However, in the interviews done while making the centre spatial analysis, with different groups and individuals presenting visual impairments,[168] it was easier to get information concerning barriers and problems in the use of urban space than novel information concerning positive elements used for orientation in the urban environment. It is important to remember that what might be considered a movement barrier for a normal seeing person does not necessarily have the same value for a blind person. Conversely, what might seem like a positive spatial reference – such as visual landmarks – could pass unperceived by the blind.

The tools of investigation should support the understanding of a differentiated orientation process in the specific spatial organisation of Florianópolis' city centre. This organisation presents both positive and negative features for orientation. It has strong spatial references together with several different barriers to perception, in a mixture of order and disorder that is 'felt' like a rather chaotic urban environment. Therefore, it is very important to obtain novel information from visually impaired persons who use the city centre regularly. This knowledge, in conjunction with the spatial analysis already done, could allow a better understanding of how they cope with the public urban environment.[169] And it could provide information about how they identify and evaluate spatial elements and spaces according to their abilities and needs.

Two new instruments were developed: 'Accompanied Walks' and 'Word's Game'. The interviews and conversations already done with visually impaired individuals and members of organisations, before the design of these

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[168] The held 'interviews' are the following: meetings with ACIC (association for the integration of the blind) members and the architecture students of the Department of Architecture and Urbanism at UFSC University, a radio program with the ACIC President, a recorded interview with ACIC's president, a group conversation with young visual impaired individuals at ACIC, and several conversation with J. a young blind man who helped all along the development of the study. Moreover in several occasions during presentations of the accessibility project at the IPUF (Urban Planning Institute) visually impaired persons were present and manifested their opinions and problems.

[169] The identification of potential sources of information in the spatial analysis already done was supported by specialised literature studies about orientation of visually impaired persons. However important, this information had to be verified (confirmed or denied) by the place users as well as to point out new spatial references.

instruments, helped not only in understanding the problem, but also in finding persons interested in participating in other kinds of 'interviews'. Some of them were more engaged and also discussed how to conduct and define procedures for the application of the instruments. Both instruments shared an 'indirect' form of obtaining information, and it is important to explain why information is searched in that way. Usually, straight answers to direct questions about individual processes of orientation are very difficult to obtain. Questions like – Which are your strategies of orientation in novel places? or – Which urban elements do you utilise as spatial references? tend to be difficult to answer in a satisfactory way. Another relevant factor affecting the investigation instrument's character is that direct and 'difficult' questions could induce the individuals to reproduce 'mobility strategies' learnt in special orientation courses. This difficulty is not exclusive to visually impaired individuals. It is extremely complex for any person to verbalise usually silent reflections, where instant perceptions interplay with memories, thoughts, and intentional actions.[170] A similar situation is found in collective design processes where there is a need of communicating about the practical knowledge of users that usually is not externalised.[171]

Trying to solve this problem, the first designed instrument, 'Accompanied walks', was based on the observation of individual actions in attaining desired activities, i.e., orienting successfully along a route. Along the route important direct questions are substituted by the observation, and verbalisation of spatial strategies connected to the present actions of a blind person while orienting in the urban environment. The second instrument was based on the discussion and evaluation of words by different groups of visually impaired persons based on

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[170] Silent reflections involved in spatial representations and orienting can be compared to the concepts of 'private language' and 'private thinking'. According to Vigostky, 'private language' is defined as an intermediate level in word's formulation happening before social communication. 'Private thinking' according to Vermersch does not aim communication to others; on the opposite it is a private and individual knowledge act that is used during and for the accomplishment of cognitive actions. Spatial representations can be compared to these concepts since they are private mental knowledge employed by the individual to perform desired activities in space. They are not explicit, do not aim social communication, are not totally conscious, and for this reason not spontaneously verbalised. See, Vygotsky, Lev (1986/1934), *Tought and language*, The M.I.T. Press, Cambridge, translation revised and edited by Alex Kozulin, and Vermersch, Pierre (1991) Pensée privée et répresentation dans l'action, *CNRS SDI 6322, Document EPHE* Laboratoire d'érgonomie cognitive, GREX Groupe de recherche sur l'explicitation.

[171] See the Technical Licentiate Dissertation of Rehal, Saddek(1997), *Att artikulera och kommunicera insikt – Bild och ord som verktyg i tidiga skeden av designprocesser*, Arbetslivets bebyggelse, Institutionen för Byggnadskonst, Chalmers University of Technology.

the recall of their experiences in urban spaces, sharing procedures of the 'Focus Group interviews' method.[172] In this way, descriptions and contextual questions, arisen from concrete situations during the 'Accompanied walks', and playful discussions during the 'Word's game' sessions were expected to stimulate individuals to reflect about their own strategies since they would not feel 'tested' in unusual situations, or 'verified' in their practical knowledge.

IMPORTANCE OF WORDS

Before describing the employed instruments in detail I would like to comment about the importance that language has in the spatial cognition process. To know a place, also means to be able to recognise it, and to recall its identity through its particularities. To have words for, and to name sensations, emotions, actions, places, objects, and ideas is part of the development of the learning process. Without names for known places, and the possession of words for their description, it is without doubt possible to remember them, but it is more difficult to communicate with others about them. Now, visually impaired persons, and particularly totally blind individuals, employ, very often, time sequential recall techniques to orient. To do that, sequences of names of streets, crossings, places and landmarks are important to remember local references, and also to communicate with others while orienting. Therefore, oral communication is a fundamental source of spatial information. The knowledge of the relevant vocabulary is important both for 'asking' information as well as for the understanding of the received information's meaning. On the other hand, it is important to remember that persons who are congenitally blind can only receive information about distant objects and places from secondary sources (as oral descriptions, tactile drawings, sculptures, and diagrams).[173] Consequently, words and names of these 'inaccessible' sources could present different meanings or values depending on their familiarity, or lack of contact, with them. The verification of the meaning and valuation of the words employed to describe spaces and orientation strategies, especially during the 'Word's game', could reveal the condition of spatial elements as positive or negative for orientation. Similarly, the lack of knowledge of a certain word's meaning would indicate the actual inaccessibility of a spatial element as a referential.

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[172] A general description of focus-group interviews method is presented on a footnote in Chapter 2, page 49. For more details, see, Basch, Charles E. (1987), and Folch-Lyon, Evelyn & Trost, John (1981).

[173] Such modality of spatial comprehension is defined Gunnar Karlsson as 'comprehension in terms of knowledge'. See Karlsson, Gunnar (1996), pp. 323-325.

‘ACCOMPANIED WALKS’ DESCRIPTION

The first procedure of the ‘Accompanied walks’ is the definition of familiar routes by the ‘subject’ of investigation. The routes selection is made considering their relevance regarding usual problems encountered in the use of public urban spaces. As any usual ‘route’, these have a starting point and objectives to reach. The ‘interviewer’ should follow, but not conduct or help, the subject along the chosen routes. The latter is asked to describe in detail how he knows where he/she is, and which information are relevant for the understanding of the places. He/she also has to explain the reasons for changes of movement direction and is stimulated to express his opinions about problems and nice things encountered along the route. The interviewer can ask for more details or explanations, but should not conduct, or induce the descriptions. The whole ‘dialogue’ is tape-recorded, and significant events along the route are photographed. Lastly the tapes are transcribed, subjects are selected by themes, and photographs are organised to illustrate relevant aspects. In this way, a temporal/spatial register of the route is obtained, illustrated by sequential photographs and elucidated by verbalised explanations about how the important spatial information is obtained.

Three routes were followed with J., a young man of 24 years old who had vision problems since childhood, and lost totally his vision when he was 16 due to glaucoma. He had a personal interest to show the kind of problems that visually impaired persons meet in the streets of Florianópolis, and participated since the beginning of the study in interviews, and in discussions about how to find new ways of getting first-hand information. J. has a very good memory of places, knows streets and buildings’ names, and possesses good orientation ability having developed personal orientation techniques of his own. For instance he does not use the cane to produce reflected sounds because ‘it calls more attention’ to his condition of being blind. It was important to make the walks with a person with good orientation skills since the main objective to accomplish was to observe how orientation is possible in a demanding environment. Since the most difficult information to obtain is about positive spatial elements it would not be very beneficial to follow the routes with a poor orientating individual who could not contribute much to this aim.

The first route started in the inter-state buss terminal, crossed the pedestrians’ footbridge, passed through the beginning of the old buss terminal, followed the ‘Conselheiro Mafra’ street, and finished in the new buss terminal. This route was chosen because it is a common route for visually impaired individuals, connecting all city buss terminals. It was also chosen because the interviewed

person wanted to show me the special difficulties and dangers of using the state buss terminal, and the footbridge. The 'Conselheiro Mafra' street is one of the main routes utilised by visually impaired individuals and therefore could fully illustrate their usual accessibility problems. Bad pavements, lack of safe crossing places, narrow pathways full of permanent and dynamic obstacles, are some of its 'bad' qualities. At the same time, it offers well-defined pathway borders, a regular urban tissue, strong functional and historical landmarks, a very intensive commercial activity, and is full of 'sound' information. Both of the local buss terminals are critical places viewing their lack of accessibility. No proper information about timetable and directions, no safe crossing points, and no pavement distinction of buss stops are provided in any of them.

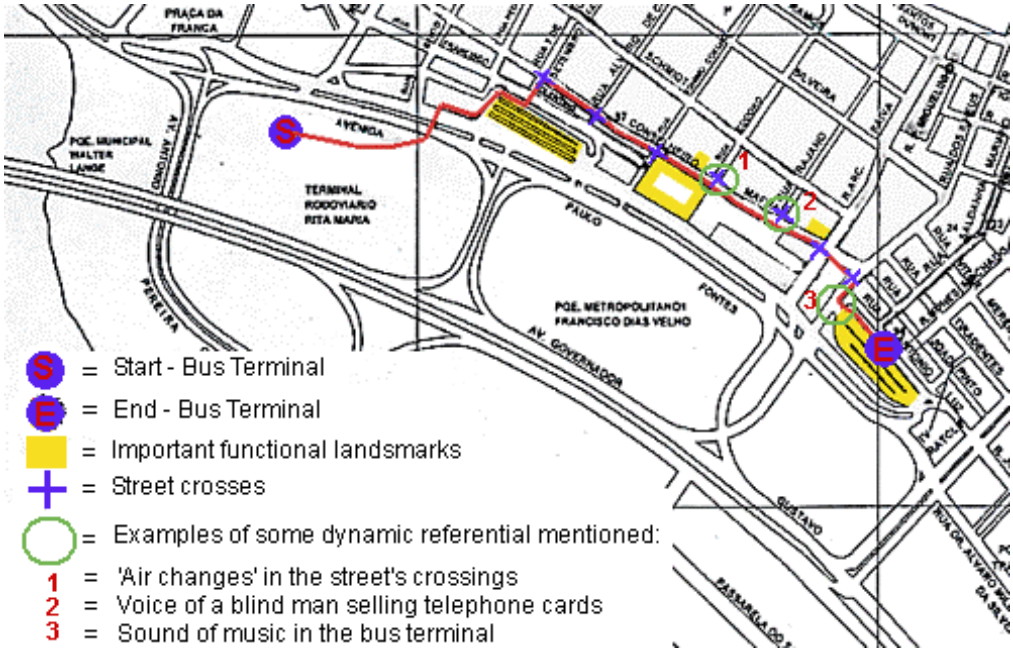

Fig. 28 – Map of the first route.

Fig. 29 – Strong historical landmarks and several dynamic and permanent obstacles along the first route

The second route is also a common route employed by visually impaired individuals. It started in the new local buss terminal and proceeded along one of the transversal streets, which connects the centre to the next neighbourhood areas. We passed in front of several centres of interest like the Central Post Office Agency, and many banks situated on the right side of the 'Praça XV' square. We also passed in front of historical landmarks, like the Theatre 'Álvaro de Carvalho', and continued up to the Central Telephone Agency. Since along the transversal streets pedestrian's traffic is not so intensive, it was possible to observe in detail crossing problems, and orientation techniques in

relation to the built environment and topography. It was also possible to observe different kinds of barriers met in crossings with vehicular traffic, and along the pathways.

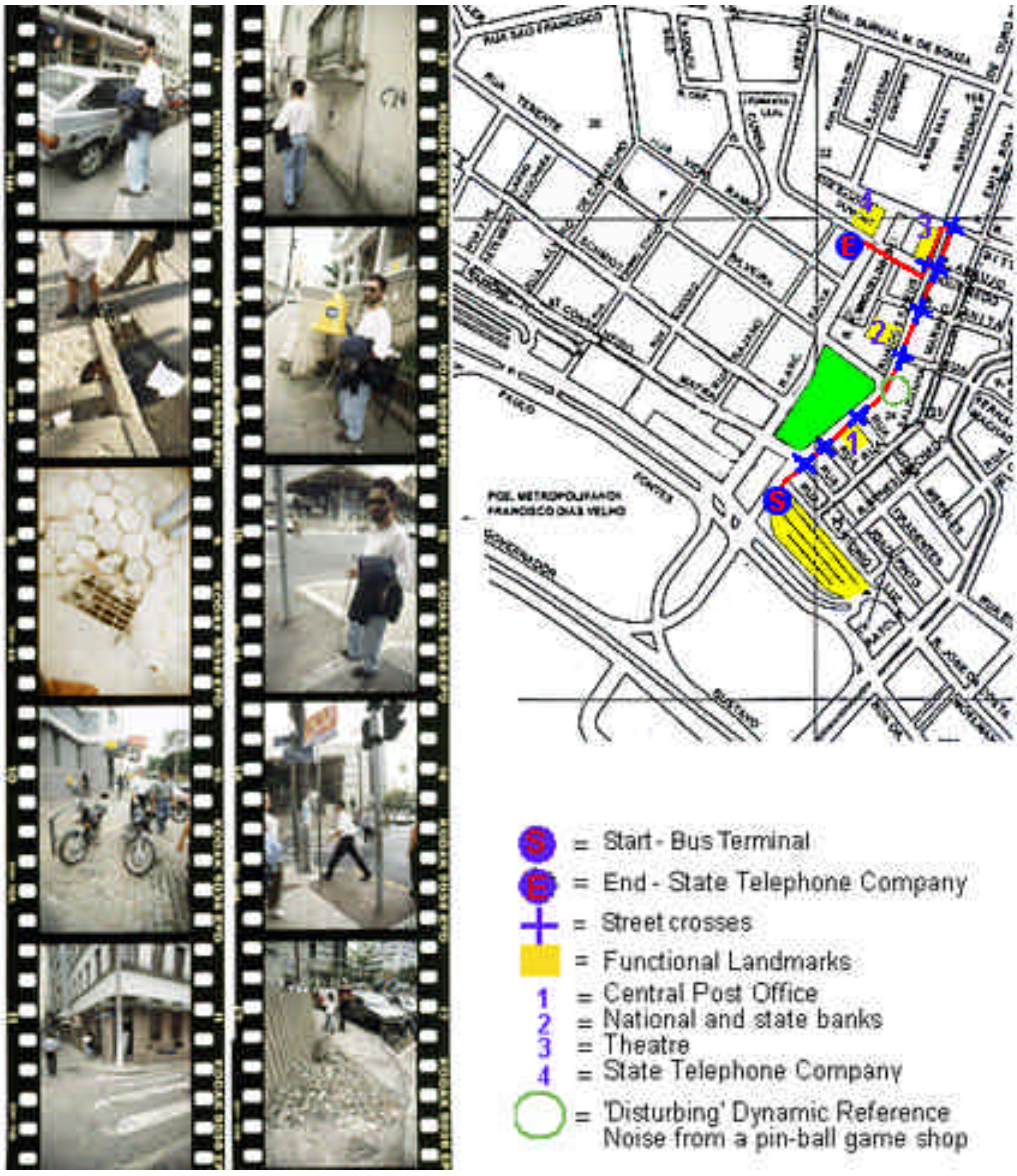

Fig. 30 – Map of the second route and photographs showing the sequence of different kind of obstacles that disturbed the following of intended directions

The third route is a personal regular trajectory of J.'s, which he uses both for shopping and social encounters. It started from one of the several informal meeting points for visually impaired persons in the city centre. This one is situated at the beginning of the main pedestrian's street, 'Felipe Schmidt', where two young blind men sell telephonic cards. We followed along this street until reaching the 'Americanas', a big Department Store that is very often mentioned by visually impaired persons as a point of reference. After a coffee brake in a gallery, we went along another transversal street to reach the 'Tenente Silveira' street, familiar to the interviewed, and finished the route in front of a building where he has personal interests.

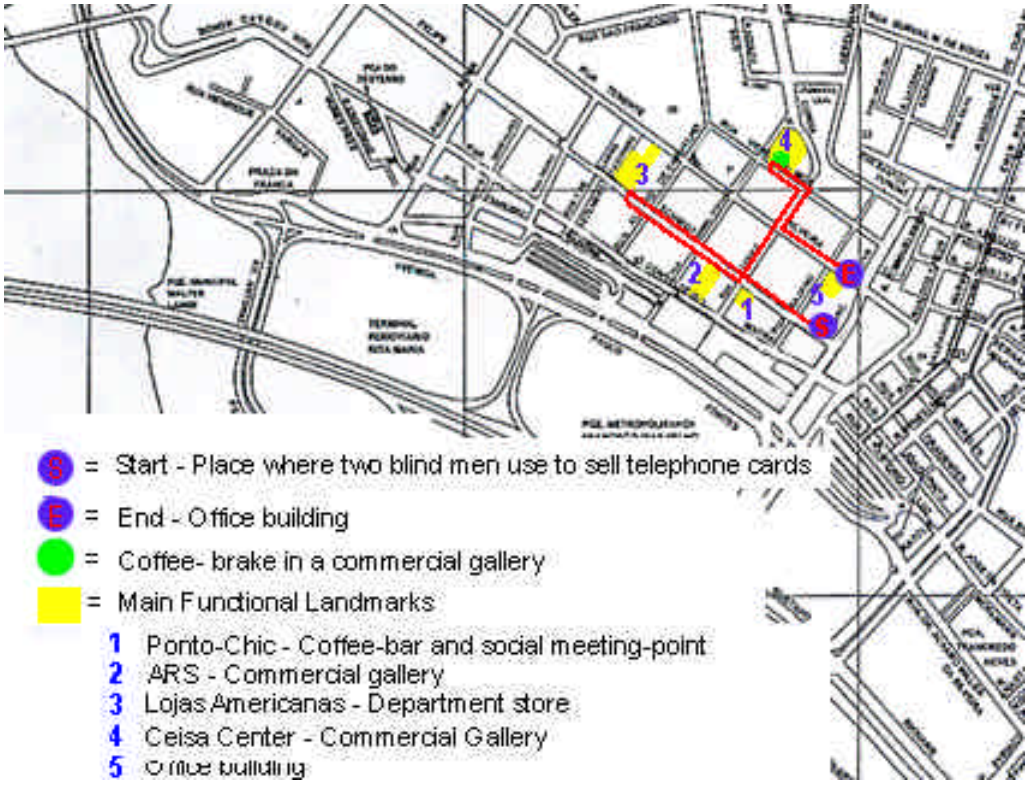

Fig. 31 – Map of the third route

Fig. 32 – Streets as places where new obstacles and familiar references can be found, and social encounters and desired activities can be reached.

In brief three different kind of routes were done:

1. One route which connects the three public transport system terminals, passing by the street that is more intensely used by visually impaired persons – Start from the inter-state bus, passing through the old bus terminal, following the 'Conselheiro Mafra' street, and ending at the new local bus terminal;

2. One route related to the access of urban services and work activities - from the local buss terminal, passing in front of several urban centres of interest like the central post office, banks, theatre, and central telephonic service;
3. One personal route related to shopping activities and social encounter – starting at an informal meeting point and finishing at a work related building.

'WORD'S GAME' DESCRIPTION

The 'Word's game' was designed to identify, in a playful way, positive, negative or neutral values attributed to urban spatial elements in normal orientation tasks. In the first instance, a very extensive list of words is elaborated, including a wide range of physical structures, actions, events, sounds, materials, etc. The list does not follow any particular order regarding similarities between elements (like traffic lights, zebra crossing line, etc.) or their potential value as referential points or barriers.[174] Participants in the game (no more than six persons) are introduced to the interviewer and the rules of the game are explained. Each participant has to identify himself/herself and to tell about his/hers sight conditions. After the presentations, each person receives two (2) objects to hold: in my case a shell and a Lego roof.[175] The participants are informed that the shell is from Africa, and that it can be kept as a small gift. The list is read without being necessary to follow the order of the words. After each word is read, participants must show one of the objects in their hands to the interviewer according to the following rules:

- Shell – if the word means something 'positive', that they employ or like, or is considered good/ useful for orientation;

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[174] The word's definition had the contribution of professionals from the ' Fundação Catarinense de Educação Especial' (State Foundation of Special Education) who work with visually impaired children and teenagers. I read to them a first list that I have done and they suggested changes adding new words. The list included both already 'known' (from interviews, conversations, work experience, and partial results of the 'accompanied walks') 'positive' and 'negative' elements, and other words that we had no idea about their use or evaluation. The list is very vast and it searched to include the biggest variety of possible things to be met in the streets and open public spaces of the city.

[175] The choice of the two objects was done thinking about the possibilities of distinction between them. In this case a natural object with cylindrical form and smooth texture, and an industrialized object with triangular form and uneven texture. This does not mean in any case that Lego is regarded as something negative.

- Lego – if the word means something 'negative', that they dislike, or is disturbing/ dangerous for orientation;
- Nothing – if they do not know what the word means, or if it is 'neutral' for orientation.

The interviewer registers in the words' list the participant's options. Immediately after, each person has to justify his/her option. It is also possible to change opinion, and to comment on the opinions of others. It is not important to show, or not to show the objects. In some groups with blind persons this does not make much 'sense' since they cannot see the 'answers'. But it introduces 'speed' and spontaneity in the answers and a playful character to the game (in fact only one person did not show the object during the different game sessions). To avoid a domination of the game by one of the participants, opinions have to be expressed in an order that can be changed when needed. Discussions are not interrupted, as they can help to clear doubts about complex situations. If the interviewer does not understand some information he can pose questions as well. The proceedings at the game are tape-recorded. The tapes are listened to, thoroughly transcript, and significant parts selected. These are classified in different subjects, which can be related to the role played by the elements in the orientation process, or the way in which information was obtained. Relations between the different visual conditions and orientation abilities of each participant are taken into consideration in the analysis. It is not the objective of the investigation though to interpret perception problems of each participant as an individual.

Four sessions of the 'word's game' were done with different groups. For the definition of groups, similar criteria as employed in 'focus group interviews' were adopted, and each group was made up of persons of similar age and sight conditions. The first group constituted of three totally blind adults with good orientation skills for the urban environment that worked at the governmental Foundation of Special Education. The second group constituted of five middle-aged persons, totally blind, and with average skills of orientation. Four teenagers who were blind from birth and did not have much experience in the urban environment took part in the third group. And finally, a group of five partially sighted adults made up the fourth group. With the exception of the first game, developed at the Foundation of Special Education, the other three games were held at the new headquarters of the ACIC (non-governmental association of visually impaired persons of the state of Santa Catarina) since all

the participants of the groups were ACIC students in professional and mobility courses.

The first 'Word's game' had an experimental character to it since the list was so extensive that I had no idea about how much time it would take. During this game, I skipped some words. When interesting issues were raised in the conversation about words they usually led to 'another' word in the 'family'. In this way some words did not need to be read. In the same way, words that did not raise comments made me jump to others, dealing with different subjects. As the discussions provoked by the words were rather interesting, the game was 'slow' and took around three hours. To avoid time restrictions and raise the interest of participants some words that had very similar function were cut, as well others that just needed confirmation of already known value (especially words which represented very well known barriers were omitted).

All the games were very interesting, and brought new information. The members of the first group (blind adults) knew each other very well because they worked together. They were all the time playing with the words of the others. They could describe with precision and detail how they could orient, and the problems they met, since they all had good orientation and a lot of spatial experience in the city. Even if the members of the second group (elderly blind men) did not posses the same amount of spatial experience and orientation skills they provided information that could be compared with the first game session. The game with the fourth group (visually impaired low-vision adults) was also very interesting. They presented their social situation very well and the problems caused by the 'ignorance' of their condition by others. For instance, when they apply for a job they are considered as 'inept', but nobody wants to give them special place in a bank's queue, or to help them to fill forms. In these last situations people tend to consider them as 'apt' persons who 'fake' difficulties in order to take advantage. This interview was also interesting because I could compare the obtained information to the several interviews held with visually impaired old persons in Sweden. It was especially interesting to talk with the teenagers group who had a more personal and differentiated opinion of spatial elements. An example of this is found in the evaluation of the word 'tree'. Usually, in the other groups trees are always mentioned as obstacles in the streets 'that clung to their heads since they have branches larger than the trunk'. Teenagers on the other hand, said that trees were nice to sit under, that they create shade and have nice sounds. Only one boy who is more independent in his orientation than the others (he takes the

bus and goes to ACIC, school and home independently) mentioned trees as potential barriers in the streets.

OBTAINED RESULTS REGARDING THE USE OF SPATIAL ELEMENTS FOR ORIENTATION

For the understanding of the results obtained during the 'Accompanied Walks' and 'Word's Game' it is necessary to make an initial classification of how spatial information is obtained by visually impaired persons when orienting in urban open spaces. Three basic situations can be found:[176]

1. Information can be identified independently;[177]
2. Information obtained through intermediaries (other persons, guide dogs);
3. Information imposed on the person, i.e., through interference and/or restraining the access to desired information, and/or disturbing movement and orientation.

It was observed, during the application of both the investigation tools, that the mode in which information is obtained affects the valuation of the spatial elements in question. In general, the spatial elements evaluated most positively are those, which contain information that can be obtained independently. These elements (like street crosses, and functional landmarks effectively used by the visually impaired), very often support spatial understanding and the decision making process in orientation. Almost at the same level, are those spatial elements, which contain information that can be obtained through the mediation of guide dogs and other people. However, when mediation depends on other people, new factors have to be considered. Situations in which help from others is 'natural' (a person telling the blind that the traffic light is green for pedestrians, or answering questions about names of buildings, streets, bus stops, etc.) are not considered negative. A situation where help is denied, or undesired, emphasising dependence or discrimination, the mediation – and by association the very spatial element involved– is considered as highly negative.

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[176] It is interesting to compare the classification regarding the modes of obtaining spatial information made at the time with the distinction made by Gunnar Karlsson (1996) regarding the three modes of spatial comprehension of congenitally blind individuals since they are complementary. See page 94 in Chapter 3.

[177] Independently in this case for a blind person means that the information can be perceived without any device (in the case of sound information) or only using a long cane.

This ‘mixing’ might seem a little confusing, but can be explained through a simple example. Talking about restaurants, for instance, all participants in a ‘Word’s Game’ group agreed that they were nice places to meet friends, but that usually in restaurants they depended on others to choose meals, find places to sit, had to wait and this drew attention to their condition. In short, they felt ‘socially handicapped’. However, by comparison, snack bars with a front counter, where the same sort of food is served to all clients, were considered positive places. There is no need to read a menu, they know where to sit, and can ask for their meal without calling attention to themselves.

These observations led to the reflection of what spatial elements are positive for orientation. In the word’s game the words used in the list referred to concrete ‘elements’, like parking place, advertisement signs, stones, grass, etc. The evaluation has to be done constantly bearing in mind whether each of these element were used for their orientation and understanding of space or not, and if they contributed, how? However, it is not natural to ‘separate’ the physical attributes of an element from its meaning and use. For instance, nobody says that ‘grass’ is useful because ‘I can feel the difference of texture with my feet.’ When people during the games talked about grass, they usually relate about their experiences with grass, and one of them said that ‘she doesn’t like the grass because it is hard to know where you are if there are no paths’. Another member in the same group said ‘he likes the grass because it is soft and you can lie down, and that when he was a child (and still could see) he liked to play on the grass’.[178] Since the specific attributes that make it possible to recognise and use an ‘element’ for orientation are not always expressed, it is necessary to draw this information by inference from the discussions in a group and between groups. The reasons for ‘liking’ or ‘disliking’ something appear during different explanations. Therefore, when people are asked about ‘restaurants’, for instance, nobody mentions voluntarily the smell of restaurants as positive information. But the restaurants and snack bars themselves, through their use, are valued as spatial referential places. And they mentioned the use of smell as a reference in other discussions. That’s why it important to select in the interviews similar subjects to make possible their comparison.

The evaluations are not exclusive, and the same element can belong to different categories regarding both the mode in which information is obtained, and the use that is made of this information. Typical examples of this are lampposts placed in the middle of narrow pathways. They are always evaluated as barriers,

[178] Information synthesised from the first ‘words game’ session.

but at the same time they can be minor 'positive' referential points. As one blind man said during one of the interviews: 'after the long wall there is a lamppost on the left. Then I know that I have come to the ACIC house.' With regarding to this variation in the value of an object, it is important to consider that the identification of spatial elements depends not only on the specific visual problems of the individuals, but also on their individual experience and spatial knowledge.

EVALUATION OF SPECIFIC SPATIAL ELEMENTS

Both instruments confirmed the importance of permanent, continuous, linear elements (walls and pathway borders) as conductors of movement.[179] In the studied city centre's situation the majority of blind impaired people prefers, to follow the line along walls of the building in the first place, and secondly, to follow the borders of pathways. Those two vertical limits were considered easier to recognise than differences in texture of the road surface (since there is a great irregularity of the textures and width of street pavement). Nevertheless, it is the joint recollection of directions and distances, marked by 'points' (streets, crosses and landmarks) along 'lines' of movement, which support structural knowledge of routes and mental spatial representations, as well as the evaluation of relative positions in space while moving. The names of streets (lines), the names of street's crossings (crossing lines and points), and the 'shared' landmarks (points) stand out. The last ones are historical or commercial buildings, recognised by their physical and/or functional characteristics. Even when functional landmarks cannot be directly perceived, they maintain their importance as referential points, since everybody knows them and they can be easily identified through intermediaries.

Dynamic spatial references are evaluated through a distinction of two different types. In the first group are natural phenomena, like the wind and the sun, which can help to confirm positions and directions in space. 'Wind' or 'air' 'changes' can also function as alert signal e.g. as to when a street corner is reached. Being in the sun, or shade helps to identify directions. But the wind is also considered a disturbing element. On windy days it is difficult to recognise close and distant sounds (like traffic sounds). Sound references maintain their importance as identifiers of the nature and position of events. In this way, the

[179] The role of these elements was already studied in the specific literature (booklets of orientation and mobility training) and also mentioned by visually impaired persons during the focus-group interviews held in Sweden.

sound of traffic signals corners, and tells about the proximity of cars to the pedestrian, and different human activities can be identified by their particular sound. Smell references (like bakeries, pharmacies, etc.) seem to occupy a minor place, acting only as 'local landmarks' and confirming identity of places and positions. As they are not permanent, they are not intentionally sought after.

All dynamic elements that, in some way, restrain the pursuance of desired routes, and alter direction of movement are valued as extremely negative. In the absence of vision the importance of spatial-temporal memory for accomplishing a planned route is fundamental. Together with instant information provided by the orientation system during movement about direction, relative distance, rhythm and speed it is possible for the individual to maintain a desired route. Any disturbance of the spatial physical disposition of memorised spatial elements along the route, in relation to their position or sequence, and/or alterations of the memorised direction or speed of known movements, disturb convenient orientation. Examples of these are situations where persons who want to help a blind person to cross the street leads them to a different part of the corner (where they cannot find known landmarks), or even cross with them to the wrong side. Even worse are the interference of street vendors who sometimes hold them by the arm (without even talking) and change their direction to prevent them from stepping on their goods. Among the physical elements pointed as negative, dynamic and dangerous ones, like work-place enclosures, holes, kiosks, and trailers, are especially disapproved of because they are not only dangerous, it is also impossible to memorise their location since they are constantly changing their position in the streets.

Also viewed as negative are urban equipment and utilities considered as 'out of place' due to excess, lack of rhythm or ordination. This excess of utilities reduces the areas of 'barrier-free' pedestrian traffic and impedes walking along walls or the pathways' border. Places of great spatial complexity, like bus terminals, are pointed out as negative and also dangerous. In the local bus terminals it is very difficult to identify the bus' stopping point, timetable, directions and routes. Due to lack of accessible information (Braille, tactile maps, etc.) visually impaired persons have to rely on sound information and the help of others. Paradoxically, some department stores were considered as positive since they can have the assistance of shopkeepers.

From the application of both instruments it is possible to conclude that for a full evaluation of visually impaired persons' accessibility in central urban areas both the traditional analysis of spatial attributes and the investigation of

permanent and dynamic references are necessary. Potential sources of spatial information identified during the spatial analysis such as existent activities, routes, safety aspects, landmarks, secondary sources (names of streets, maps, information services), and disposition of urban equipment – could be compared with the evaluation given by visually impaired individuals. As important as to identify potential and employed spatial references, is to investigate how they are perceived, understood and used and the degree of independence the individuals attain in the process. It is also interesting to observe that several of the spatial elements pointed as spatial referential by the visually impaired are also employed in orientation by persons with normal vision. Not all of them, however, are consciously perceived as references, like shade and sun, streets declivity, presence of wind and sounds, etc. by the latter. Nevertheless these usually forgotten qualities, problems and attributes of public open spaces, should be considered not only in the development of special urban design projects, but also in other urban design projects.

SELECTED EXTRACTS OF THE 'ACCOMPANIED WALKS' AND 'WORD'S GAME'

In the following pages selected parts of dialogues from the ' Accompanied walks' and the 'Word's game' are reproduced. They have subtitles referring to the main subject of discussion. Photographs of places and situations, which are mentioned, sometimes illustrate the dialogues and I used 'italic' to indicate my own reflections. This selection does not intend to cover all practical results obtained with both instruments. Its intention is to bring out a more direct and 'alive' understanding of both potentialities, and problems that visually impaired people encounter in their orientation in urban areas. The extracts selected are parts of the interviews conducted with persons who had a good orientation and familiarity with the use of the city centre (first 'Accompanied walk' and first 'Word's game'). At the end of this section the list of words used in the 'Word's game' is reproduced.

On difficulties in orienting at the inter-state bus station

'Word's Game':

J: The interstate bus station is both a good and a bad place at the same time. It gives you opportunities to meet… to go to several places, to travel. Now, the access to the station I think is really bad. All is in the same pattern (the pavement). There are no differences. In some places the space is too open, like the outside part, there are no differentiated pavements, it is complicated to find

the doors entrances. Moreover there are ditches without protection enclosures where I already had an accident. And inside the station…

Z: It is maddening!

M: The main problem is that the spaces are too vast, a lot of people are talking. Sometimes there is echo, plus the noise of the vehicles, floors without distinction. We cannot also find the counters of different agencies, we do not know where to walk, people inform you in a very hurried way. Or they do not inform you at all. Then, you cannot feel safe about the information received…I think that a visually impaired person will always have problems in an interstate bus station, that he needs help from sighted people.

Z: Since we live here (in the city), we could have more knowledge about it. In a bus station where we arrive for the first time we don't know it well, we need help. But we live here and use it always. We should be more used to it. But it is not possible…

M: Because, it is too bad.

J: I think that with some changes, even small ones, it could be much better. For example, if we consider changing floor surfaces? Marking the entrances. Changing the floor near the counters. Even the arrival hall is much bigger than the departure one. If I am not wrong there is a bar on the left, and chairs and those pillars in the middle, and you have public telephones as well. Let's say, if we could have a different floor coming from the arrival gate directly to the door leading to the outside, where the taxis are, it would be marvellous for us.

Z: We can only know where the bar is by the sound of plates and glasses…

Z: We sometimes go alone. But then, we ask a guard…I had already taken a bus by myself. But you always feel a little bit insecure. To be able to manage, a blind person has to possess a lot of experience. What I mean is that it is not everyone who can manage… If we ask, is an interstate bus station easy for a blind person? No, it is not. But some blind persons can handle it…

Fig. 33 – Photographs taken in the interstate bus station during the first 'Accompanied Walk'. On the left photograph can be seen the wide pathway with no marking of the entrances, on the right picture, the ditch without protection.

Wind as a spatial reference and as an obstacle

'Accompanied walk'

J: In the street crossings I have as a reference, the air current. When you are in a closed room it is different from being in an open environment. You can have this feeling, when you pass by a wall or a building. I can sense it. I developed this. I can anticipate before reaching the corner. There is always an 'opening', and the noises also change.

'Word's Game'

Z: The wind can be used as a reference. At the place where I am crossing a street I can feel the air 'more free', an air current that I use as a reference. And the wind is bad, because it disturbs hearing.

M: The sound of wind is one of the most obstructive things for a blind person, because a strong wing carries away all sorts of sounds. For instance, sounds that

are close seem to be distant. If you hear the horn of a car, it increases as it approaches, and diminishes as it goes away. But when it is windy the traffic sounds are tuned out. It is difficult to walk when the wind is strong.

J: I want to explain some more what Z. had said. If in the city centre you go to the 'Felipe Schmidt' street, as all buildings are very high, you can feel when you come to a street crossing because it is freer. It is like to go out from this room to an external environment. The day I had that 'little problem' in the interstate bus station (J. fall into a ditch), was a day with a terrible south wind. There was a machine breaking the pavement there. You get a little dazed and unfocused too. That wind coming to your ear, that shhhh, like M. said. The variation of distance of sounds is too big. Wind from one side, and noise from the other. You get disturbed and can loose orientation.

The sun as a spatial reference

'Word's game'

Z: Sun with ozone or without?

J: On the beach or in the centre?

J: I think the sun is a positive thing. It helps orientation as well as the shade. When it is sunny, and there comes a shade in a definite place, you know you are passing by something.

It is important to observe that for some low-vision persons the sun can provoke glare effects disturbing their perception. Usually persons with this kind of problem prefer cloudy days.

Fig. 34 – Streets walls with different highs and openings that can be perceived by sound's reflection, wind and the presence of sun/shade.

Streets, public and commercial buildings as spatial references. (How to relate references with directions and distances).

'Accompanied walk'

J: The names of streets are a very important referential for me. I remember, and relate them to places, perhaps the name of a shop, the oldest commercial establishment and things like that. If I want to go to the city council agency, which is on 'Álvaro de Carvalho' street, I know that it is situated besides the BESC (the state bank). I then ask, for the city council besides the BESC. I refer to a building that everyone knows. For instance, the 'Shop 1001' is between the 'Jeronimo Coelho' and 'Álvaro de Carvalho' streets. It is a reference, it is a yellow shop. On 'Felipe Schmidt' street there are several points of reference. You have the Americanas (a department store), the ARS (a commercial gallery), the Ponto Chic (a coffee bar), and you have the DASP (a public health centre) up at the end of the street in front of the old textile factory. Then you also have the streets as references. Look! This here is closer to the 'Padre Roma' street than to another street. I combine several information at one time.

In the text above we can see how streets are used to structure understanding of bigger areas, and how functional landmarks (and visual 'shared' ones as well) can indicate the position of the person while moving along a street.

J: I went to work for a person who lives in the 'Saco dos Limões' (a neighbourhood close to the centre) and I got instructions about the route on the telephone. First, which bus I should take, and from which bus terminal. Then, at which bus stop I should get off. She gave a point of reference, which is the 'Getulio Vargas' School, that is the most well known school in this neighbourhood. Then I asked in which direction I should continue. She told me to walk in the same direction as the bus, but that I should cross the street towards the school. After that, I should continue walking in the same direction and then turn to the right on the second road crossing. I asked very detailed questions. As if there is a shop or a known building nearby. Another friend of mine only told me that her house is after the pavement at the end of the pathway. So when I step on the earth I knew I had arrived at her house.

'Word's game' – talking about the street 'Francisco Tolentino'

M: In the first place the 'Francisco Tolentino' street is made up of several sections. There is the part close to the Public Market that is very confusing. Sometimes cars stopped on the pathways, which are packed with people; a lot of pedestrians and people selling things as well. Past that part, comes the part between 'Álvaro de Carvalho' and 'Sete de Setembro' streets. Midway though gets a little better. But when you cross to the other side of 'Sete de Setembro' it is bad. It is bad because you have the mess of the Bus Terminal, cars going up and down and it is very difficult. Now, from that place onwards all pathways are very bad, lamppostss are placed near the walls. There, the pathways are very narrow, and one has to walk in the street because there is no space in the pathway.

In this second text permanent and dynamic elements are highlighted both as references and obstacles for orientation.

Fig. 35 – Streets and functional landmarks, such as the cathedral and the national bank, can become structural references; and a shop can become a local reference point giving information on exactly where one is situated in a particular street.

Dynamic and permanent spatial elements

'Word's game'– talking about the word bus

I: How do you know when you have to stop? Do you ask someone to tell you?

Z: If we don't know where it is, we ask the driver to alert us. Now, if we know, if it is a familiar route, we use our own acquired references. Among these are, jolts on the road, turnings, road crossings, slopes going up or going down hill, the pavement, asphalt, and holes. Things like: the three bridges too. It is so easy to find. One is at the 'Salgado' avenue and then comes the three bridges.

As the description above suggests when the route is unfamiliar the person depends on information from others, in this case oral information from the driver. On the other hand, on a familiar route it is easy to recognise permanent features on the way. One is left to imagine how different stimuli come together to

create a perception of these features. Turnings on the road, for instance, might be perceived by both the change of direction of movement, and variation of speed, and perhaps also by the sound of changing speed.

M: The noise of the loudspeakers in the bus terminal is too high. People running from one side to another in both directions, and the pathways are very narrow. Is it possible for the blind person to 'see' the step? No, it is not. There are people sitting on the benches and people walking in both directions, and the space left is sometimes of 2 and half meters, sometimes 3 meters. And, if there is someone who jumps out of a bus? And there are the queues! Then you have, people sitting on benches, the queues, noise, and people walking. Hence, there is no space left for you. Now, about the problem of getting on a bus at normal bus stops in the city, it is very serious! A blind person asks, "Are you going somewhere?" The other answers, "Why, what do you need to know?" The blind says, "I need to catch the bus for 'Córrego Grande'. Could you let me know when it comes?" The person says, "Yes, I would." And then you wait, and suddenly, the person says, "Listen, I have to go my bus is coming, ask someone else to alert you." Then, the blind person turns to the other side, and says, "Can you tell me when the bus for 'Córrego Grande' is coming?" But there is no one left at the bus stop. After a while, the bus to Córrego Grande passes by, and the blind stays. The blind stays…

Compare the extract above, where dynamic elements were considered mainly as obstacles, with the following description given by J. during the first 'Accompanied Walk' in the same bus terminal. In his description, dynamic elements are used both as valuable references, and sometimes considered as obstacles.

'Accompanied walk '

J: A different pavement tells me that I am on the right crossing point. The rubbish bin is also a reference. There is not so much traffic today. Here, there is a very bad smell. Now, you can use the smell too (laughing) as a reference. Look, what a wonderful hole! Now, I am coming nearer. Here I know by heart the distance between the corner and the terminal. And when I hear the guy selling telephone cards, this is my cue to cross the street. He is also blind, and I know him.

I: How do you cross here?

J: My platform is the first one, so I don't need to cross. I don't ask for help but people help sometimes. I hear the sounds. It is difficult to know where the bus

stops though. Do you want to see what I use, more or less, as references? I try to walk close to the edge of the pavement, but sometimes people push me to the middle. I count the sound of the loudspeakers (that are hanging from the 'ceiling' of the bus terminal). When I come from this other street I can come straight to the bus stop. You can hear more or less by the sound that there is a way out there. But here it is more difficult because close to the benches there are too many people.

I: I cannot understand how do you find your bus stop.

J: It is by the sound of the music (of the loudspeakers). Sometimes I pass a little bit further. And at the weekends there is no sound and I have to ask someone. When there are too many people I loose orientation. But, if there was a marking on the floor I could know where my bus stop is. It is the third one. And when in the way back, I find the holes in the pavement again, and the shade, I know I am leaving the bus terminal. And I also have my human referential, the telephone cards' vendor.

Word's List

- pop-corn car
- parking
- inter-state bus terminal
- nurse measuring blood pressure
- container
- hospital
- Americanas
- footbridge
- restaurant
- door mat
- automatic door
- bus
- music shop
- border of pathway
- dog
- pathway
- stones
- doors
- birds
- Public Market
- irregular pavement
- advertisement signs
- bridge
- street names
- INSS
- white cane
- concrete barriers
- dollar sellers
- bicycle
- traffic sign
- Besc, BB
- walls
- windows
- flowers
- Post Office
- statue
- Praça XV
- flower beds
- fountain
- cathedral
- street corner
- Rio Branco street
- public telephone
- water
- bus terminal
- step rain
- paper collectors
- unevenness
- walk-man
- water puddle
- lights
- street railings
- street gutters
- light poles
- perfume
- Felipe Schmidt
- ramp
- trees
- siren
- conversations
- bags
- street bank
- rubbish bin
- shade
- bad smell
- iron fence
- fig tree

- music
- political meeting
- Senadinho
- Fish shop
- Rolling staircase
- Hole
- Building number
- Post box
- street vendors
- friends
- traffic light
- table games
- cars
- telephonic cards sellers
- shop stands
- sun
- marquises
- slope
- zebra crossings
- sea
- grass
- wind
- tribunal
- round-about
- beer library
- Hospital de Caridade
- supermarket
- colours
- aeroplane
- Theatre
- magazine stand
- students
- fast food shop
- pedestrians
- old people
- SESC
- guard
- double way
- free food market
- City Council
- Cruz e Souza palace
- Vitória Pharmacy
- Escola Técnica
- shoe polisher
- beggars
- helicopter
- Baia Sul
- Hercílio Luz bridge
- sugar cane juice
- hot dog
- avenue
- temple
- university preparatory courses
- police station
- bus stop
- horse
- administrative zone
- Mauro Ramos
- rumble stripe
- galleries
- shopping centre
- beach
- advertisement man
- sound (shops)
- Express Avenue
- chairs and tables
- music band
- crossing
- bookshop

PART III
CHAPTER 6
SITUATED KNOWLEDGE IN DESIGN CASES

CHAPTER 6 – SITUATED KNOWLEDGE IN DESIGN CASES

In the preceding chapters the different kinds of knowledge needed to construct specific knowledge to solve different design situations were presented. Each one of the design cases had distinct participants involved in different ways, differing work and time conditions, specific objectives and different potentialities and restrictions. The extent and type of knowledge available in each design case was unique and the results obtained in the design practice depended on the use and combination of this knowledge. The practical character of the design cases presented might also in a more down to earth way illustrate the application of the abstract concepts necessary for the understanding of accessibility problems considering their use by visually impaired people in urban environments. Beyond the intention to present model solutions for situations, that by definition are complex and unique, they might depict different processes in the analysis and search for design solutions. Likewise, their description might help to lighten how the development of 'design cases' worked as central investigation method. And as such, how they convey the need to search for new theoretical technical information and appropriated tools to attain first hand data. Finally, I suggest that the description of each one of the studies might illustrate the ways in which they foster a reflective process as regards the construction of particular and general problem-knowledge.

Three different design cases focusing on the accessibility of the historical centre of the city of Florianópolis were developed. Between March to June 1997, accessibility was proposed as the main subject for the fifth year students of the Architecture Department at the Federal University of Santa Catarina – UFSC in the course of Urbanism.[180] Running parallel to the students' project, from January 1997 to April 1998 a co-operation project between the Federal University of Santa Catarina and the Institute of Urban Planning of Florianópolis, IPUF was developed. This second design case was undertaken together with some members of technical team of the planning institute, and one student of architecture as assistant. Its central objectives were to undertake a detailed spatial analysis of the historical quarters of the city, identifying accessibility problems, and to elaborate design recommendations. Finally, between April and June 1998, a third design case was carried out. Another co-operation project was initiated, this time in the form of a technical supervision, aimed at supporting the development of executive design project to improve

[180] The course was under the responsibility of Vera Bins Ely, Associated Professor at the Department of Architecture and Urbanism, UFSC, and myself.

accessibility in a pilot area in the city. It was also expected to propose a revision of the actual municipal accessibility law for public urban areas in Florianópolis.

Each design case had a particular development objective and character. While the projects made by the architecture students were more 'free' and exploratory, the design case developed in co-operation with the city council was essentially analytical and normative, concluding with a series of recommendations. The last design case was essentially practical and was aimed at applying in a concrete situation, the parameters elaborated in the second study. The diverse nature of each design case offered different opportunities of approaching a complex design situation and carefully examining its problem from different points of view. It is a recount of these different ways of searching solutions for a problem that is presented here.

6.1 FIRST DESIGN CASE - LEARNING SITUATION: ACCESSIBILITY PROJECTS MADE BY ARCHITECTURE STUDENTS

> 'Design accessibility for disabled citizens was proposed as the main subject for urban design studies for the fifth year students of architecture with three main purposes. The first of them is the emergency and importance of the theme, and its absence as an obligatory subject in Brazilian architecture schools. The second is the shared belief that the study of complex situations, such as accessibility in public urban environments, can augment the student's analytical capacity and artistic creativity. Moreover, it can lead to a greater ethical concern regarding technical knowledge application through design. The third refers to the university's social role of producing technical knowledge and contributing to the search for real practical solutions through its discussion within the community. Two main groups of disabled citizens were focused on this study: those with locomotion, and visual disabilities. However having apparently different problems and opposing needs, to find accessibility solutions for those two groups means to improve mobility, safety and integration in urban public areas, not just for other groups of disabled persons, but to extend it to all citizens.'[181]

Teams of five students developed the design projects, in two different phases. The first phase of analysis aimed at students understood the problem through theoretical classes, a detailed data collection, and observation of the reality. The second phase of the project involved both the development of parameters for intervention, and the proposition of design solutions. An introduction to investigation methods was taught but the teams were free to define their own methods and techniques to study the problem. To support the understanding of the problem two interviews with different organisations of disabled persons were organised. Representatives of non-governmental associations of motor and visually impaired persons (AFLODEF and ACIC) came to the university at different occasions to talk with the students. The meetings were very fruitful, and the barriers the groups encountered to access the classroom illustrated their accessibility problems. The associations were also invited to participate in the final project presentations.

The introduction of the Universal Design theme to the architecture students was also inserted within a broader panorama of my own research development.

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[181] Dischinger, Marta and Bins Ely, Vera (1997).

The course worked as an arena for discussion of problems, design hypothesis and technical solutions between the researcher (as a teacher), the students, and the technicians from the planning institute and the different groups of users. I also aimed to verify the fitness of previous design hypotheses designed for a park situation in Sweden in a very different urban situation,[182] and to observe their transformations. These basic hypotheses were: that the design of integrated centres of information with central and local information centres connected to main urban activities, and the presence of clear routes' hierarchy recognisable while moving, could improve the orientation of visually impaired persons. In accordance with these hypotheses for the place analysis the following points were suggested:

- To identify centres of interest and places of permanence as positive referential places and important 'points' for local orientation;
- To identify existent routes' hierarchy in the central area;
- To identify potential locations for urban centres of information;
- To identify barriers to information, safety and comfort along routes;
- To relate observed problems with existent legislation and their application.

From the analysis of the place the students formulated the following central design parameters of intervention: to define preferential 'routes' barrier-free along the main streets; to define a rhythm for urban utilities location along the streets; to offer proper spatial information; and to redesign areas of permanence to allow for the participation of disabled users.

[182] Dischinger, Marta (1995), pp. 59-65.

Fig. 36 - Photo of a page of the students' accessibility analysis [183]

Fig. 37 – Photo of a page of students' accessibility analysis [184]

The students design projects tried to reconcile apparently opposing needs and problems. These were in regards to the improvement of accessibility conditions for the visually and movement impaired, and the needs of all city residents. They had to satisfy the need for obstacle-free routes with the existence of streets spontaneously appropriation for social or informal commercial activities. The solution proposed was to regularise the existent lack of rhythm and random positioning of urban utilities, and to provide useful urban information. Many of the solutions proposed came in the form of rules, or design parameters for future projects. The students suggested the need for reinforcing the existing norms for advertisement in public spaces, to reduce visual pollution. They also proposed the definition of special parking areas for the locomotion impaired, and the need for a selective collection of rubbish.

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[183] Students: Eliana M. de A. Nascimento, Kristina Cancelier, Leilane Paegle, Humberto Carvalho, Carlos Henrique da Silva.

[184] Students: Eduardo Giovanni, Evandro de Andrade, João Batista Rocha, Luis A. Mendonça, Ricardo Pauletti.

In the definition of *'barrier-free routes'*, the projects concentrated on the design of the street's pavement by using the contrast between the physical properties of different materials (colour, texture, sound). In this way visually impaired persons could easily perceive the 'lines' of free movement and the presence of barriers. This solution was particularly used to improve safety in the crossings with pedestrians and vehicles taking into account the different traffic situations (cars in one sense and pedestrians; pedestrians in both senses; cars in two senses, etc.).

To improve mobility conditions of visually impaired users in the pedestrian streets different solutions were developed. For instance, an area of 1-meter width with a differentiated pavement was designed close to the building's facades, to mark a less intensive pedestrians traffic area. This area should facilitate both the shop's entrance, and offer an outer line free of 'obstacles' for the blind. Next to this line, an 'exclusive' area for pedestrian traffic was defined (having around 1,20 m width). Between those two areas, a rail in the floor was proposed to serve as cane guide for the visually impaired.

To define and solve the problems of lack of rhythm and inadequate location of urban equipment in the streets with pedestrian traffic only, the students sought to 'organise' the barriers, designing 'islands' with different urban equipment. These islands were placed centrally in the street between the two barrier-free lines. The islands location follows a predetermined rhythm established by the number and kind of equipment they contain. Among these items we can mention rubbish bins, benches, public telephones, a fountain, investigations and post boxes. The use of vegetation on the islands to be used as smell references for the visually impaired, and to provide shade were also designed. The conflict between informal commercial activities and barrier-free flux could similarly be resolved through the creation of special islands with commercial activities. The 'islands' served, as a place to concentrate informal activities of the streets and urban utilities, and to reconcile the needs of barrier-free routes with the street appropriation needs. This solution exemplifies how design can turn 'restraints' into 'solutions'. In this case, both the concentration of the equipment, and the functions included in the 'islands' not only eliminated barriers but also helped to improve contradictory needs of appropriation by different users. It also illustrates the problematical definition of spatial elements in absolute categories as 'positive' or 'negative' for accessibility and orientation, since their evaluation is always dependent from the spatial context and their use.

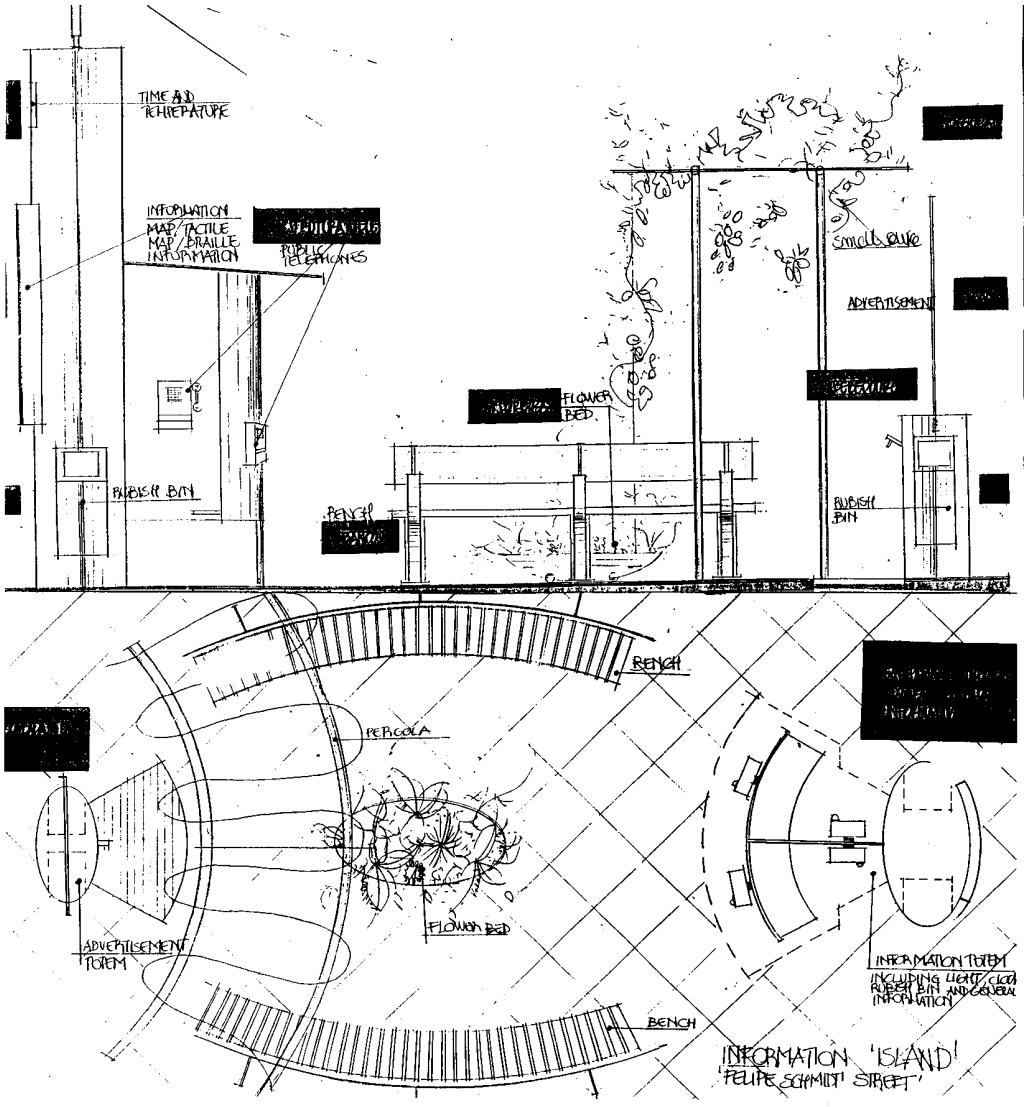

Fig. 38 – Student's project, 'Information island' for the 'Felipe Schmidt' street [185]

[185] Students' team: Alexandre de Souza Freire, Edmara Espíndola Soccal, Angela Cristina Teske, Míriam Carla Santine

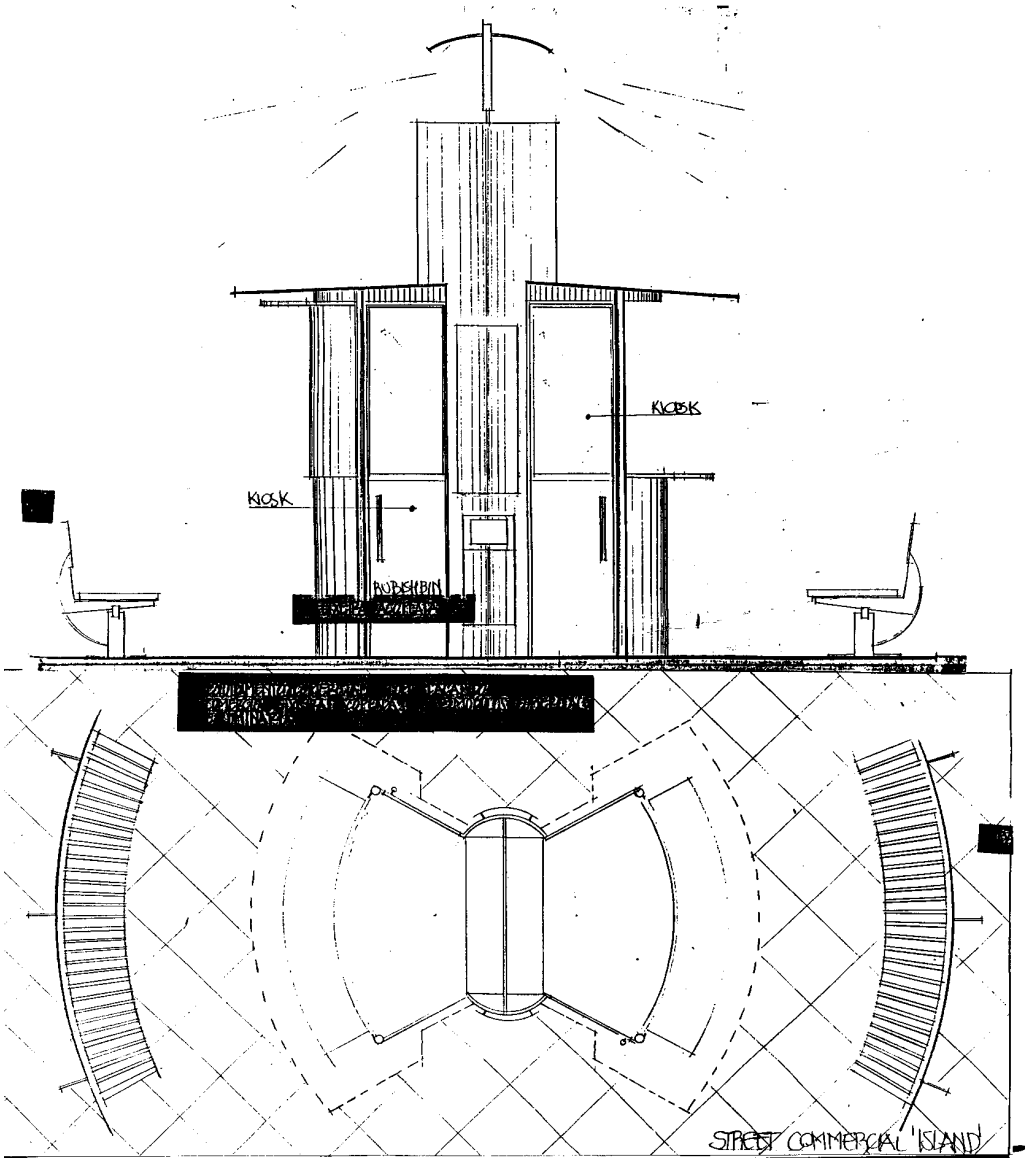

Fig. 39 – Students project – 'Commercial island' for the 'Felipe Schmidt' street [186]

[186] Students' team: Alexandre de Souza Freire, Edmara Espíndola Soccal, Angela Cristina Teske, Míriam Carla Santine

As regards the offer of appropriated urban information two main solutions were proposed. To concentrate special information in 'information centres' especially designed for that purpose. These centres were located near the local bus terminals and tourist areas and contained tactile maps, city models, and computers with digital screens. Another solution proposed was to spread urban information on the proposed 'islands'.

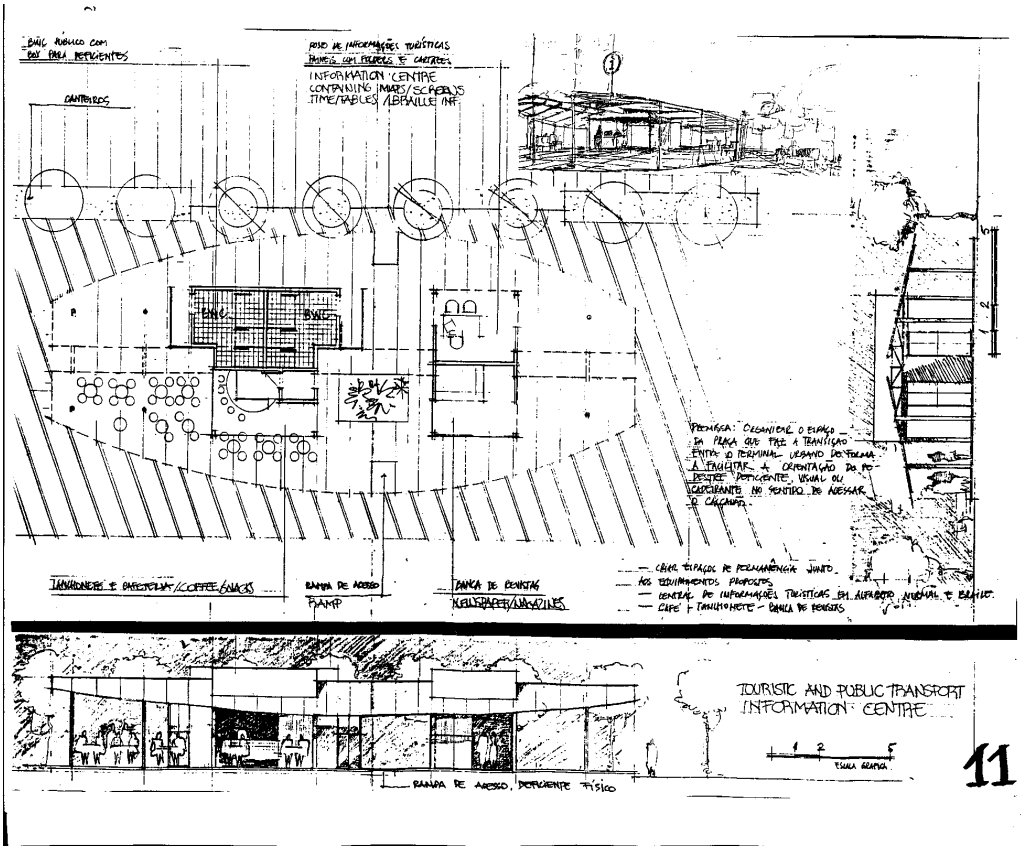

Fig. 40 – Students project – Information Centre [187]

[187] Students' team: Alexandre de Souza Freire, Edmara Espíndola Soccal, Angela Cristina Teske, Míriam Carla Santine

EVALUATION OF THE STUDENTS' PROJECT

The students' projects were very effective as learning instruments and as vehicles of discussion of the problems they aimed to solve. The projects' presentation in larger forums including students, teachers, public institutions, and different disabled organisations, encouraged a wider discussion of the problem. Moreover it helped to step up the pressure on the necessity for public institutions to make a commitment toward dealing with the problem. The discussions aimed chiefly to support the development of the problem diagnosis and design solutions. Theoretical and methodological classes initially supported them. These introduced new knowledge about accessibility and Universal Design concepts, and different procedures of how to analyse the urban place. The discussion of ethical aspects regarding the professional practice also occupied an important place in the dialogue between teachers and students.

Practical limitations of time imposed that the teachers supplied all possible information and hypotheses of work that could stimulate a fast answer in terms of concrete design solutions. For the development of most of the student's projects the course methodology was effective, and the projects were adapted to the situation. The fact that the complexity of the place exceeded the design hypotheses proposed initially to the students affected the extent and level of their design solutions. These were more effective in a small scale, or centred on unique problems (rearranging public equipment along one particular street, or solving different types of crossing) than at a larger scale of the whole centre The idea was that each student's group could develop on a satisfactory level punctual solutions that could be put together in the final discussion and evaluation of the projects. However, in the final evaluation of the projects it became evident the importance of a holistic approach to the design of accessibility solutions, and their specialisation stressed the need of integrated and contextual solution of the problem. The evaluation of the restrictions that this kind of partial local solution represented for accessibility affected the way of conducting the next design case, and the revision of the design hypotheses already defined. It also influenced the design parameters formulated in the second design case including the need of working both locally and with the whole urban structure.

As the student's projects were conceived of as 'ideal' design solutions they attained a proposition level much faster than the co-operation project that started at the same time. As in other ideal design situations the absence of constraints, which are usually present in real design situations, allowed the creation of innovative solutions by the students. Conversely, these creative

solutions could help to indicate new ways of solving the problem in future real design situations, both for the technicians from the urban planning institute, as for myself. It is very important to stress though that the validity of these innovative solutions was based on theoretical and practical knowledge about the problem.

To finalise we can say that the theme propitiated for the students, a different 'vision' of disabled persons as users of space and as citizens. The opportunity of meeting and discussing accessibility questions with impaired persons, and the organs responsible to legislate and to execute public projects, contributed for the student's greater engagement. The discussions between the groups of disabled persons, the architects of the planning institute and the students were also very interesting in advancing possible solutions and introducing the problem from different perspectives. The study of a real situation trying to solve an usually disregarded design problem showed instead that the lack of accessibility conditions affects a large number of users of public spaces in Brazilian cities.

6.2 SECOND DESIGN CASE- PRACTICAL DESIGN DIAGNOSIS

In December 1996 I submitted a proposal to the director of the Institute of Urban Planning of Florianópolis, IPUF, suggesting a study about accessibility in the centre of the city. A co-operation project, between the Department of Architecture and Urbanism of the Federal University of Santa Catarina, UFSC, and the Planning Institute, started in January 1997, and concluded in June 1998. It was co-ordinated by myself and by the Architect Enio Germano Martins, Manager of the Planning Section at the IPUF at the time. It also counted on the participation of an architecture student, Nadia Khaled Zurba, who was contracted by the planning institute. To fully understand the possibilities and limitations of this study in the planning institute it is necessary to make a short digression. It is important to understand the feasibility of the different stages in a project development, i.e., execution, maintenance and control of public spaces in the city of Florianópolis. This would enable us to understand the extent of the problem in the city, and its connection with the existent lack of communication between different governmental organs and institutions.

The planning institute is an organ of the City Council responsible for the development of urban plans and projects, not only for the city but also for the whole island. However, other public organs are responsible for the execution and control of plans and projects, and they do not always agree. An additional hurdle, besides the lack of integration between planning, execution and control are the differing degrees of political power and influence between organs and institutions in which the planning institute certainly not is the stronger partner. In the last ten years several controversial urban plans and projects involving opposing interests[188] have been discussed between governmental institutions, private capital and the local population. In this conflict-prone arena the university has a tradition of participation and sometimes of confrontation with the public institutions. This position of the university is in line with its dominant role as producer of knowledge, and its relative independence towards the powerful economic interests and political pressure groups.

[188] Most of the existent conflicts between local population organisations and public planning institutions are related to opposed interests of ecological preservation of beach areas versus intensive tourism exploitation.

With respect to the city centre's accessibility, the opposition of interests between public institutions and private capital, and population is not so extreme. Criticism about accessibility is often directed towards the absence of a more aggressive policy of improvement of the central urban areas. Dissatisfaction is also indicated as regards to the lack of control or abandonment of public areas of the historical centre. In the general context of opposition between the university and public institutions, it is a little bit like an 'alien' that I initiated the co-operation project with the planning institute. It is important to mention that the technical team involved in the project was very supportive of the study, since it could add important information to support their own revitalisation projects in the city centre. It was very important that the design case was developed 'in' the institute and not 'at' the university. The possibility of direct and personal contact between the planning institute team, the architectural student, and myself helped to clarify mutual visions about our work. It became also possible to observe the difficulties to turn into reality ideal project parameters face to existent political and economic interests. Unfortunately, the last ones very often have the last word on how the final project should be accomplished.

DESIGN PARAMETERS

For the solution of the problems identified in the place analysis and with the visually impaired persons, it is fundamental to consider the positive aspects, which are existent in the area. The historical centre possesses a well-defined urban structure regarding its form and identity, which is stressed by the dominant topography and the existence of strong functional and architectonic landmarks. The centre shows a lot of vitality with intensive commercial and service activities, and traditional areas of leisure and social encounters. All these observed aspects are basic supports to the design of solutions for better orientation, mobility and appropriation for the benefit of visually impaired citizens.

With the intention of orienting the development of future accessibility projects a series of design parameters were developed to solve the problems of movement and visually impaired persons. These parameters are presented in the form of recommendations that are organised into different categories. Even each category of problem has specific spatial contexts it is from their interdependence that the problem solution as a whole depends.

To work in pilot areas - A first basic recommendation refers to the strategy of project development. One way of improving accessibility is to select 'spatial

elements' marked out as 'barriers', or to identify the lack of elements, which provide accessibility (ramps on corners, tactile maps, etc.). From this selection specific thematic projects can be developed and applied in the whole city.[189] Even if these strategies are favourable to the partial improvement of accessibility they do not guarantee it totally, since accessibility depends on several interrelated factors. A second type of action suggested was the prioritising of areas considered as critical regarding accessibility conditions. In these areas, all aspects referring to the improvement of accessibility should be treated, taking into account their connection with the city as whole. One advantage of this strategy is the possibility of 'testing' design solutions in smaller areas, and to call attention of the population to their importance.

The general criterions used for the choice of pilot areas are the functional importance of the area, intensive pedestrian presence, and the existence of accessibility problems. Examples of critical areas in the city of Florianópolis are the following:

- The two local bus terminals – intensive use by pedestrians, lack of safety, lack of accessible information for all users and especially for the disabled ones, the rarity of urban utilities (public toilets, telephones) and lack of adapted ones, occupation of pathways for informal commercial activities;
- The inter-state bus terminal (Terminal Rita Maria) – no connection with the local public transport system, long and difficult routes to the station, absolute lack of accessible information, no special signs for the orientation of the visually impaired;
- The three main pedestrian routes and some of their interconnections – bad conditions of the pavement regarding surfacing and colours, lack of rhythm of urban public utilities, the contradiction between dynamic informal activities and pedestrian traffic, safety problems at crossings, absence of information system for the visually impaired, excess of architectonic barriers, visual and sound pollution.

The next necessary step for the selection of pilot areas is to study how these areas are integrated in the whole urban net. This is fundamental in Brazilian cities where usually due to political reasons urban improvements are usually developed in a partial form and especially poor neighbourhoods are left aside.

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[189] Examples of this practice can be the regularisation of the levels between the pedestrians' pathway and the vehicular tracks, the painting of pavement borders with contrasting colours, or the standardisation of rubbish bins and their better distribution in public areas that were lately put in practice in the city centre by the city council.

In the case of accessibility partial solutions contradicts the very definition of accessibility itself, since the improvement of singular areas, or isolated routes does not allow their connection within the urban system. Not only spatial discontinuity between areas can compromise accessibility, also the lack of information about a new design system can make it inaccessible for their users. This first design parameter showed to be crucial in the development of the next third design case, since the partial application of technical solutions revealed how important it was an integrated design approach to guarantee accessibility.

To create preferential routes – Considering the localisation of important activities preferential routes offering accessible conditions for impaired persons should be created. Their choice should depend not only on their importance in relation to the intensive pedestrian traffic but also on their potential for the improvement of accessibility.[190] The definition of preferential routes involves other aspects such as the study of vehicular traffic in the city centre, the augmenting of exclusively pedestrian traffic areas, and their future connection possibilities in the network.

Preferential routes design should include the consideration of the following points:

- The improvement of the pathways along routes with respect its appropriate pavement design (materials, level, colour contrast);
- The provision of road-crossings with proper traffic signs (with sound or conventional) and the creation of ramps or elevations at the pedestrian's level, and the elimination of physical barriers in corners;
- The creation of a free of barriers 'line' with a minimum width of 1,20 m and a height of 2,00 m. This line has to be marked by a differentiated pavement;
- The creation of parking places for disabled users with proper localisation, dimension, and time for parking;
- The proper regulation of the goods distribution and paper rubbish collection.

To create safe crossings - Proper signalling and technical solutions taking into account the varieties in road-crossings and their spatial contexts should be created to improve safety. For wheel-chaired users both ramps and elevation of

[190] For instance it is useless the construction of ramps for wheel chair users on steeply streets that they do not frequent.

the pathway can be used depending on the local situation. Historical areas deserve special consideration due to the reduced dimensions of the pathways. Safe crossing lines have to be also marked by a different texture of the pavement and colour contrast. Road-crossings with vehicles should have sound traffic signals and in some cases railings.

To improve localisation and design of public urban equipment and furniture - A deeper study in co-operation with the public institutions responsible should be developed to define criteria for the definition of type, number, localisation and rhythm of urban utilities (electricity poles, light, traffic and sign posts, postal boxes, public telephones, rubbish bins, etc.). These criteria should guarantee that the utilities serve their main function without the creation of barriers through their concentration in some areas, and absence in other areas. The creation of a street design with 'lines' or 'islands' of equipment, clearly marked with contrasting pavement (as proposed by the architecture students) is a possible solution for a better pedestrian's traffic and use of the street.

To design special utilities for impaired users - The design of urban utilities should consider their use by disabled persons. These should be placed in order to provide access to public services and allow participation and appropriation of public spaces by all. Examples of this kind of facilities are: special public telephones for wheel-chaired and visually impaired users, special rest places, information in Braille and tactile maps, proper pavement signalling for bus stops for the blind and visually impaired.

To create an urban information system - Urban information should always take priority over advertisements information. As observed in the place analysis, the latter not only visually pollutes the urban areas; it is also an obstacle for the access of urban information. Central and local information, as well as the public transport system has to constitute an integrated system as far as information is concerned. The following aspects should be observed:

- To develop truly informative system for the public transport system for the whole city with clear indication of routes, names of places, centres of interest, timetables, and names of bus stops;
- To create an accessible system of information about public services (health, education, and other institutions), cultural and tourist events. These can be provided by preliminary information services (booklets, maps, and telecommunication devices) or in central information centres (with accessible design and information supports);

- To create an informative orientation system for visually impaired users especially in bus terminals – tactile maps, different pavement, local totems in Braille and tactile maps);
- To regulate advertisement in the urban area reducing visual pollution and improving access to information. Rubbish bins, public telephones, postal boxes, lamppostss, street signs and other urban equipments should not contain advertisements. All advertisements in public areas should be submitted for approval by the planning institute.

To improve safety of the urban repairing work's areas - A strict control of areas under repair has to be done along with proper signalling and protection of dangerous areas with the development of a standard design for work-places enclosures. This design should allow a clear identification of work executors, and the safety of pedestrians.

To regulate dynamic activities - The dynamic informal commercial activities in the streets have to be organised to avoid conflicts with the pedestrian traffic. This can be done through the following:

- Studies for the localisation of street shops, stalls and informal commercial 'points' with a new standard design of temporary equipment;
- To leave free lines for pedestrian circulation in open restaurants and bars on the streets;
- To eliminate the exhibition of goods and wares against the outer walls or on the pathways;
- To organise the systems of goods distribution in the central area (timetable, definition of areas for parking) and of paper rubbish collection (timetable, definition of collecting areas, redesign of the equipment).

PRESENTATIONS OF THE SECOND DESIGN CASE

The accessibility diagnosis was firstly presented in a Seminar in November 1997 at the IPUF. Several public institutions responsible for the execution and control of urban projects and organisations of disabled citizens were invited to

discuss accessibility questions in the light of the analysis' results.[191] The need to proceed with analytical studies and to start developing integrated projects in pilot areas was considered essential for an effective improvement of the accessibility conditions in the centre of Florianópolis. The multidisciplinary character of this kind of project was stressed. And the participation of the different organs and institutions responsible for urban planning, control and administration of public spaces of the city was considered indispensable for its fruition. This need for an integrated approach arises not just from the complexity of the problems but also from the fact that a lot of the accessibility problems have their origins in the lack of co-ordination between the urban administration and maintenance organs. A letter was written and signed by all the organisations that were present and sent to the city major.

A second presentation of the study was done in March 1997 to the Major and her cabinet (made up of all its different secretaries). No 'formal' decisions were taken in this second presentation. However, a 'green light' was obtained to include a technical supervision for accessibility questions in the development of an urban rehabilitation project of two central streets in Florianópolis. In this way one of the main ambitions of the study was attained, since the analysis of the problem and the design parameters proposed, would actually support the development of a project of urban accessibility. Moreover, the application of the proposed design strategies will allow their in-depth study and evaluation.

[191] Invited institutions: AFLODEF – Associacão Florianopolitana de Deficientes Físicos (non-governmental Association of Movement Impaired Persons); ACIC- Associacão Catarinense para Integracão do Cego (non-governmental Association for the Integration of the Blind); Fundacão Catarinense de Educacão Especial - Centro de Recursos de Pesquisa e Tecnologia (State Foundation of Special Education- Research and Technology Centre); ACG - Associacão Catarinense de Amigos do Cão Guia(Association of Guide dogs' friends); Departamento de Arquitetura e Urbanismo, UFSC (Department of Architecture and Urbanism of the Federal University of Santa Catarina); Câmara de Vereadores de Florianópolis(Legislative Council members); SUSP (State Secretary of Urban Services); CELESC (State Light Energy Company);TELESC (State Telephone Company); and CASAN(State Water and Sewage Company). It is important to mention that however invited most of public institutions were not represented at the seminar.

6.3 THIRD DESIGN CASE - TECHNICAL SUPERVISION: STREET'S ACCESSIBILITY PROJECT

A technical supervision to assist in the development of accessibility design solutions for two central streets 'Álvaro de Carvalho' and 'Esteves Júnior' gives continuity to the practical design diagnosis. The supervision consisted in the detailed study and analysis of the new place, the further definition of specific design parameters, and the exploring of 'ideal' technical design solutions to be conducted prior to, or concurrent with the development of the final urban design project. The design project was co-ordinated by the architect Jeanine Tavares, and developed by the architects of the planning institute, Enio Germano Martins and Marco Antônio Ramos.[192] The architecture student, Nadia Khaled Zurba, continued to work directly with me as an assistant.

The technical supervision was included in a wider urban project, which aimed, initially, at the reform of the water supply and sewage system of two streets. To these objectives, were added firstly, the improvement of vehicular traffic and the regularisation of pathways. And, in the second instance, the improvement of accessibility for impaired users. The project was to be executed under the technical responsibility of the Secretary of Urbanism and Public Services-SUSP. The number of institutions involved, and their different responsibilities are emblematic. They reveal the need for co-ordination between the different organs to guarantee the success of multidisciplinary urban projects, and of the problems, which might occur if integration is left out.

From the beginning the technical supervision had very precise design objectives, which were based on the previous parameters already developed. These were formulated as the following:

- To define and design preferential routes for impaired citizens (pathway design, materials) depending on the localisation of main activities;
- To eliminate architectonic barriers, establishing patterned solutions for urban equipment and utilities (localisation, rhythm, design);

[192] The official name of the project was 'Urban Design Project for the Recuperation of Esteves Junior Street', which was linked to the' Program of Urban Image Revitalisation of Florianópolis – Subprogram: revitalisation of the central area'.

- To design solutions for the improvement of signalling and safety of crossings (localisation of safe lines, ramps design, floor signalling, traffic lights);
- To elaborate recommendations regarding systems of orientation and information for public transport and services, improving the visual communication of public facilities and reducing visual pollution factors;

In addition, I was also asked to propose a new urban law for the accessibility of public open spaces based on the evaluation of the District Law NR. 2.153 from 1984, which 'guarantees rights to impaired persons and takes other decisions'.

WORK METHODS

It is important to stress some particularities of the employed methods, and 'tempo' of the technical supervision. We started with a detailed analysis of the two streets in the project, 'Álvaro de Carvalho' and 'Esteves Junior', examining their articulation within the urban area with the aim of identifying needs, potentialities, and problems. This analysis had to be more detailed than the previous space analysis already done in the historical centre, being itemised and precise. It identified and described the directions of routes, quality of surfaces, conditions and intensity of vehicular traffic and the conflicts with pedestrian traffic, important activities, meeting points, visually polluted areas, the impact of other projects, etc. The correct formulation of specific parameters for intervention, as well as the development of technical design solutions, depended on the quality and detail of this local knowledge. We could count on the general accessibility parameters formulated in the previous study, but a higher precision was fundamental to their adjustment within a concrete design situation.

Simultaneously with the data collection and photographic record[193] were developed the initial design solutions to be discussed with the technical team of the IPUF. It is important to remark that we[194] joined the project after some delay, when it had already reached the final design stage. In spite of the 'discontinuity' between different design actions ('understanding' the existing places and 'proposing' new places) the result was very positive. We tried to systematise the analysed situations almost at the same time as we tried to

[193] The detailed data collection and photographic record of the two streets were made, respectively, by Nadia Khaled Zurba, and myself.

[194] The architecture student, Nadia, and myself.

define generic design parameters to be applied to the different situations, and our 'model' technical solutions were effectively tested in very concrete and precise situations. Final design solutions were then developed, case by case, at the 'critical points' detected in the diagnosis, always in co-operation with the architects of the planning institute. In the final report made for the Planning Institute all 'model solutions' are included. Firstly because they illustrate a design process and secondly, because of the fact that some of them were not developed as final design it was not connected to their suitability. Technical restrictions of the project, or 'cultural resistance' anticipated from the future executors were also extrapolated.

DIAGNOSIS, DESIGN'S PARAMETERS, AND MODEL SOLUTIONS

The problems met in these two streets are very similar to those described in the design diagnosis of the historical centre, which was developed during the second design case. Consequently I will try to focus on the particularities of these streets, the description of the accessibility problems 'implicit' in the parameters formulation.

The 'Álvaro de Carvalho' street begins in front of one of the local bus terminals and is part of the historical urban tissue. Together with the 'Esteves Junior' street they form an axis that connects the old centre with the new neighbourhoods of the North Bay. This important link is stressed by the topography – the two streets meeting at their highest point – giving an overview of the south and north bays respectively. They face the 'old' popular historical city, and the 'new' high-class neighbourhoods in the areas reclaimed from the sea in the North Bay. The 'Álvaro de Carvalho' street presents far worse conditions regarding pedestrian's safety and comfort. The most critical point is at the crossing leading to the old bus terminal (it is important to remind that the bus terminal was selected in the first design case as a critical area). In this point, there is no zebra crossing, no traffic light, and several physical obstacles preventing an uninterrupted view of vehicles. We suggested that the project implementation should start exactly at this point, also considering the number of users. This opinion was considered 'idealistic' and 'unrealistic' by the IPUF technicians. They argue that the improvement of this crossing depended on projects of the 'Francisco Tolentino' street. Moreover, the project was supposed to start at the end of the 'Esteves Junior' street (and effectively started there). In spite of the posterior inclusion of this crossing in the final urban design project the fact remains that works started on the opposite side of

the city. This fact verifies the official urban policy, which usually favours those areas inhabited by who hold economic power.

Another particularity of both streets is the concentration of public services along them. Commercial activities at the beginning of 'Álvaro de Carvalho' street, are followed by banks, the public library and a public school. In the 'Esteves Junior' street an important supermarket and the Health National Institute headquarters are located. The latter attracts to the area several clinics, and laboratories. One of the most traditional private schools of the island is situated in the end of the street. At this point vehicular traffic at rush hour is critical, since private vehicles fetch many students from school. The declivity and the irregular limits of the pathways are other important features of these streets. Both aspects prevent or at least inhibit the movement of impaired users (in particular of wheel-chair users). To these main factors can be added the irregular distribution of urban equipment and facilities, dangerous crossings, bad conditions of the pavement surface, irregular parking, visual pollution and lack of urban information.

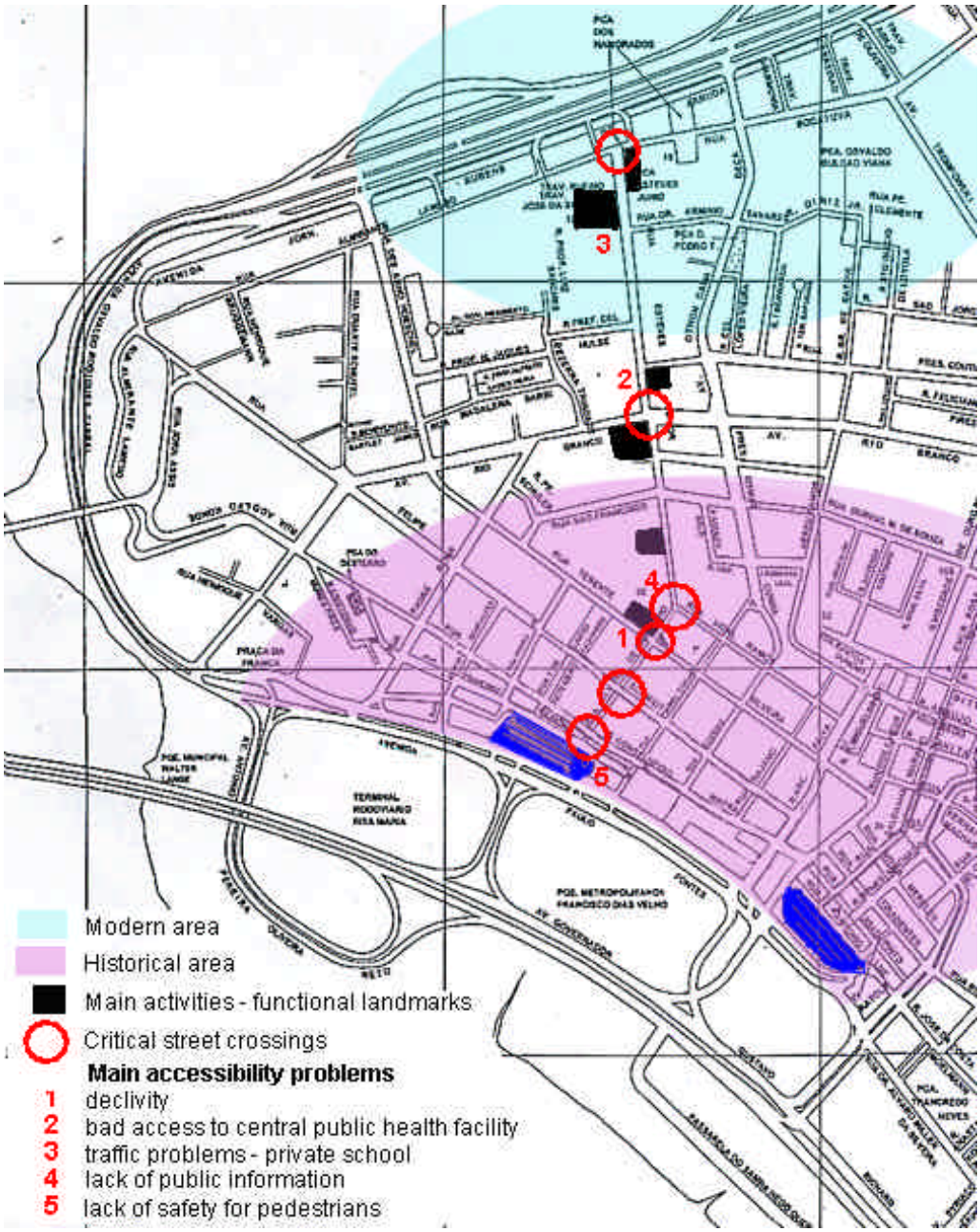

Fig. 41 – Map showing a diagnosis of the accessibility problems in the streets 'Álvaro de Carvalho' and 'Esteves Junior. Source: IPUF

Fig. 42 – Illustration of the different problems: declivity (1), irregular limits of the pathways (2), visual pollution and excess of obstacles (3), lack of information and access to public services (4, 5) and dangerous crossings (6).

Adhering strictly to the initial objectives would not allow for the development of design studies for the improvement of urban information and visual communication. The limited time for the project (April to June) was not enough for the development of such a complex study. And the 'latent' limitations of what would be effectively considered in the final project execution, made us give up some interesting ideas that were not correctly appraised. The specific design parameters and technical pattern solutions, which were developed, are reproduced in the following pages. They include illustrations of the original 'model' designs and the final project designs. Some solutions can also be compared with the photographs of their execution in the 'Esteves Junior' street.

Creating preferential and eventual routes accessible for impaired persons - Due to the excessive declivity, presence of obstacles, and reduced width of the pathways it is impossible to provide safety and comfort for impaired persons on both sides of the streets. Considering these physical restrictions, and the localisation of important activities, preferential routes were properly defined as such at least on one side of the street. Preferential routes should allow the

continuity of movement through a continuous band (1,50 meter width) free of obstacles and having ramps for wheel chair users in the street's corners. Eventual routes are those, which can be used by impaired persons but do not present continuity in their design.[195] For the success of this design solution it is very important that future users have access to previous information (maps, diagrams), and the existence of local information (signs or symbols) about the continuity of the routes.

Creating lines of urban equipment and furniture - A band with a width of 55-cm along the edge of the pathway was designed to contain urban equipment and utilities, 'cleaning' the pathways and optimising their use. The continuous band has a contrasting pavement material (texture, colour, and sound) to facilitate its recognition, especially by visually impaired users. In cases where it is impossible to change the position of urban utilities, or other physical barriers, their surrounding pavement signal has to be made of a similar material. The localisation, number, and type of equipment/utility have to be decided according technical specifications (light, traffic signs), intensity of use (related to existent attraction poles), and existent disposable space along pathways.

Creating small meeting areas – With the aim of improving spatial distribution and qualifying urban spaces, small 'squares' were created. These were equipped with urban utilities (public telephone, post boxes, benches, place for wheel chair users, vegetation, and rubbish bins). The existent activities defined their localisation (schools, public library, health facilities, commerce, bus stops, etc.) together with the already existent wider areas of the pathways. These pocket squares have to be designed aiming to guarantee their identity.

Creating 'alert' 'warning' pavement - A different pavement surfacing is made at the beginning of wheel-chair ramps and at street corners to indicate the zebra crossing position and direction for low vision and blind persons. These persons have great difficulty not only in identifying where the designated crossing paint is, but also to know which is the correct direction for the crossing. Different textures and colours help the identification of the points of crossing, and parallel lines that are perpendicular to it indicate the direction of crossing.

Finding solutions for different types of crossings - Pedestrian safety and comfort requirements at crossings are different depending on their importance, flux,

[195] It was impossible to solve in a first moment the accessibility problems in some parts of the street. For instance, the very narrow pathways situated in front of historical buildings, and in some areas 'invaded' by constructions for private use. In both cases, solutions depended on future negotiation between the governmental institutions and the private owners.

and priority between pedestrians and vehicular traffic. Moreover different dimensions of pathways, declivity, and the presence of physical obstacles have to be considered. These conditions are considered for the design of each kind of crossing, maintaining the continuity of preferential routes, case by case. The narrow dimension of the pathways determinate the length of the wheel chair ramps, which should include the 'alert' pavement (the designed dimensions are smaller than the actual technical norms specification). The reduced pathway dimension also affected the positioning of the ramps in the external edge of the cross lines to allow for a bigger area of movement in the pathway, and the simultaneous crossing of wheel chair users and other pedestrians. In the crossings where exclusive pedestrian traffic was existent was proposed the elevation of the cross line giving continuity to the pathway over the vehicular track.[196]

Reducing visual pollution and improving urban information systems - This was developed only to the recommendation level. However, joint actions like elimination of barriers (walls, poles, signs), relocation of the urban utilities and equipment, uniformity of the pavement design and materials, certainly contributed for the 'cleaning up' of visual pollution. Regarding the need for an urban system of information in the area some critical situations were found. There are no local orientation maps, or totems, to assist users in orientation and to inform them about access to the public transport system. This inadequacy is especially critical in the area of the National Health Institute. This service receives a great number of in-land visitors who need to be redirected to laboratories and other health facilities in the zone, or in the city. Public facilities, like the Public Library, also lacked a more adequate signalling system to inform about their function.

[196] The elevation of the pathway across the road encountered much resistance from the IPUF technical team. It is hard to accept 'priority' of pedestrians when cars are considered as the 'owners' of streets (very often cars are parked over the pathways, or on the zebra crossings). After several discussions, this solution was employed in the crossing of the pedestrian street 'Conselheiro Mafra' with 'Álvaro de Carvalho' street.

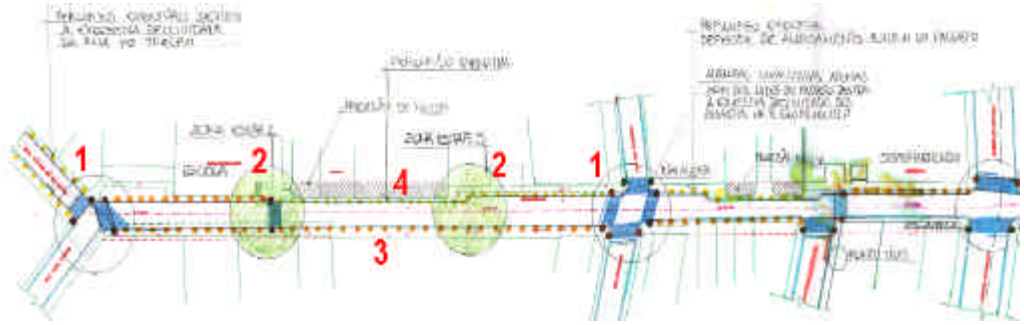

Fig. 43 – Model design solutions for: street-crossings (1), creation of pocket squares (2), preferential routes (3), and eventual routes (4)

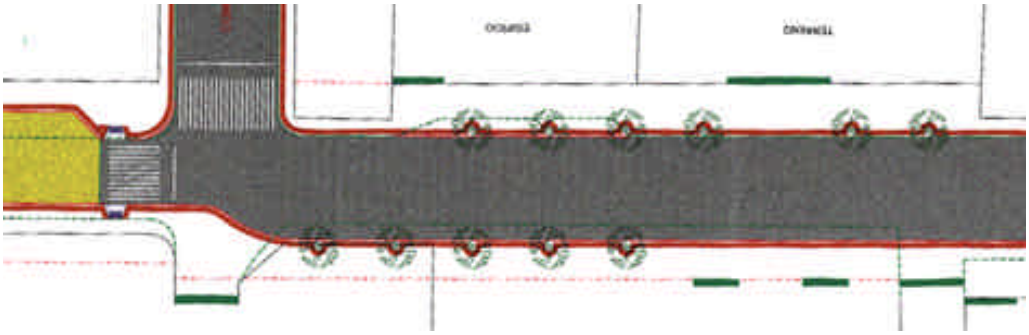

Fig. 44 – Final design project showing details for crossing (1), vegetation (2), and regularization of the pathways limits through the demolition of irregular walls and constructions (3). Source: IPUF.

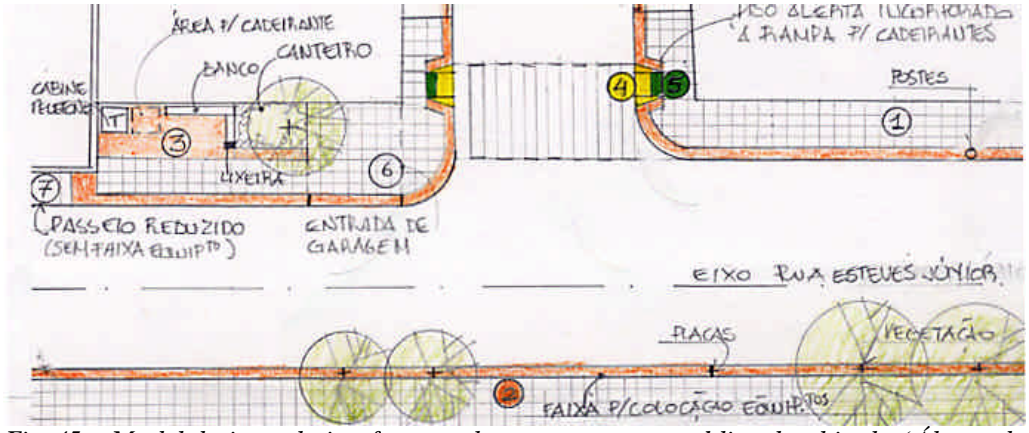

Fig. 45 – Model design solution for a pocket square near a public school in the 'Álvaro de Carvalho' street.

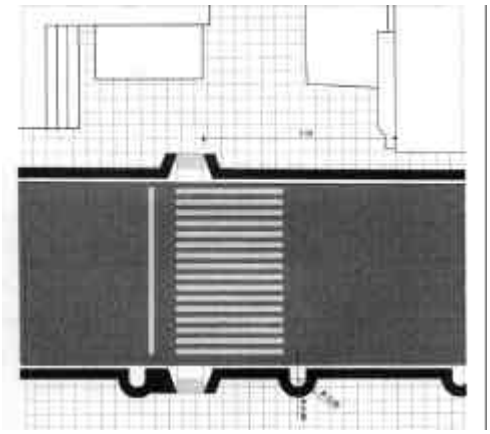

Fig. 46 – Final project of street-crossing ramp, zebra crossing and the pocket square. Source: IPUF

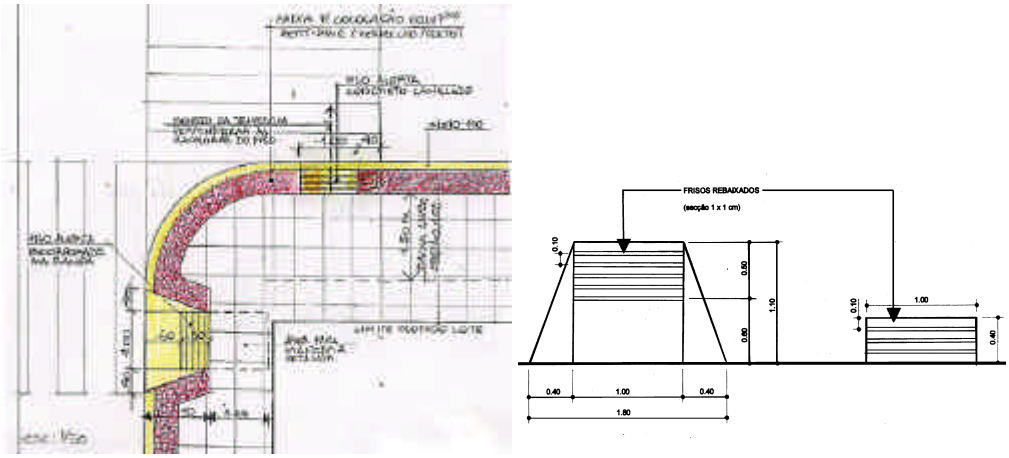

Fig. 47 – Model solution proposed for ramps and 'alert' pavement at street-crossings (1). Final project of ramps and 'alert' pavement (2). Source: IPUF

Fig. 48 – Photographs of the design project implementation showing: the zebra crossing in front of the private school (1), the lack of treatment in front of the public health centre, INSS which is one of the most critical points in the street (2), the regularisation of the pathway limits (3), and the ramps for wheel chair users in the street corner (4).

COMMENTS AND EVALUATION ABOUT THE TECHNICAL DESIGN SUPERVISION

A persistent discussion process with the IPUF technical team occurred during the development of the supervision. Most of the discussions were conducted 'around' drawings. It was important to adjust the accessibility needs underlying the more schematic model solutions (proposed by me), and the inclusion of other aspects in the final design. My role mainly has to do with what theoretical knowledge was needed to explain different kinds of accessibility problems due to specific disabilities, and also the concepts underlying design solutions. The

technicians with their practical experience, and technical knowledge, were concerned about development and execution of inter-institutional urban projects. They were more aware of the design restrictions placed by different factors (political, financial, technical, cultural resistance, lack of communication between institutions and technicians) than I was. These discussions brought the need for explaining some concepts that were clear just for myself and for no one else. Consequently, they conveyed not only efforts for a better communication, but also a better self-understanding of the concepts. Moreover, during the discussions information obtained directly from visually impaired persons that was necessary for the diagnosis and design solutions were presented.

It is interesting to observe that the traffic engineer who was responsible for the project execution never took part in these work meetings. Perhaps his absence, and subsequent lack of understanding of the problem, can explain the changes of some important technical details in the execution of the project (pathway design, trees' plantation, location of ramps, etc.) The most obvious change is done with respect to the specification of the pavement. Smooth, light grey concrete slabs were proposed for the free-barrier track in the pathway (1,50 m. wide). A continuous band of 55 cm. along the edge of the pathway for the localisation of urban equipment and utilities should have a contrasting pavement material (texture, colour, and sound) to facilitate its recognition especially by visually impaired users. What was done instead was: a grey textured track for free barrier movement, and a red track with round small bumps for the bordering line. They do have colour and texture contrast, but part of the urban equipment and utilities (electricity poles and traffic posts) were placed out of the bordering pavement (on the inner border or completely out of the track), thus loosing its main function. It was possible to observe though, that in the places where the project was applied the street does look cleaner and it is easier to walk on.

When observing, and taking photographs of the place after its reconstruction I regretted that the project was not followed according its technical specifications. It looks 'absurd' to break the pathway, to take out all utilities, to construct a special border for placing urban utilities, and to replace the traffic posts out of it. The disregard of the problem, and of the specific reasons why this technical solution was proposed is visible in the execution of the 'formal' solution where the problem of accessibility was not contemplated. The final result lacks fidelity to the original project since technicians had no apparent reasons to adopt and execute a more 'complicated' technical design solution.

Their absence from the work meetings and public presentations of the project, and the lack of co-operation between institutions, led to a lack of involvement in the project, which came to be considered perhaps idealist or 'outsider' inspired, but also as a 'waste' of money. Efforts placed in the study and developments of the accessibility project are lost as well as the opportunity of testing the pilot project was not taken by the city council.[197] And finally the very accessibility of impaired citizens is not fully attained.

Fig. 49 – The impossibility of removing the electricity poles, and the careless in replacing traffic-posts turned the borderline pavement meaningless. In some parts it can be observed that the excessive texture of the barrier-free pavement makes more difficult the recognition of textures contrast.

The technical supervision also provided issues for reflection on the relations between accessibility for impaired citizens, general accessibility of public spaces for all users, and the existent accessibility laws and norms. This reflection arises from the physical characteristics of the place, marked by the presence of a historical urban tissue with a special urban design. Steep streets with narrow pathways, invasions of the public dominion of pathways for private uses (walls, parking, buildings), and the irregular width of the vehicular track were very important considerations for design solutions. Very often they were decisive in defining accessible routes for motor impaired citizens. They also show the impossibility of obeying the existent technical norms. In places where the

[197] It is important to remark that architecture students developed a 'Post-occupation evaluation' of the Pilot Project in 1999/2000, which was coordinated by Vera Bins Ely and myself. This group belongs to the Research Program for Graduation Students (Programa PET, ARQ, UFSC)financed by a Governmental Research Agency (CnPQ)and develops urban studies about 'Universal Design'.

problems described above come together, the planning of a ramp would simply mean one more barrier instead of a technical solution. These situations led to the design of an 'illegal' ramp which is a little shorter that the official one. The design need to solve the problems advanced, in practical terms, a more theoretical discussion regarding accessibility in historical areas and compliance with norms, which was due to occur in the accessibility's law evaluation.

PROPOSING A NEW LEGISLATION

The proposal of a 'Project for district law, which assures accessibility to public urban spaces for disabled citizens' is developed from the study and analysis of the present District Law NR 2.153. This law 'guarantees the right of disabled persons and gives other recommendations'.[198] Also other laws and norms were examined. Among these are, the national law NBR 9050 – Adaptation of buildings and urban utilities to impaired persons, ABNT 1990, plus international laws and norms.[199] The new law formulated is not restricted to the inclusion of new aspects of accessibility in open public spaces. It also aims to update the existent law and to raise its suitability regarding the urban design particularities of Florianópolis city. One of the main reasons for the revision of the District Law is the discrepancy between the definition of disability formulated in the law and the evolution of this concept in the last years. Besides, the mistakes in formulating certain technical issues have to be corrected. Finally, it aims to realise the letter of the law with a more comprehensive formulation that can increase its effective application especially in central historical areas.[200]

The law project proposed is divided into five chapters. Contrary to the present district law's organisation, chapters are organised under general subjects and

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[198] 'Lei Municipal N. 2.153/84 que 'Assegura direitos as pessoas deficientes e dá outras providências', Florianópolis, unauthorised translation of the text of the law.

[199] Sources employed: ABNT 1990, NBR 9050 – Adequação das edificações e do mobiliário urbano à pessoa deficiente, Associação Brasileira de Normas Técnicas, Rio de Janeiro/ Design with care: Planning for disabled persons in developing areas – Design guidelines (1981), First draft report for UN, YIP Secretariat and SIDA, Stockholm/ Johansson, Roger (1993), *Streets for everybody*, Swedish Association of Local authorities, Göteborg/ Tetzchner, Stephen (1991), *Issues in Telecommunication and disability,* Commission of the European Communities, Luxembourg.

[200] A clear example is how to obey the norm for ramps in the narrow pathway maintaining the established values of length and declivity. As a result, because it is 'illegal' to make a smaller ramp, no ramp at all is built, either a provisory and lousy 'ramp' is placed that gives little help to wheel chair users and a lot of discomfort to other pedestrians.

not around isolated built elements (pathway, staircases, etc.). The first chapter defines the law's objectives and scope, including the concept of disability, and the rights of disabled citizens to participate in the urban planning process. Chapter two defines the creation of pedestrian preferential routes accessible to disabled persons, and their necessary technical characteristics, which are required to assure mobility, safety, and comfort to users. The third chapter is about continuity and safety at crossings, and the fourth defines aspects of distribution, localisation and design of urban equipment and utilities. Finally, chapter five defines aspects of accessibility to urban information and to the public transport system. The chapters division followed the previous categories of problems already defined in the second design case. All chapters were to be discussed in a multidisciplinary group in the urban planning institute and finally be sent for approval by the municipal council.

The discussions started and the first text produced was adjusted taking into account the critics made by the Planning Institute lawyer and architects involved in the co-operation project. The three first chapters were discussed, re-written and were accepted as final proposals. The meetings came to a halt with the end of the project co-operation between the university and the planning institute, therefore chapter 4 and 5 were not discussed. Consequently, the proposal was not sent for official approval.

Not only the formal end of the co-operation project stop the progress of the law evaluation, since I was willing to informally continue the discussions. In fact, some accessibility issues were more controversial from the beginning of the co-operation projects. These aspects were less likely to become law. One of these aspects is the access to urban information. Even though a detailed discussion on the proposed law's chapter did not occur, the disagreement with this point was evident. It was difficult for the technicians of the planning institute to take positions, which gives priority to public information above advertisement information. The lack of political power of the planning institutions when compared to private interests is the source of the problem. The present neo-liberal government official discourse encourages the inclusion of the private initiative for the improvement of the quality of life. The privatisations of public services are presented as efficient and positive. Private companies are also invited to participate in urban projects. The 'rewarding' for their services often includes the use of public equipment as support for advertisement. This result in urban visual pollution, and also in the resistance to obey law attempts to regulate the distribution of 'information' (interpreted as obstacles to the 'freedom' to advertise). In the present situation, for technicians who work in

the public planning service to defend prioritising public information 'against' private interests might be fighting a lost battle.[201]

The final part of the technical supervision– a revision of the present accessibility legislation – was a personal 'defy' since I always avoided the elaboration of recommendations in the form of laws. Why this reluctance? Perhaps, is due to my 'inner' belief that diversity and specificity of places can hardly be compatible to strict rules. On the other hand, if rules are too flexible they do not actually work. The level of accuracy and amplitude of a law is very difficult to attain. This was particularly difficult in the historical part of the city where local 'exceptions' were the rule. Perhaps from a more traditional and academic position it was possible, and valid, to criticise the present legislation, without the need for elaborating a new one. However, being a practical design study, the planning institute expected not only the critique regarding on actual laws, but the proposition of new ones. I do not intend to state that the laws proposed by myself are good, nor even original. But the experience of making practical design studies and formulating laws that could correspond to the observed variety of problems examined and to the designed solutions actually proposed, certainly was a very enriching experience of producing and discussing knowledge through very different levels and mediums.

Another important remark is the need for a multidisciplinary team in the formulation of the laws. The associations of disabled persons know what they need and want regarding their rights. Lawyers know how to write in a way that assures the accomplishment of the law, while urban planners, architects, and designers know about the places and technical conditions that can allow or not allow the accomplishment of the law. The fact that it was possible during the previous design study to find technical solutions to solve the incongruity

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[201] It is rewarding to note that presently (year 2000), in the 'Conselheiro Mafra' street, historical buildings had their interfering signs and advertisements substituted by small signs, and the electricity poles were eliminated, as much as the excess of urban equipment (rubbish bins, flower beds, etc.) All these actions contributed for a significant reduction of the visual pollution and for the improvement of the accessibility.

problems between the laws and the reality, and to then construct, demonstrated several points. Primarily, there is a need for adjustment of the present laws, as well as for the creation of new laws. Second that technicians have to understand accessibility problems to be able to apply the laws and to develop appropriated design solutions. This last assertion brings us back to one of the central reasons that motivated the first case study presented: the absence of these subjects in the architecture courses.

PART IV
CHAPTER 7
GENERAL CONCLUSIONS

CHAPTER 7 – GENERAL CONCLUSIONS

The public spaces of old city centres usually offer a rich variety of sensations and stimulus. There is a myriad of different things that can be seen: blinking lights of advertisement screens, objects in shop windows, trees, fountains and statues, and especially a never-ending bustle of people doing different things. Children going to school, people rushing to work, elderly people sitting on benches watching others pass-by. The sound of cars and buses mixes with the sound of voices and movements of people walking, talking, working and shopping in the streets. The scent of fruits and vegetables can be smelled in the public markets. It is usually in the centre one finds the traditional places where people gather to discuss, to manifest, and to celebrate. That is perhaps the reason why even when city centres loose some of their main economic functions they continue to be lively. But when we see technical representations of urban areas in zoning plans or urban maps, or fancy photographs of new specially designed architectural spaces, almost nothing of the above is there.

In those photographs, maps and drawings a fairly detailed register of functions and activities, analytical representations of fluxes of movement, an aesthetic record of visual forms, and also representations of architectural periods and building's styles can be found. The fidelity of representation towards dimensional and visual attributes of the physical space is considered indispensable. Such concern does not exist with regard to the register of non-visual attributes of space. Perhaps there is no need to represent such attributes, since they 'come along' with space itself. But some questions remain. Why are some of new urban areas, totally planned and designed, so boring and dead? Why do they, in spite of their sometimes high visual aesthetic qualities and functionally well planned design, often look 'empty'? And why are they not appropriated in the same way as non-planned spaces? Has the 'forgetfulness' of other spatial attributes than dimensional and functional ones in the representation and design conceptions of space, something to do with it? Architects and designers consider visual, and functional dimensions fundamental features for the understanding and enjoyment of space. Why, and how then, can visually impaired persons cope, and enjoy, the disorganised and messy open spaces of non-planned city centres? As an architect and designer, could one learn to 'see' other aspects essential for the quality of space, from the understanding of the perception of blind and partially sighted persons in their use of the public spaces of a city? And in which ways could this learning support the search for more appropriated methods and processes aiming to attain Universal Design objectives?

The conclusions presented here correspond to the general dynamic process of the study development. Firstly, conclusions situated at a more applied level are presented. They describe how design knowledge was constructed throughout design cases, searching for solutions in real contexts. Secondly, theoretical reflections relating and extending current concepts of spatial perception are presented. These concepts are basic for the understanding of a differentiated urban analysis. This analysis, in turn, can identify the roles of spatial elements as references in the absence of vision. Thirdly, design criteria are suggested aiming at supporting accessibility projects for visually impaired citizens. Finally, in the fourth point, possible implications are drawn between the reduction of spatial complexity in the design practice, and the essentially visual-based tools employed for registration, analysis and conception of space, and the need to register and consider non-visual spatial information in the design practice is suggested.

In this way, both practical and theoretical knowledge should support a better comprehension of usually 'disregarded' attributes of public urban spaces. They should also lead to a reflection about our own practice and responsibility as students, researchers and professionals of architecture, towards universal design parameters and spatial accessibility for all kinds of users. I would like to express my belief that a more comprehensive and deeper study of human spaces, considering all our senses and feelings, would certainly leads us, architects, designers, and urban planners, to a more ethical attitude in our practice, and towards a greater control of spatial architectural quality.

The ideas presented in this conclusion belong to different spheres, which are divided in four sections. In each of them, further development into related subjects is needed. Hence, a résumé, describing main intentions and subjects developed in each section, is included to guide the reader.

1st SECTION –'*Design cases as central investigation methods*' is divided in three parts.

It starts by considering the *Importance of context for the search of Universal Design solutions*. The need for a broader understanding of Universal Design principles, and for the consideration of local context for the application of technical solutions, are the main points developed in this subsection.

Design cases and the production of knowledge is the second subject introduced presenting the complex nature of real spaces, and the need for relating and extending theoretical concepts about spatial perception.

The importance of channels of participation in the design process is the third subject presented. It is a narrative of the fruition of design cases with the possibilities of participation and communication between participants.

2nd SECTION – '*Analytical approach of the environment considering its perception and use by visually impaired persons'* is developed through a sequence of five interrelated points.

The first of them, *Experience of space depends on more attributes than we are aware of,* aims to distinguish when spatial elements are spatial references, and the importance of manifest and discreet attributes of spatial elements.

In the second point, '*To orient in space is more than following tracks'* suggests the importance of a more comprehensive understanding of orientation.

The third point is the '*Importance of understanding of spatial structure'*. This subsection considers the importance of the concepts of routes and landmarks in different strategies of orientation.

A more detailed discrimination of different sorts of landmarks follows in the fourth subsequent subsection called '*Importance of reliability and meaning of landmarks*'.

Finally, the fifth point '*Mental representations of space in the absence of vision'* gives specific considerations to the means by which modes of comprehension of space are developed, and a classification of spatial elements is proposed.

3rd SECTION – *'Accessible design for visually impaired persons',* aims to address more practical advises regarding the design of accessible urban public environments for visually impaired persons and it is organised in two points.

The first point *'Accessible design considering different spatial contexts*' stresses the importance of studying each context over mere application of norms and rules. A series of recommendations is proposed, which are intentionally more reflective and general.

In the following point *'How to transmit spatial information in a non-visual form'* the possibilities and need for future research concerning the investigation of non-visual means of representation is presented, including some practical advice concerning their design.

4rth SECTION – '*Design for all senses'*, an effort is made to sum-up some of the most important points of the thesis. A different perspective, relating them

with the quality of space for all users is also explored along three different points.

'*Different view of orientation'* is the first point developed, stressing the importance of purpose and meaning, and the use of all our senses, in the perception of space.

The second point, *'Reduction of complexity in the design practice',* relates the contradictions between a space borne from human actions and the dominance of visual, dimensional and technical aspects in its professional representation and conception.

The third and final point, *'New ways of studying and representing space',* starts with the consideration that the lack of non-visual attributes in design practice is not due to the lack of technological means of representation. The concepts and spatial analysis proposed for the study of space, which takes into account lack of vision, are then re-examined. Finally, the need for new spatial analysis methods and tools for the study and representation of space for all senses is proposed.

7.1 DESIGN CASES AS CENTRAL INVESTIGATION METHODS

IMPORTANCE OF CONTEXT FOR THE SEARCH OF UNIVERSAL DESIGN SOLUTIONS

> 'When I work with the world, I use all its variables in a certain moment. But no place can have all or the same variables, neither the same elements nor the same combinations. For this reason, each place is singular, and one situation is not similar to any other. Each place combines in a particular way variables that might, very often, be common to other several places.'[202]

During the development of the design cases the real, and difficult, design question to be answered was – how could the existent urban space support not only orientated movement, but also understanding and participation in the absence of vision? The application of technical standard solutions aiming at eliminating obstacles and improving safety would certainly reduce the problems confronted by visually impaired persons. But these solutions are, surely, not enough to guarantee understanding and participation if they are not contextual. Local studies of accessibility depend not only on the identification of restrictions, but chiefly on the identification of the elements and conditions which assist understanding, access and use of important activities in the place itself. Since the nature of the problems of obtaining spatial information depends on the specific spatial contexts, solutions have to be found in the study of the place itself.

The relation between the basic knowledge that was needed to support the development and framing of the problem in each design case was double bound to its context. Firstly, the theoretical knowledge about perception processes allowed the understanding of the first-hand information given by the visually impaired persons, and oriented the process of spatial analysis in the place. Without this basic knowledge it would be impossible for instance to identify the different senses used by a blind person to recognise a bus route going home and to establish meaningful connections between the senses working with the actual spatial sources of information mentioned. Secondly, a different comprehension of the general knowledge, and the need for more knowledge was stirred by the 'questions' arisen while doing the spatial analysis and the interviews. This was the case when I found that I was at loss to classify usually 'unimportant' or

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[202] Santos, Milton (1988), unauthorised translation, pp. 58.

unconsidered urban elements (as light poles and sun/shade) as possible spatial references and even as landmarks for visually impaired persons.

In every new design case a different combination of technical, social, political and time restrictions combined with the amount of local contextual knowledge about the problem and the growth of applied theoretical knowledge lead to a different design solution. This is the case when the students 'found', while trying to apply the suggested design hypotheses proposed by the discipline, that it was not so easy to distinguish a clear hierarchy of routes among the central streets. The real place was much more complex and it was not possible to define one central primary route, followed by secondary or tertiary ones. According to a complex combination of the functions and users each street possesses, more than one street was a primary one. The fact that new design hypothesis had to be searched brought along the need for re-studying the concept of routes, the importance of their continuity, and how they could be distinctively signed by landmarks (and if this solution was possible or meaningful).

Along the development of each design case these combinations of going forward and backward, produced new knowledge. What is generalized from this experience is more a methodological approach of design analysis that can be used in other situations, than the actual designed solutions. These, were not only local solutions, they were sometimes the 'most appropriated' solution, which was possible to be made facing the local restrictions and constraints (and not always the best solution for that place). In reality, every new design situation asks for specific solutions and it could not be otherwise. Once more, it is important to stress that the concept of Universal Design refers to the local inclusion of diversity, and not the spreading of 'universal solutions' that basically disregard the very diversity of person's needs, social and political situations of each different place. This design attitude of respect towards each place's singularity does not mean that there are no general principles of 'Universal Design' that can be applied and combined in different ways.

DESIGN CASES AND PRODUCTION OF KNOWLEDGE

The concrete design situation studied in the public open spaces of Florianópolis is not only multifaceted because it included the understanding of social and political contexts. The specific spatial analysis necessary to frame the design problem is also extremely complex. How can one investigate the positive or negative roles of spatial elements in the orientation of visually impaired and blind persons? From psychological studies we know that lack of vision affects the quality of perception experiences in space, and the resultant spatial knowledge. It is not only the

sources of information, like sounds, shapes and textures, which differ in the absence of visual information. Attributes of a spatial element, usually regarded as positive, could be, alas, experienced as negative. For instance, a pedestrian bridge with a beautiful landscape is usually evaluated as a safe, and even a pleasant, way to cross a street. However, for a blind person, the impossibility of knowing how deep the gap between the bridge and the road underneath is, and the consequent fear of falling, can be much greater than the feeling of safety that the bridge can bring.[203] A traditional architectural urban spatial analysis, mainly based on a visual perception of space, is therefore not adaptable for the kind of investigation that is needed.

Still, *not knowing* exactly how to analyse the place was a positive fact at the time the study started. Instead of developing an initial classification of 'obstacles' and 'good references' for orientation, a neutral and detailed record of all spatial elements was made. All sorts of spatial elements that could be perceived by all the senses (dynamic human events, buildings, sounds, etc.) were registered. After this initial observation and registration of the place, it became necessary to organise the collected information relating to the spatial elements' identity and the roles they accomplish in supporting or disturbing, orientation. The need for some sort of classification was then recognised, both for a personal understanding of the problem, and for purposes of communicating with other researchers.

To arrive at a meaningful classification, it was necessary to relate the practical knowledge obtained through the spatial analysis of real places, to the first-hand information given by visually impaired persons and the theoretical knowledge about spatial perception.[204] Even though only tentative, a connection between

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[203] Explanations offered by blind persons, interviewed during the first and the fourth 'Word's game', about their reasons for 'not liking' the pedestrian's bridges.

[204] From the theoretical studies, the ecological theory of perceptual systems proposed by Gibson, and in special the relationship between the senses and the physical environment as source of potential information, was more significant. From the study of the orientation processes proposed by Spencer, Blades and Morsley, the role of permanent and dynamic landmarks for orientation, and how the notions of distance, and direction could be perceived along a route, were also fundamental. These concepts associated with the review made by Weil-Barais about time perception made it possible to interpret the importance of rhythm of movement along routes with different spatial organisations for the memorisation and local spatial perception. Finally, a deeper understanding of blind person's orientation processes and spatial representations was supported by the studies of Karlsson and Magnusson. About Gibson, see Chapter 3, p. 69, about Spencer, Blades & Morsley see Chapter 3, p. 83, about Weil- Barais, see Chapter 3, p. 77, about Karlsson and Magnusson, see Chapter 3, p. 79. and p. 94.

these three spheres of knowledge had to be reached to make the development of the design cases possible. It is only after the conclusion of all design cases that it became possible to reach a more elaborated classification of the spatial elements that is presented in this chapter on pages 234. However partial, the results obtained at this intermediate stage of the study are very important for the initial articulation of different levels of knowledge. They are in the form of two tables that are presented in the following pages.

The construction of the tables was fundamentally a design action, in the sense that it aimed to apply theoretical, first-hand information and my own initial observations of the urban space to construct a useful 'tool' for me and for others to understand the problem. I placed myself in the position of someone who needed to evaluate the different quality of spatial elements in relation with the sense that might be used to their perception. Moreover I tried to speculate how design could make use of this information to increase the understanding of space. Naturally, these tables are reduced models of classification; in a similar way as design propositions can be models of possible solutions. The tables should work in two ways. That is, they should help someone who needs to understand how a place can be perceived when vision is absent, as well as to help someone who needs to anticipate the results that can be expected from design choices to improve the place perception.

The first table compares three different spatial situations concerning the existence of accessible spatial information for blind and visually impaired persons. These situations are; (1) when there is lack, or limited information on offer; (2) when information is accessible; (3) when information is existent but not accessible. The first and the third situations were studied, in Sweden and in Brazil, respectively. And it was very important to compare the situation of 'empty' open spaces, with the crowded, noisy and messy city centres. The second, is a hypothetical situation of 'balance', which is included to illustrate how information could be obtained in a favourable spatial situation.[205] The connections throughout the table are done through the listing of spatial elements that can act as spatial reference for orientation, and how their presence/absence, or their distinct features, can affect their accessibility in the three situations.

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[205] The Brazilian architect and researcher, Benami Turkeniewsky, suggested the inclusion of a situation of balance in a discussion we had about my work in 1997.

The reader of the table has to make an effort to place himself in the position of a visually impaired, or a blind person, trying to orientate independently in public open spaces. Following the horizontal lines he/she can try to imagine how the presence, or differences, in each one of the spatial elements listed are related to the acquisition of spatial information about *where* he/she is, and/or, about the *meaning of the place*. If one places himself as a designer aiming to solve a concrete situation, the elements listed can be compared with the situation one is evaluating. A correct spatial evaluation based on the theoretical understanding of how the place can be perceived without vision is not enough though for the formulation of design solutions. This evaluation and understanding should necessarily support a dialogue with the visually impaired users. They are the only ones who can evaluate and add important information that can confirm, redirect or change the proposed design hypothesis.

TABLE 1 – EVALUATION OF URBAN ENVIRONMENTS ACCORDING TO THE POSSIBILITY OF VISUALLY IMPAIRED INDIVIDUALS TO OBTAIN SPATIAL INFORMATION

1. Lack of References	**2. Situation of Balance**	**3. Polluted References**
No vertical walls	Accessible vertical walls	Vertical walls + obstacles Vertical walls with irregular shape
Absence of rails or vertical surfaces	Rails and vertical surfaces bordering paths or protecting dangerous places	Inadequate or badly positioned rails and vertical surfaces
Non structured paths, undifferentiated in their dimensions and physical qualities	Paths following an hierarchy, with differentiated dimensions and physical qualities	Paths changing dimension and physical qualities independent of function
No difference between floor pavement of paths and surroundings	Floor contrast between paths pavement and surroundings	Mixed floors or undifferentiated according the function
No difference of level between path way and street	Difference of level between pathway and street	Level difference too high or absent
No colour contrast between pavements	Colour contrast between pavement	Too many colours resulting in undifferentiated or confusing pattern
Regular smooth surfaces with no paths	Regular design of paths with straight directions and rhythm	Too many paths, undifferentiated, difficult to identify
Indistinct pavement surfaces, no difference of texture, shape or colour	Regular designed paths with distinct pavements	Irregular pavement surfaces, making difficult to walk with safety
Streets too long without crosses, or with labyrinthine forms	Streets with corners and crosses with a certain regularity, available or known names	Absence of rhythm in the position of corners and crosses, no available names
Undifferentiated buildings	Buildings with differentiated architecture	Architectural pollution
No Braille or tactile information available	Braille and tactile information available	Sign and advertisement pollution
Absence of other persons to ask for information	Personal information available	Too many people, people who give undesired information or interfere

Great surfaces paved with uniform floor without natural or artificial vertical elements (more then 50 m diameter)	Presence of architectural and natural elements inside an area less than 50m. diameter	Too many architectural, and natural elements concentrated in small areas (smaller than 25 m diameter)
No functional landmarks available to confirm relative position in space	Presence of functional landmarks	Landmarks masked or inaccessible due to the presence of physical obstacles or noises made by human activities
Absence of previous information about routes	Available previous route information	Contradictory information about routes
Absence of information about public transport system- location, directions, time table	Available information about public transport system	Too much traffic, conflicting information
Absence of information about public service location	Public services signed	More than one entry to public services, more than one service in the same building
No activities or events	Presence of activities and events marking places with a certain regularity in time and physical location	Too many activities without regularity in time and space
No limits or borders	Well signed and protected limits and borders	Conflicting limits and borders
Absence of sun/shade, wind marking places or locations	Sun and shade, wind marking places and locations	Sun and shade making a confusing pattern for low vision people
No water presence	Water signing places by sound and smell	Water as obstacle in routes
No vegetation	Vegetation marking and helping to define places	Too much vegetation making places inaccessible

The second table relates potentially existent sources of stimulus that are not visual, with their perceptive channels, the stimulus and the kind of information that can be obtained, and the sources' potential meanings. Here, Gibson's classification of the perceptual systems[206] is central for the construction of the table. His descriptions of the specific working of each perceptual system are interwoven with the knowledge about potential sources of information and their potential meaning when vision is lacking. The table does not aim to be exhaustive, in any way. It is only intended to illustrate through a few practical examples the potential relations between dynamic and permanent sources of environmental information for orientation and their potential meaning. Similarly to the first one, this table can be used to support the study of how usually disregarded spatial elements can be included in design solutions that aims to increase the perception of places for visually impaired users.

[206] This table is partially based on the Table 1: The Perceptual Systems by James J. Gibson (1966), pp. 51.

TABLE 2: SOURCES OF NON-VISUAL INFORMATION AND POTENTIAL MEANING

Source of Stimulus	Perceptive channel	Stimulus obtained	Resultant information	Potential meaning
Wind	Haptic and Auditory system	Different pressures and temperature felt by the skin Air vibration (sound)	Directions, intensity and temperature of the wind, sound of the wind	Wall's openings, location of streets, geographical orientation, street corners, known windy places, cover up or alters other sound information
Sun and shade	Haptic system	Different temperature felt by the skin, vision of light (for persons who can still distinguish light)	Different temperatures, light and dark Glare effects	Street sides, presence of vegetation, buildings and vertical, horizontal surfaces, geographical orientation, notion of time
Own movement	Basic orienting system and haptic system Time perception	Forces of gravity and acceleration, deformation of tissues, joints configurations. Instant and sequential events	Body equilibrium, direction, and acceleration of movement, positions of body, duration and rhythm	Relative position in space, speed, rhythm of movement, direction and distance, notion of movement and actions, notion of sequence, rhythm and duration of movement and events
Different sounds	Auditory System	Vibration in the air	Nature and location of all kind of vibratory events	Meanings of human communications, recognition and location of close and distant events and activities, confirmation of relative position in space, 'rooms' dimensions, location of vertical walls and openings
Different smells	Taste/smell system	Chemical substances in the air	Nature and location of activities and spatial elements which posses smell	Can confirm the location of a place (smell of smoke marking an industrial area) or identify activities (smell of a bakery, pharmacy) and consequently to confirm relative location in space
Surfaces of support – dimensions, forms, levels, texture	Orienting system and Haptic system	Deformation of tissues, configuration of joints, forces of gravity	Contact with the earth, mechanical encounters, object shapes, material states, solidity or viscosity	Hierarchy and function of routes, declivity, textures and types of materials of surfaces, forms and dimensions, distances and directions – location in space

IMPORTANCE OF CHANNELS OF PARTICIPATION IN THE DESIGN PROCESS

The first design case, the study of central accessibility proposed as main subject for architecture students, can be described both as a teaching and a learning situation. If formally I occupied the position of teaching, and the students of learning, the very proposition of the theme was done with the intention of

increasing my knowledge including the student's visions about the problem. The inclusion of other actors that usually do not take a more direct part in academically situations was also central for the teaching/learning process. Visually impaired persons and technicians from public planning institutions came to the university to inform about the problem as well as to discuss the students their design proposals. These meetings of students, technicians and users propitiated a dialogue around the design propositions where all participants could share and conquer some form of new knowledge. For the visually impaired the information about orientation techniques from other countries and the design solutions presented by the students was a novelty. For the students and technicians the descriptions of how the visually impaired could orient and the difficulties they confront surely changed their way of seeing and evaluating any urban public space accessibility. Moreover the technicians from planning institutions could add their experience from making political and economical restraints into real projects, to the discussion. The students evaluated this direct contact with the different dimensions of the problem as the first opportunity they have had to develop a 'real project' in all the five years of study at the school of architecture.

During the second design case, the study and diagnosis of the city centre accessibility, different dialogues were constructed piece by piece. The place analysis was interwove with different sort of interviews with the visually impaired, discussions with the technicians of the Urban Planning Institute and with the architecture student who worked as assistant. The construction of these simultaneous channels of dialogue between the different interlocutors involved with the problem was important not only for the development of the study itself. From the dialogues' integration, depended the very continuity of the study on more practical basis, that is, the possibility of transforming theoretical parameters into real projects.

One level of communication was expected to support the technicians' future design actions. This 'technical dialogue' evolved during the work inside the urban planning institute, and was formally expressed in the form of a booklet. In it, were presented a detailed documentation (observation, photos, interviews, etc.) of the place, the place analysis and the design parameters proposed to solve accessibility problems. It was also expected that the study results could be useful in convincing institutional authorities, which create and define urban policies, strategies, and execution of the projects, on the necessity of such a project. However, to guarantee a more extended level of participation and evaluation, other interlocutors had to take part in the design process.

With this aim the accessibility study was officially presented on different occasions, with the participation of public organs, organisations of disabled citizens, political representatives, and the media. Yet, either important actors were missing from the meetings, or the discussions did not lead to compromises regarding the establishment of an inter-institutional work group. In a way the visually impaired organisations and individuals, were not considered as real participants in the design process. They were invited to the project official presentations as future users, who were represented by a specialist (myself). Accordingly to this vision, their opinion was taken for granted as supportive towards the project. Similarly, the need for testing, evaluating and discussing the design parameters within a larger group was not felt as necessary. In spite of this limited view of the importance of a more inclusive participation, the study was expected to continue, and I was invited to make a technical supervision regarding the improvement of the accessibility of two central streets.

The third design case, a technical supervision in a real project, was the case who revealed in the most striking way the importance of the construction of channels of dialogue to guarantee a correct development of a design propositions. The lack of dialogue implied on a series of mistakes that compromised the very urban accessibility, which was being searched through the realisation of a pilot project.

The third design case included the development of concrete solutions, and a revision of the local accessibility law. It was not possible to conclude the discussions on the law proposal. Perhaps the most influential factor for this was the lack of perspective regarding their discussion and approval by the local authorities. In spite of this, the combination of the different views of professional and users, who took part in the discussions, showed how important it was to incorporate the differing knowledge and practical experiences for the law feasibility. The design project was developed with the participation and exchange of the practical knowledge of the architects of the planning institute and the architecture student and myself. However, the concrete construction of the designed solutions lacked fidelity to the original project. They are isolated ‘reproductions’ of design solutions, which do not follow the more comprehensive recommendations made in the second design case analytical study on how to work with accessibility problems in a broad contextual situation. Moreover, they reveal a lack of understanding of the problems, which initiated the technical solutions. And their application as ‘fashionable’ designs, sometimes compromises their basic function of improving accessibility for visually impaired citizens. This was caused in part, by the lack of integration between the different public institutions in Brazil. It is unrealistic to expect complex and interrelated problems to be resolved without the participation of all the sectors

involved. In this case, the almost total lack of communication between the planning institute architects, authors of the accessibility project, and the engineer responsible for the construction, was the primary factor responsible. But also the non-participation of the visually impaired organisations in the design process, in a more active form, has its impact. Visually impaired persons were never invited to test or even to visit the pilot project. In spite of this lack of evaluation, the technical solutions were repeated in other urban areas in a fragmented form.

In all the design cases the participation of visually impaired persons and the support of their organisations was fundamental for the obtaining of information about the problem. Different visually impaired persons took part in the discussions with the students at the university, in the 'Word's Game' sessions and in the ''Accompanied walks' following all stages of the study development. However, the organisation's representatives did not take part on the more political forums of discussion. Apparently, they have other channels of political pressure and did not seem to see the design projects as useful in the practical processes of acquiring better conditions of accessibility in the city. Their participation would have been invaluable, firstly because they know better than anyone about their problems. Secondly, they were the only participants in the design process who could use their political rights to demand a full application of the proposed solutions, or even to ask for their change and improvement.

A final reflection gives respect to the different weights that channels of dialogue do have in the process when design cases evolved from being 'theoretical' studies, to concrete practical design projects. If it is 'easy' to include others to co-operate in the search of theoretical knowledge (and many persons are really generous to share their experiences), it is also easy to deceive them in the case of a real project. There is a great gap between the degrees of complexity, participation and compromise, which are necessary to guarantee the success of a theoretical work (more dependent on the investigation conditions) and the success of an urban project. In the last one, political, economical and social practices will intervene, and technical arguments will be accepted in the measure as they reinforce these practices.

Reflecting on how the design process evolved during these three design case situations I would like to conclude with a question related to the ethical and practical stance of urban planners and designers. If we are used to employing principles and methods based on a technical rational model – where scientific knowledge very often disregard participation and integration of others – how can channels of participation be constructed to include all kind of participants in the design process?

7.2. ANALYTICAL APPROACH OF THE ENVIRONMENT CONSIDERING ITS PERCEPTION AND USE BY VISUALLY IMPAIRED PERSONS

TOTAL EXPERIENCE OF SPACE DEPENDS ON MORE ATTRIBUTES THAT WE ARE AWARE OF

> 'I used to pass by a local street after I left work, sometimes. I never noticed anything special in that street, it seemed quite neutral to me. However, on one sunny day I saw a little boy with his mother in that street. My attention was called by his joyful voice. I looked at what he was doing and saw that he was playing with a seed, making it flow in a small pool of water in the pavement. He was delighted, and called his mother several times to look at his 'boat' floating. For the very first time I realised that it was a fountain in that street. A very nice fountain, with water falling from a rock and running in a narrow and snake shaped canal. I had never noticed the curving channel before, the rock with the water falling, nor ever heard the sound of the running water. However, from that day on, this street was different for me. The presence of the fountain gave it a special and unique quality.'

To orient in space, there is a need to know where one is as a person, to understand what is perceived, to be able to decide where, and how, one wish to go. According to one's intentions different spatial elements can be used to accomplish this task. A child will probably use other elements for orientation than an adult, which are related to his/hers interests and use of places. Depending on the degree of experience, and knowledge of space, more elements will play a role in the mental spatial representation a person might have of a place[207]. In spite of the existence of individual variations in the perception and understanding of space, some spatial elements are more relevant than others for the recognition of spatial identity, structure and meaning. These elements constitute *spatial references* through which the individual can relate to the environment.

In the following pages an effort will be made to organise the theoretical information and the reflections made during the development of the design cases to understand how a differentiated perception, caused by the reduction, or lack of vision, affects the access and use of spatial references, and

[207] Spencer, Blades and Morsley, (1989), pp.118-125.

consequently the orientation and understanding of space. According to Gibson, perception is supported by a basic human ecological condition in which our body occupies a central position as an 'active searcher' of environmental information through the co-ordinate work of our perceptual systems.[208] Each different 'element' belonging to our environment possesses unique and distinct qualities. These qualities constitute potential sources of stimuli that can be perceived through different perceptual channels. The resultant information obtained will allow the spatial element's recognition. A simple example is a glass of juice. Vision of form, volume, colour and texture tell us that this might be an orange juice. Smell, taste and touch will provide other complementary information, like flavour and temperature of the juice. While being able to receive several different stimuli simultaneously, not all of them deserve the same grade of attention, or effort, or are 'interpreted' as information at the same time depending on our intentions and attention. In our example above, if vision alone could provide the information about flavour and temperature of the juice (by the hue colour and appearance of the glass surface) it would probably obliterate the need of tasting, smelling and touching. The latter actions though, would confirm, or contradict, the information obtained through vision only (the juice could be of tangerine, and colder than we initially guessed).

Vision can provide instant information about several features and array of many different things in the environment, especially about colours, forms, depth, location and movement. Vision allows us to 'foresee' distant objects in space, and to relate our own positions and movement in space, it being the main channel for perception of spatial information. We are more consciously *aware* of the information brought by vision and visual features of space, and they usually 'overlap' with the perception and recall of other sensory information. But other attributes, which perhaps are not so consciously perceived, are also important to confirm the meaning provided by simultaneous inputs from all the other senses. A shift in the level of, usually non-consciously received information, can be experienced by anyone who suddenly closes his/hers eyes. Instantly, several 'new' information brought by the other senses can be identified.[209] Sounds and touch feelings suddenly gain importance as main existent stimuli, and our body acquires a new status occupying the 'centre' of

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[208] James J. Gibson, (1966).

[209] Sometimes there is a need to close our eyes to concentrate on the information brought by the other senses. This is the situation experienced in a concert, when we feel that the 'vision' of the interpreter interferes with our concentration and feeling of the music.

our perception field. Certainly, these information were already present earlier, but they did not occupy the first positions of our awareness. They attain importance only if we pay attention to them, if we are conscious of their significance. On the contrary, we do not need to think that what we see is important or not. To see something, in almost all cases, is considered synonymous to knowing, to recognising, or to understanding something.

Depending on different conditions of perception – given by the relations between the environment, the individual and the existent spatial elements – the importance of non-visual attributes can increase or diminish, but it is never neutral or irrelevant. It is in particular this possibility of obtaining significant information, through other senses than vision that allows visually impaired persons to orient, to understand and be able to use different spaces. However, it is very important to consider that each perceptual system picks-up information that differs in type and quality. To see a tree, is not the same as to touch its trunk, hear the sound of leaves moving, smell it, and be under its shade.

When visual information is not available, other sources of spatial information naturally occupy the central roles for the understanding of different places. And other spatial elements, or different attributes, will be employed as *spatial references*. When I was walking with a blind man in the centre of Florianópolis, during one of the experimental 'Accompanied Walks', he told me that he could *'feel'* the presence of the street corner *'because the air changes*.' I tried to understand, and feel in the same way as him. And in the following street corners I was paying attention to very small changes in the 'air'– like sound, speed, freshness, and temperature. All these were very subtle *changes of information*, but they were certainly there, and *contributed to reaffirming the information that the vision of the corner brought to me.*

To pay attention, and to relate to different sensory information, that seems to be such an obvious need in the perceptual process of the blind, is not taken into consideration when vision is present. To be able to identify *spatial elements that are references* for the orientation of blind persons it is important to distinguish between, what can be named as, their *manifest* and *discreet* attributes.[210] Their main difference is that while manifest attributes are immediately perceived as salient features for understanding of a place, discreet ones usually contribute to

[210] We could also name these attributes as 'evident' and 'non evident'. In this case the very word 'evident' establishes associations between the meaning of knowledge (what we known, what is clear) with the meaning of 'visible' or 'what can be seen'.

the acquisition of meaning, but are not always consciously perceived. Since vision usually provides us with instant information about spatial organisation, visual attributes are perceived first, constituting manifest features of the spatial element. But a spatial element possesses other sensory attributes, which depend more on attention and exploration. Manifest and discreet attributes are always relational within their context, and they can be identified in the scale of the city, the neighbourhood, the street, and in each spatial element that constitutes them.

Drawing this distinction is even more necessary for the professionals that are responsible for the study and design of human spaces. The over-valuation of the importance of visual and manifest attributes for orientation usually implies a disregard of non-visual and discreet attributes. Discreet attributes can be found in any space, being always there, independent of our recognition, consciousness or will. A deeper and more detailed view of our living spaces that includes these 'forgotten' qualities can certainly augment our analytic capacity, and also our design capacity, and consequently improve the spatial quality of designed environments considering all human senses.

TO ORIENT IN SPACE IS MORE THAN FOLLOWING TRACKS

The essence of orientation is the possibility of individuals to understand the spatial relations between themselves, other individuals and the environment, locally and as a whole.[211] To consider this as a basis for orientation is crucial for the study and design of places meant for visually impaired users. However, a more tempting and misleading conception of how to support their orientation, threatens this more comprehensive understanding. This is the lingering belief that to create 'threads' to be followed in a labyrinth of urban spaces helps them stay on course. This idea is based on three main misconceptions. First of all, it is assumed that it is impossible, or unnecessary, to understand the labyrinth if we can follow a safe thread. Secondly, the fact that we are really in trouble if the 'thread' is cut is not considered. And thirdly, it reduces the rich variety of life and potential for action existent in the urban environment to the bare walls of a labyrinth. Such an action, is not only a mistake, it means condemning visually impaired persons to the impossibility of spatial understanding, and to dependence.

[211] Spencer, Blades, and Morsley, (1989), p. 6.

It is possible to find concrete examples to illustrate the influence of this pervasive idea. One of the design solutions proposed by the architecture students to improve the orientation of blind persons in the urban environment of Florianópolis created a line-trail imbedded in the streets' pavement that could be followed using a white cane along a safe route. Also the project developed during the technical supervision was partially limited to the pavement distinction between zones free of obstacles and zones containing urban equipment. This project limitation was in great part due to the fact that it was not possible at the time to develop a more comprehensive project including an information system marking local landmarks and important activities.[212] Another real situation regarding special mobility and orientation courses for blind persons was observed in Florianópolis, where the teachers advised the blind students to orient along a street, counting and memorising positions of traffic posts and light poles. These two strategies can be effective in helping orientation of blind persons. But we might wonder, is there nothing in those streets that could act as a reference and at the same time be related to the street's identity, and to its spatial organisation? Something is wrong if a blind person is in some way obliged to count, or to follow non-meaningful objects of this sort in order to orient.

The impossibility of obtaining visual information certainly reduces the number of accessible referential, but it does not reduce the existence of different qualities of information provided by the spatial elements. Distinguishing between *manifest* and *discreet* attributes for the detection of useful spatial references for blind users is more complex than finding non-visual attributes as sequential tracks to be followed in a path-finding process. The question is to identify which spatial elements can support understanding and appropriation of space, and the taking of independent decisions.

IMPORTANCE OF UNDERSTANDING OF SPATIAL STRUCTURE

One of the most difficult problems for blind and low-vision persons is to orient in urban environments. More often than not, they have to experience and learn *routes*, and *places*, with the help of other persons (usually another visually impaired person or a specialised orientation teacher). To independently

[212] A project for a general information system for all users was sketched but never materialised. It should contain local information 'totems' (with Braille and tactile maps placed close to public buildings and main street's connections), a public telephonic orientation service close to public facilities, as well as booklets, and tapes to offer previous information explaining the working of the whole project.

orientate in urban environments they have to rely on the memorisation of spatial relations in a *route* such as *distance* and *directions* between references. And they also have to memorise the temporal sequence, or *rhythm,* of the references, related to their own movements in space (that are usually described as kinetic memory). In the absence of vision, it is not easy to change from one route to another, or even to change the direction of movement along a route, without loosing orientation. There are significant differences in the orientation process when vision is lacking. One difference is the more objective, alert and conscious mode in which information is searched. Another difference is related to which spatial elements can furnish accessible and reliable information.[213] This information should not only allow recognition and memorisation of different places along a route, but also to support the understanding of the urban structure as a framework for the route. [214]

The importance of this last point can be understood through a practical example. We can walk in an unknown city having misleading ideas about the general organisation of the street's structure. For instance, assuming that they are in a regular chess-like pattern, when they are in fact radial and concentrically designed. Probably, if we employ an orientation strategy based on crosses as sequential spatial references, these will be misinterpreted, and we might change direction without noticing. When eventually 'lost', we might wonder what happened, since the defined orientation 'strategy' was correct (to define directions and count crosses). Yet our general concept of the urban structure was wrong. How then can we propitiate understanding of urban structure for persons who cannot see and have to rely on the information provided by other senses than vision? A practical example of such a positive urban structure was observed in the centre of Florianópolis, where the chess-like street design, with short and regular blocks, supports the feelings of rhythm and distance. Moreover, the geographical position of flat streets parallel to the sea, cut perpendicularly by the streets that went up the hill, provides a good perception of direction and situation.[215] The presence of important buildings,

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[213] See chapter 3 for a more detailed description about how sensory information can be obtained for the recognition of routes, landmarks and for the notions of distance, direction and rhythm.

[214] Spatial concepts of visually impaired persons can present a wide variation depending on the remaining vision, personal experience and if they were blind for birth either later in their life. Some congenitally blind persons that have very poor orientation skills and limited spatial experience have great difficulties to imagine urban spatial organisations.

[215] This notions of direction provided by the topography are also stressed by the dominant winds of the island and the presence of sun and shade.

acting as landmarks in the street crosses, help to increase the structure understanding.

The possibility of understanding different spatial organisations and urban structures is fundamental to increase independence in the choice of routes for visually impaired persons. This need of understanding of the urban structure can be compared to travelling in a subway without a map of the connections between different lines. We will always be obliged to go back to the starting point to initiate a new route. In a similar way this is the problem encountered by blind persons who want to switch from one familiar route to another, without knowing the structural relations between streets. Depending on their degree of spatial experience, and mobility skills, they might be unable to find a street that can connect the two routes, and may not even recognise when the two routes actually cross each other. In the case of Florianópolis, one of the central difficulties experienced by the blind was the absence of tactile maps of the centre with the identification of the urban streets, the main streets and the significant structural landmarks. Such information would make a significant difference for a blind user that could for instance plan a different route according to his/her particular interest.

The importance that urban forms, usually called 'open spaces' and 'closed spaces', have for the understanding of the urban structure also have to be examined in a different light. Their usual representation in urban maps distinguishes them as open public spaces and compact masses of built blocks, respectively. This formal representation does not necessarily coincide with its actual sensory perception. This is especially important for the blind, whose perception and mental representation depends on their possibility of actually moving through the given spaces. To distinguish 'open spaces' and 'closed spaces' regarding their character of being *permeable or non-permeable* is suggested as crucial for their perception. For instance the main square of Florianópolis centre, the Praça XV, is a typical urban 'open space'. However, the irregular design of paths and bed flowers, the intense pedestrian's traffic, and the presence of good's sellers, made it very difficult for the blind to orient there. They usually bordered the square and never crossed it alone. Another example of urban 'open space' in Florianópolis is the area conquered from the sea. For the blind this space was 'absent' in a way from the centre, this feeling being stressed by the 'wall' made of the vehicular traffic. The perception of 'open spaces' as permeable has then to be examined in each specific spatial context, verifying when they offer conditions to be frequented and explored, and when they are felt as 'limits' even if there are no physical walls.

To improve orientation and understanding of urban spaces for visually impaired persons it is necessary to further distinguish the roles of spatial references as *landmarks* for orientation. Some landmarks provide information about the route's identity, and about the individual local situation along a route. They constitute *local spatial landmarks*. Other spatial references support the understanding of the relations between this route and the surrounding areas. The last ones are *structural spatial landmarks* for orientation. More than allowing place's recognition, they help to clarify the relations between the parts and the whole and support the organisation of mental representations of places, and urban spaces. It is very important not confound the *local* and *structural* roles of spatial landmarks with their *manifest* and *discreet* attributes. The first distinction refers to the importance that spatial elements do have for orientation and understanding of urban places. The distinction between manifest or discreet attributes refers to their possibility of recognition according different stimuli and respective perception channel. For a blind person a spatial element recognisable through a *discreet attribute* can constitute a *structural landmark* for orientation.

If we return to our second table (see page 218) the first four columns describe the way in which spatial information can be found through their discreet attributes, while the last column refers to their potential meaning. However the distinction of their roles for the recognition of distance, direction and rhythm while following a route, as a local or structural landmark, or for the recognition of the place identity depends on the detailed analysis of the place and its context.

IMPORTANCE OF RELIABILITY AND MEANING OF LANDMARKS

The degree of confidence that different spatial elements do offer as landmarks is a pertinent aspect to consider in the orientation of visually impaired individuals. Their significance and reliability as information sources for the recognition of objects, events, places and urban structures depends on two main factors: the permanence, and the constancy of attributes in space and time. According to them, landmarks can be classified as *permanent, cyclical* or *dynamic spatial references.* Usually *permanent* landmarks are physical structures that stay for a relatively long time in the same place, without change in their attributes. *Dynamic* and *cyclical* landmarks are those that may suffer

changes both in their location in space, and in their attributes over time.[216] It is then *the degree of change* of landmarks that affects their *reliability* for orientation and understanding of places. Consequently, permanent landmarks are usually evaluated as more reliable than cyclical landmarks, and those more reliable than dynamic ones.

The usually clear-cut relationship between the degree of importance and reliability for orientation, and the degree of permanency of the landmark, is altered in the absence of visual information. Even if dynamic landmarks are less reliable than permanent ones, blind persons depend largely on them for the recognition of places. The smell of an industrial area can be a very strong spatial reference about the identity of the place and its relative position in space. A blind person can feel safer while keeping physical contact with, and following the sounds of movement of other persons crossing the street, even if he/she cannot always rely on their presence to cross a street. A central street that can be easily recognised during weekdays by the sounds of human activities and vehicular traffic does not posses the same sounds on a holiday. Dynamic and cyclical landmarks can be essential for the recognition of place's identity, and the understanding of urban structure, even if they are not as reliable as permanent landmarks.

The usual dominant concept of landmarks - as permanent physical structures recognisable by their 'visual' attributes – contributes to the fact that dynamic spatial elements are not considered as valid spatial references. Human activities and traffic movements are usually considered in a functional evaluation of urban life. Dynamic and cyclical natural events (like sun, the day's rhythm, wind, etc.) are more often analysed with regard to the technical aspects of comfort.[217] However central for the perception of a place's quality and identity, dynamic and cyclical elements are rarely considered as valid references for orientation and understanding of space.

Landmarks can be recognised by the *distinctiveness* of their attributes, by their *functional importance* hosting human activities, and by their special *location* in space. These qualities can co-exist in one landmark, reinforcing its importance

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[216] See chapter 3 for a more detailed description of the permanent, cyclical and dynamic landmarks.

[217] More recently the relations between urban form, climate aspects and human comfort have been considered in special urban studies. However, more usually these aspects occupy a secondary position in the design of urban environments. See a work of this kind in Mascaró,Lucia (1996), Ambiência Urbana/ Urban Environment, Sagra, Porto Alegre.

as a reference. To be able to select which spatial elements can constitute valid landmarks for the blind, it is not enough to search for spatial elements that posses attributes that can be perceived independently. It is true that visually impaired persons evaluate landmarks that they can perceive and use in a direct form more positively.[218] However, they also receive environmental information from other persons, and commonly employ *functional* landmarks that they do not directly perceive. As a blind man said in one 'Word's game' session: 'I think that everything that has a public status in any place can be useful as a reference. Even if you don't know, another person might know about it. A restaurant, a school, a church, a public square, all of them are useful as references. The bad situation is when you are on a residential street that does not have any commercial point.'[219] In this case, the desired information is not obtained from the direct perception of the spatial element's attributes, since it is not seen, neither touched nor smelled, and not heard. It is the oral information, from a person in the street, which mediates between the source and the receiver. *The possibility of sharing the knowledge about a landmark with other persons explains why the visually impaired can use functional and even visual landmarks for their orientation.*

It is then important not only to verify which are the possibilities of independent perception of landmarks, but also the reasons why they work as such. The mere consideration of spatial elements, i.e., just considering their direct possibilities of perception in the absence of vision, irrespective of their relevance for the meaning and spatial understanding of space, is a grave mistake. It might lead to the utilisation of what can be named as *artificial landmarks,* like counting traffic poles on a street.

MENTAL REPRESENTATIONS OF SPACE IN THE ABSENCE OF VISION

There is a tendency to confuse the character of spatial element's information – as permanent, cyclical or dynamic, with the quality of the resultant spatial knowledge. It is easier to imagine that dynamic elements (like vehicular and pedestrian's traffic, human activities, and natural events) provide essentially dynamic information, and that their mental representations also share a dynamic quality. Music, for instance, can hardly be imagined as static, being essentially temporal. Spatial representations of places though, even if perceived

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[218] See the evaluation of spatial elements for orientation obtained in the 'Accompanied walks' and 'Word's game' in Chapter 5, p.155.

[219] Free translation of part of a dialogue during the first 'Word's game' interview.

throughout different periods of time in a dynamic process, are mostly assumed to have fixed static mental images. We tend to forget the changing character of visual perception, and that mental representations of permanent elements (pathways, streets, buildings, etc.) are not necessarily static. In fact to construct our knowledge about places, both permanent and dynamic elements interact. Spatial concepts cannot be reduced to only 'frozen images' of places, or similar to concrete two-dimensional spatial representations like photographs, drawings, and maps. Spatial knowledge always involves not only the acquisition of information about physical permanent features, but also temporal and spatial relationships between environmental features and society.

In the absence of vision not all permanent physical structures are available for perception, or are perceived in the same way. To have an idea of a street, a blind person necessarily has to walk along it. Consequently, the information obtained along the street is essentially dynamic (form, texture, and inclination of the pathway, distances between corners, direct and reflected sounds, etc.). And the several elements that constitute sources of permanent information will be perceived throughout a period of time. Visually impaired persons use other discreet dynamic sources (like the wind, sun and shade, sounds' reflection of different materials) as well. These are sources that are usually shadowed by visual perception. The differing importance of permanent and dynamic references in the spatial perception process of blind persons, however, does not imply that their mental representations of space, or their spatial concepts have only a dynamic character. We will commit the same error if we considered spatial representations as equal to 'pictures' of places for those who can see. It is important then to know how, in the absence of vision, spatial 'images' are construct.

Understanding of space is very complex. It depends on the integrated functioning of all our perceptual systems and the information that they convey. And it also depends on intentions, and mental spatial concepts, that transform perceived information from a given spatial context into meaning. To understand how to support the understanding of spatial organisations for visually impaired persons, and especially for the congenitally blind, it is important to know in which ways the latter group comprehend spatiality. According to Gunnar Karlsson: 'There are three comprehension forms of spatiality; comprehension in terms of *image experience*; comprehension in terms of *notions*; comprehension in terms of *knowledge*.'[220] According to him, in the first case,

[220] Gunnar Karlsson, (1996), pp. 303.

personal experience in a direct and concrete form facilitates understanding and the constitution of image experience, which should not be confused with a visually based image experience.[221] In the second form of comprehension, in terms of notions, uncompleted sensory experiences and explicit cognitive processes give meaning to something that cannot be perceived in its entirety. The third form of comprehension, in terms of knowledge, is conveyed only through the description of other persons and not based on sensory experiences.[222]

Establishing relations between these three forms of comprehension and the results obtained in the design cases, I suggest a classification of different modes of comprehension of the urban spaces by blind persons, as following:

Comprehension is based on direct contact and experiences of places. Urban spaces are extremely complex, and without vision they can never be perceived in their totality.[223] In this case it can be said that only certain spatial elements, or parts of spatial elements in urban environments can be understood through sensorial experiences only. Examples of urban elements that can be perceived in their entirety are public telephones, benches, rubbish bins, etc.

Comprehension is partially based on direct experiences in space *but has to be complemented with ones own reflections*, to obtain a notion of the urban element. Most spatial elements are not perceived in their entirety, but meaningful relations can be established from the partial or sequential experiencing of the element. An example of this kind is the street's pathway. Some of its attributes can be perceived directly while moving, but there is need for reflection to imagine its continuity, directions and rhythm of interruptions by other street's crosses. Traffic and light poles are other valid examples. Blind persons are very familiar with them, either as obstacles or as spatial references, but their upper part has to be complemented or imagined from descriptions.

Comprehension is based on descriptions of other persons and cannot be related to personal experiences. Very clear examples of that are, non-reachable things

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[221] Blind persons commonly employ the word 'image' to refer to his/hers mental representations of space even if they are constructed form other sources than visual ones.

[222] A more detailed résumé of Karlsson´s work can be found in Chapter 3.

[223] Perception of the totality of urban complex spaces will always depend on the summation of different experiences also when vision is present.

like the sky, distant landscapes, the horizon, roofs, screens, skyscrapers, and roundabouts in avenues.

CLASSIFICATION OF URBAN ELEMENTS AS SPATIAL REFERENCES

If we connect the three forms of spatial comprehension proposed above with the points developed along this section, it is possible to suggest a classification for the immense variety of spatial elements that constitute urban environments in relation to their *meaning* and *reliability* as spatial references. The complexity of the problem itself is further increased by the divergent focuses of the main theories studied. While psychological studies are more focused on the individual's perception processes, urban traditional analysis mixes spatial formal analysis directed by a visual perception of space with the consideration of social processes. The classification needed though, have to combine the comprehension of the individual access to potential information in *public spaces*. In these, the very scale of objects affects their possibilities of perception, where most of the urban elements can hardly be directly experienced by the senses when vision is not present. Consequently, their understanding is almost always dependent from a combination of direct perception and cognitive processes. Moreover, orientation and use of urban spaces cannot be analysed separately from social uses of space. This relation is manifest for instance in the already described situation of blind persons using 'visual' landmarks for orientation that are accessed through 'mediated' oral information. It is the design analysis of a concrete place, associated with the study of how this space was perceived and used by its real visual impaired users that made possible to combine all different knowledge that was necessary for such a classification.

This classification can be characterised by the following:

Small/medium spatial elements, like postal boxes, path borders, benches, light poles, grass, trees, flowers, bushes, sand, stones, rocks, etc. that can be *directly perceived*, and used as *local permanent spatial references* for orientation;

Small/medium, like objects exposed for selling, boxes, protective fences, hot dog cars, chairs and tables. These can be *directly perceived.* However, due to their essentially *dynamic character* (they occupy different positions in space over time), they cannot be used as reliable reference for orientation even if they are *relevant for understanding of the place's meaning* (they very often are mentioned by visually impaired persons as being obstacles);

Large spatial elements, or physical structures like streets, street-crossings, blocks, buildings, squares, corners that can only be *partially perceived*, but are of fundamental importance as *permanent referential* for spatial *local orientation* and the *understanding of urban spatial structure* since they constitute the very elements of that allow the recognition of *routes*;

Essentially dynamic spatial elements, emanating from all sorts of human activities, like cars, bikes, buses, people walking, selling, meeting, talking, etc. (they can change both appearance and location in space over time), that can be *totally or partially experienced* but *cannot constitute reliable references for orientation even if they are essential for the understanding and recognition of places, and can contribute to the understanding of the routes and urban structure*;

Essentially natural/dynamic spatial elements and events like rain, shades, sun, wind, smells, etc. that can be *totally or partially perceived* in some of its qualities, and *help to support local orientation in space as a dynamic referential point,* reinforcing the meaning obtained from other sources.

While it is possible to make a general classification of spatial elements in relation to their *meaning* and *reliability* as spatial referential, it is not possible to draw a neat classification of urban elements as, *local or structural landmarks* in relation to their *manifest* or *discreet* attributes. The last distinction depends both on the individual orientation skills and spatial concepts, as much as on the contextual relationships between spatial organisation and human occupation of space.

7.3 ACCESSIBLE DESIGN FOR VISUALLY IMPAIRED PERSONS

> 'The focus of investigation is placed on the study and design of open spaces when they do not offer enough references for the visually impaired. The ultimate objective is therefore to make proposals on the basis of the present unsatisfactory situation in order to alleviate the discrepancy in favour of the visually impaired. In order to achieve this objective, it is necessary to understand the nature of spatial perception brought about by the absence or reduction of visual information and to dedicate more attention to the study of the integrated functioning of all our perceptual systems. This knowledge, essential for the exercise of the design profession, is sometimes neglected and overshadowed by the importance that visual information occupies in the perception of space. Besides, a large amount of design practice tasks being essentially visual (analysing, projecting, representing and communicating results), seems to make it only natural 'to ignore' the importance of our other senses, and the complexity of the spatial perception process. "Working" in a world of representation and images, we can sometimes forget that projects might materialise one day and be used by real people with varying values, experiences or abilities… There is an essential difference between the human ability of abstracting space in order to orient and of abstracting space in order to create, shape and control the use of space… Designers, architects, urban planners, geographers and politicians use abstraction of space as a working tool which will affect the perception, understanding and use of space by others, detached from what seems to be the more disorganised and sensual quality of space. However, it is part of their responsibility to understand both the reasons and consequences of their interventions in the environment. And an important part of this understanding passes through the knowledge about the use of space and human spatial perception processes.'[224]

These ideas, written in 1995, are still central to the development of the thesis. And they bear the same difficulties in communicating with others on how to apply theoretical knowledge into concrete spatial situations.

An effort is made in the thesis, to establish meaningful connections between the initial theoretical studies, and the practical results attained while studying places, making projects, and talking with visually impaired persons. These conclusions are mainly directed on how to undertake the study of such a

[224] Dischinger, Marta (1995), p. 19.

problem. After all, pattern design solutions can be hardly applied without considering specific spatial, socio-economic, and cultural contexts. Consequently, I have not aimed at drawing conclusions from one specific place, which could be turned into technical solutions to be applied in all places. They are based on the belief that each spatial element and each place are both complex and unique. As such, they have to be analysed and understood in their wholeness, in order that appropriated design can be developed from, and for, each of them.

ACCESSIBLE DESIGN IN DIFFERENT SPATIAL CONTEXTS

Some of the results attained in the design cases have a more direct application. These, take into account the improvement of urban public spaces' accessibility for visually impaired persons. I have listed what I learned from making practical projects, and from talking with visually impaired persons, to improve accessibility in different spatial situations. These 'practical reflections' are organised as points, or general advises for design actions, and do not intend in any way to be exhaustive. They start with a more general approach, evolving towards more particular and detailed design considerations.

To detect potentialities and problems of the place for all users and for special users – Universal Design solutions should not create 'exclusive' environments, designing places inside other places. To pursue the improvement of accessibility conditions for impaired persons it is not enough to identify and understand where the restrictions are. It is necessary to consider all its potentialities. And to identify similarities and differences in the use of space by normal seeing and visually impaired persons, and also persons with other impairments. For on one side, there is a need to search and classify the elements, which support orientation and understanding. On the other side, there is the need to define the criteria of classification for obstacles in different spatial contexts, justifying why they can be considered as such. The elimination of permanent and dynamic obstacles, and consequently of danger, creates safer routes, uplifting the conditions for further exploration and curiosity. But it is the identification of spatial references, and activities that are of general interest, which might improve the chances for social interaction.

To relate the new design logic with the existent orientation logic of the place and the city – When vision is not present, or very restricted, a more cognitively-based process of orientation is needed. There is a need for intentional search for information, and a need to keep track of the order, and sequence of information (rhythm) obtained in space and time while moving. Usually the

memorisation of learnt routes is based on the place itself, and orientation is based on the information from non-visual sources. The possibility of taking decisions is usually restricted by the lack of previous and/or instant information that assists change or interrupt a route, to choose a shorter way, to change to the side of a street, etc. The creation of a completely new system of references, independent of the existent references of the place (traditional landmarks, urban structure, importance of streets) could lead to a more dependent process of orientation. More important than creating new elements, equipped with their own features, is the need to mark and stress the existent features of the place, which are significant for its understanding. Depending on the place's formal structure, different design strategies might be implemented. When functional landmarks are available, it is necessary to stress their location and rhythmical sequence pointing out which are structural. In 'neutral' environments it might be necessary to create additional information, to stress the existent urban structure and perhaps to also create new functional landmarks. In 'messy' environments, it is necessary to eliminate barriers and obstacles for a better general spatial understanding, and to support independent movement along a desired route.

To provide additional information about the design logic of a new orientation system is crucial for its success – When a new system of orientation is designed, it is fundamental to provide for the users information about it (through models, maps, tapes, or instructions) previous to the actual use of the place. To know, in advance, that special textures in the pavement are indicating borders, or places where it is possible to change directions, or to access entries of facilities, is important for the understanding of their specific meaning in each situation. As an example, we can examine how the orientation system of the new bus station in the city of Göteborg is solved. The general information system is based on the presence of screens' signs, the gates' numbers, and information totems. This system is stressed by the general formal organisation of the station's architectural elements, which indicates shopping and sitting areas, information points, and circulation areas. Imagine now, that one is a blind user of the bus station. Somehow, one has to follow a safe 'line' between the shops, the information totems and benches, and to know where ones gate of departure is. The solution proposed is a rubber line on the floor marking with different texture the presence of crossing lines accessing the bus gates, and the totems with public telephones, signs, etc. The lines have good contrast of sound and texture against the granite floor, and run safely between shopping and waiting areas. However, as many examples of orientation systems for blind users, its success depends on the joint use of previous information (through a tactile map

or sound information), and learning in the place. If information about the existent hierarchy between the two main lines of circulation (close to the shops and close to the gates), and between the transversal connections (towards bus gates, or telephones and the like) is not available, the chances of understanding the system proposed are reduced.

To provide information about the quality and life that animates space – the mere information about orientation systems is not enough, without complementary information about what can be done in the space. Services, cultural activities, events, interesting aspects of the city architecture, history of places and buildings, are fundamental pieces of information. They help to improve not only orientation, but also appropriation of space. There are some similarities with the situation of a blind person, with a new comer in town. If there is no information about what exists in that place, the possibilities of exploration are limited. In a similar way, if a blind person only receives information about the orientation systems, his interest for further exploration is even more limited. A new comer in town can see interesting things and be attracted by them. But a visually impaired person cannot. To know about something, arouses interest and curiosity, and further enhances possibilities of exploration, and enjoyment of space.

To identify preferential routes and to make possible to switch routes – For the definition of preferential routes for impaired users in urban environments, two criteria are basic for the definition of the localisation, and design of the routes themselves. The first criterion is to define at least one possible route linking important centres of interest (such as public transport system, health and educational facilities, public services, etc.). For this definition, both potentialities and impediments along the routes have to be considered, taking into account the feasibility of design implementation. The second criterion is that accessibility along the routes should be continuous, and that connections between routes should be created. The choice of preferential routes should also depend on their possibilities of interconnection.

To provide continuity at least along accessible routes, if not possible in larger networks of routes – A perfect designed area without continuity with its surrounding environment is of little help for a visually impaired person. In our first example of the bus station in Göteborg, when someone leaves the bus station and enters the central train- station, no more tracks, or special information can be obtained. An even worse situation is confronted at the open space of the square situated in front of the Central Station. There, in some parts the rails of trams are imbedded in the same pavement used by pedestrians.

There are no tracks, or lines, that might conduct a visually impaired person to the trams, and bus stops, or to the local transport bureau. The difficulties of extending complex systems of information in larger areas are understandable. Subsequently, the selection of important routes has to be made to guarantee, at least, access to public transport system connections and main public services.

Design solutions must conciliate the need of being contextual with the need of employing unique or similar systems of orientation – Each place has its unique organisation, and design solutions have to be meaningful in the specific contexts. But it is impossible to memorise 'specially' designed systems or signs, with a particular logic, for each route, or each part of a town. This is perhaps one of the reasons why it is so difficult to reconcile the need for employing patterned solutions, with the need for agreement within specific spatial contexts. Even along a single route it might be important to solve different needs, and also to stress different spatial organisations. A route can pass, for instance, across a historical and a modern area. In the historical area, we find irregular streets design, frequent landmarks, small squares, narrow and crowded pathways limited by walls of commercial buildings. And there is no vehicular traffic. In the modern area are, long wide streets with no functional landmarks, viaducts, intensive vehicular traffic, wider pathways bordering open public spaces. Design solutions in both areas will probably be different. Even though, they necessarily have to share a common logical system of information that can provide continuity to the route.

To care about final meaning through the agreement of information provided by different senses – Design solutions can hardly be equal taking into account the variety of urban situations. However, they have to be consistent regarding the meaning they convey through their sensorial attributes. For instance, smooth, continuous surfaces of a pavement might mean – safe-walk, no obstacles. While, rough, textured surfaces (continuous or not) might indicate – be careful, obstacles or presence of urban equipment close by. As much as possible, design solutions have to follow a logic that stresses the desired meaning. Visual, sound, texture, shape, and smell attributes have to contribute to it. It is important to remark that feelings about materials, and colours, can vary with the culture and the places. For instance, in Brazil, asphalt with its very special texture, colour, smell, temperature (especially in summer), is always associated to vehicular traffic. However in Sweden, pathways for pedestrians and bicycles can be paved with asphalt as well, even if its primary use is for vehicular traffic roads. As a consequence, in Brazil, it is easier to use asphalt as a sign for vehicular road, and as a dangerous territory for pedestrians. Similarly, in Brazil, the colour

black is easily associated with vehicular traffic. In Sweden, to indicate the three different kinds of traffic consistently (pedestrian, bicycles, and vehicles) is more complex.

And finally, we should remember:

- To always consider that a blind person has in fact a different perception of the world. But also that he/she has the capacity to use his/her perception to understand the things that are in the world, according to his/her interests and needs, as other persons do;
- That design can help to increase the opportunities of bringing more information about the world that are not currently accessible to them;
- To study what impact the proposed designed changes will have for comfort, safety, perception, and understanding of the place for all users;
- That designing for all senses does not mean creating perfect environments where all sensorial information perfectly 'agree', but to bare in mind that we use all our senses to perceive space;
- To reflect that design, whatever we think or do not think about it, has other dimensions than only visual ones. And that, not taking this fact into consideration, might produce places that are very poor in their total quality.

HOW TO TRANSMIT SPATIAL INFORMATION IN A NON-VISUAL FORM?

> 'Mobility is not only dependent on knowledge about objects in the environment. In order for a person to be orientated, it is necessary for him or her to know his or her own position relative to a goal. Currently, a global positioning system is under development that can provide very accurate information about a person's location. The system is an extension of a navigation system designed for ships and aeroplanes, and has reached such a degree of accuracy that it may be used for individual manoeuvring. With aeroplanes and ships, position is indicated in degrees of latitude and longitude. The most important task in making navigation devices that are useful for people with visual impairments is to find a way of indicating where the person is located in a manner that makes sense to the user. This must be a map that is both readable and which presents and environment with landmarks that the blind reader can experience. In this way as well, telecommunication can contribute to equality by making society more open to its citizens, and making them independent of impairments and disabilities.'[225]

Two related design problems are presented in the paragraph above. The first is *what information is meaningful* for a visually impaired person actually orienting in space. The *second is how to actually design the information instrument* to make it understandable for the user. The offer of necessary information in this case is given in a supplementary form. Basically there are two modes of giving information in space and time, independent of the information support. Firstly, information can be obtained previously from maps/or models, and through oral instructions from a tape or a person. Secondly, information can be obtained in each place, in a dynamic form by instruments like navigation satellite systems possessed by the individual, or fixed in special locations like sensitive electronic cells. Whether the information is given previously or instantly, in a dynamic or static form*, the nature of the information does not change*.

Most of this thesis focuses on *the investigation of the contents of information*, which are needed to improve orientation. Furthermore, emphasis is placed on how to promote changes in the environment itself, rather than creating special information systems. However, the need to provide additional information about the design logic of a new orientation system is presented as crucial for its success. In the absence of visual information, it is more difficult for the

[225] Stephen Von Tetzchner (1991), p. 472.

individual to relate ones own positions with local landmarks. Even more difficult, is to perceive and understand spatial relations between external landmarks. This understanding is only possible sometimes through additional information. Moreover, only supplementary information can support the comprehension of spatial relations that cannot be perceived in a direct form while using space. The design of accessible spaces for visually impaired persons is not a matter of creating special channels of safe movement. The design of devices, tools or objects as complementary forms of spatial communication is not a matter of 'translating' visual information through other means.

It is of fundamental importance to consider that the spatial perception of visually impaired and blind persons is different, both to select important information, and to actually design how this information can be accessed. Tactile maps and models are very useful if they are conceived like *diagrams*.[226] Diagrams help us to understand complex information, and to put them in the right places. In the same way, a three-dimensional model, or a tactile map, can help to organise and locate different impressions and perceptions that could not be joined in the absence of visual information.

A great deal of this study and observations, were dedicated to the evaluation of how supplementary information for orientation was offered in the city of Florianópolis. During the development of the design cases, both the lack of relevant information, as well as the excess of unnecessary information were observed. However, time limitations, and the complexity of the problem, among other reasons, did not allow for the development of design solutions for additional systems of information. For this reason, the following suggestions refer mainly to what needs to be included as supplementary sources of information, rather than of how to effectively design the information device. Even though limited in their reach, I considered their inclusion for consideration relevant.

On including information about permanent and dynamic features of the city spatial structure dynamic features are central for orientation and understanding of urban spaces (transport, human activities in the streets, bus services, events,

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[226] Visual diagrams support the understanding of complex or unavailable relations between physical objects, human actions or abstract ideas by its visual representation in a special form. This form assigns to each diagram component particular spatial positions, which are in turn related to notions based on sensory body positions. For instance the elements occupying top and central positions are immediately perceived as more important or general than lower, or lateral ones (the head and heart as centers of ideas and life).

reparation works on the streets, new constructions, etc.). The character of dynamic activities and events presupposes the need for changes in the content of information. It is therefore more feasible to adopt dynamic means of communication, which include sound, and oral communication. Computer terminals, sound information, and public telephones, are ideal vehicles for this. They presuppose the creation of a network of urban information service, which can be utilised by all citizens.

When studying *tactile maps or three-dimensional models*, usually, visually impaired persons have to interpret a scale representation of spaces. However, maps and models are more important in facilitating a synthesis of disparate experiences in space, and on informing about directions, and relative locations in space. The identification of the function of important landmarks is more important than a true representation of their physical dimensions. In the usual orthogonal representations of 'sensible spaces' very often the distance represented does not correspond to the felt distance walking in real places, especially when they possess other sensorial qualities that are not represented.

The *positioning of informative maps and models* in the urban environment has to be coincident with the surrounding space.[227] One of the best ways of achieving this objective is to place the map horizontally in a platform that can be touched, or read, from above. The person has to have a predefined position to reach the map, which must coincide with the directions of the environment represented. In this way the common problem of contradictory information between directions in the map, and directions in the real world is eliminated.[228]

Appropriate symbols to represent the significant elements used by the blind in their orientation, which distinguishes their importance as key-structural or minor-local references, and also indicate where permanent obstacles are, must be designed.

A search for *meaningful representations of 'unknown' spatial elements* that cannot be directly perceived by congenitally blind persons should be conducted.

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[227] An information totem with a tactile map, which was part of an information system proposed for the Park 'Trädgårdsföreningen', was actually designed by myself, during the first stage of my studies in Sweden. See Dischinger, Marta (1995), p. 65.

[228] From psychology experiments made with normal seeing people it is known that the mental rotation of maps is a difficult task. The difficulties of interpreting the conflicting information, from the map and from the environment, are certainly increased for blind persons, since their possibilities to perceive distant environmental information are restricted. In Spencer, Blades and Morsley (1989), pp. 144-149.

It is necessary to consider the relevance of their presence in the map, for orientation and understanding of the place. And also to consider that from the designed representation (and description) will be constructed the very 'idea' about this element, and the possibilities for its recognition.

To *include representations and descriptions about sensual characteristics of spatial elements,* which are important to the understanding, recollection, and effective use of places. In this sense our maps, models, and oral descriptions have to be conceived in a different way and search for proper symbols that can correlate to the nature of the different sensory attributes.

To consider the *technical aspects about the legibility* of tactile maps and models. There is a need to search for a balance between:

- The selected relevant information that needs to be conveyed to users and the technical possibilities of doing that (depending on fingers accuracy, and area that they can explore);

- The questioning of the point at which scale precision is relevant (or if maps have to be more symbolic and thematic like a subway's map);

- How to combine and convey the tactile information with other oral or written information contained in the same device, or in other devices.

To effectively put in practice any of the points above it is decisive that one investigates the ways in which spatial information can be transmitted, and effectively perceived. To be able to select what to inform, in the absence of vision, it is necessary to know what types of information are available for normal sighted people. In addition to that, it is necessary to study how the information can be perceived, and understood, through a different process of perception. Strange as it might seem, it is necessary to study how we interpret visual representations, to transform visually based information into sound, or tactile based information. To study why, and how, is easier to understand complex information through its visual representation, is crucial for the application of this knowledge in a similar design task. Practical and technological investigation in that field is usually associated, with the use of computers by blind persons, or with the design of special environmental instruments and devices that support the acquisition of visual information. However, the study of how complex spatial information can be conveyed through non-visual representations is still a new and fragmented area of investigation, and a challenging field for future research.

7.4 DESIGNING FOR ALL SENSES

These last reflections evolved chiefly from my attempt to understand how space can be perceived, when vision is not possible. They arise from what I learnt about space from visually impaired persons. What they perceive, and how they perceive it. What they understand from different spatial situations. The kind of difficulties they confront while orienting, but also their purposes and wishes, and the enjoyment they can derive from space. To understand the problem I had to analyse urban spaces from a different standpoint. It was necessary to further scrutinise concepts of orientation, and to develop a differentiated spatial analysis. This analysis intended to classify spatial elements, with a focus on their perception by the other senses. This approach also increased my understanding, as a person, on how we all perceive space. Further on, it made me realise the importance of attributes, which are usually forgotten in design practice. Thus, I would like to re-examine, almost point-by-point, the conclusions presented previously, highlighting how they can be valuable for the design of spaces, for all persons, and for all senses.

DIFFERENT APPROACH TOWARDS ORIENTATION

The mere application of technical solutions to improve the accessibility of visually impaired persons in urban environments is limited both in its conception and its final practical results. It reduces both the complexity of the problem and the possibilities of finding better design solutions. The usual misconception that we have of blind persons, as 'lost in darkness', arises from our own feelings of insecurity that we, who are not blind, experience when for some reason we cannot see. But we close our eyes to listen to music, don't we? And does space disappear because we don't see it? Or rather, we have no words to describe this *other space*, which is not formed from our visual impressions? If space is more than just visual space, why then should the design solution of accessibility to urban spaces for visually impaired persons be conceived as only that of finding tracks to follow? *The very consideration of accessibility as only an orientation problem, a way-finding process, is a strong reduction in itself.* More important than that, it takes away the intentionality of movement in space, and the independence of choice. It takes away the need of individuals to understand, participate and enjoy space. It also condemns the visually impaired to their condition of handicap, since it does not see them as capable of using and enjoying space as others. What is more, it also condemn us, seeing people, to design spaces that does not take advantage of the fantastic source of experiences that other senses than vision can give us.

I have concentrated my effort at studying how to support the orientation of the visually impaired in urban environments. The improvement of their conditions of orientation is basic for supporting a stable platform for further exploring and experience in space. The very notions of further exploration and understanding are essential for the comprehension of what orientation really is. For any person, with or without full possibilities of perceiving the environment, to orient is a purposeful act that means more than independent mobility. *To orient involves a basic understanding of time-space situations, and a comprehension of relations in a spatial context.*

We all are different, and in one way or another, handicapped while confronting certain situations. The possibilities of perception of space certainly affect the possibilities of recognition, understanding and use of space. And when one of our abilities is lost others have to compensate for this loss. *The integrated use of all senses, that seems so naturally obvious in the perception of space by the blind, is seldom recognised as a fact in the perception of space by normal seeing people.* However, we all perceive, understand, use and enjoy space, not only because we can see. But, also due to the fact that we can move in desired directions throughout spaces. We can hear sounds of movements, activities and natural events in space. We can touch and be touched. We can feel the soil we walk on. We can feel the warmth of the sun, and smell the scent of the flowers, or of smoke. We usually assume that we perceive space only by seeing it. But our understanding of space is attained through the integration of all our sensory experiences in the world. *And it is the combined perception of manifest and discreet attributes of space that make it possible for us to perceive space in its wholeness, even if we are not conscious of that.*

This happens because in the perception of space, usually vision dominates and obliterates the information brought by the other senses. We are more consciously *aware* of the information brought by vision and the *manifest* visual features of space, and they usually 'overlap' over the perception and recall of *discreet attributes provided by the other senses.* Yet, if we take away all the non-visual attributes of space, what is left, is much less than we can possibly imagine. How can a space be without sounds? Can we imagine the quality of a space without any tactile information about it? Where might the enjoyment of a park be without scents, or without the feelings of the sun's warmth and wind's breeze? Could we actually move in space if we did not have the ability of maintain our balance and of self-orienting?

REDUCTION OF SPATIAL COMPLEXITY IN THE DESIGN PRACTICE

Understanding of space only from its visual attributes not only disregards its other sensory qualities, but also takes no notice of the human actions that create space. *The understanding of space through only its visual materiality is a poor and 'frozen' reduction of the life that animates space.* Human spaces that were built up from action itself posses all these qualities. But often, spaces are conceived of on reductionist basis where only the functional and technical aspects of human actions are considered. Consequently, most of its non-visual and non-measurable dimensions are also forgotten. Paradoxically, the very professionals who are responsible for the planning and design of space are the ones who most blatantly disregard this fact. This 'handicapped' conception of space partially arises from an education, which overestimates the importance of formal visual aesthetics and dimensional technical factors. The quality of space, which considers all senses, is seldom addressed as a necessary dimension in the teaching of design professions.[229]

The dominion of dimensional and visual aspects in architecture is deeply rooted in the history of how men conceive and represent space in the occidental culture. Space and time are basic categories of human life. However their meaning is rarely discussed and we tend to consider space and time as natural facts, made natural through the attribution of its common sense. Even though possessing complex dimensions, usually space is treated like an objective attribute of things that can be measured and apprehended.[230] Space as a 'thing' can be represented, planned, parcelled, sold, conquered, altered, destroyed, transformed and created by men.

To measure 'space', is an essential act, which expresses the domination of space by men. But even if men developed systems and tools that can measure and register all sorts of distances between things in space, from the infinitesimally small to the increasingly big, space itself has no fixed dimensional attributes. The conquest and control of space needs, as a precondition, the very idea of malleability and usability, as stated by David Harvey. Also, according to him, it was the utilisation of perspective and mathematical cartography during the

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[229] There are specialised fields of knowledge in architecture, which deal with the other senses. Acoustic and environmental comfort are very well established and developed areas of knowledge. However, in most architecture schools these fields are considered as 'technical specialisation', and they seldom take part in the basic curriculum.

[230] Harvey, David (1989), The condition of postmodernity: an enquiry into the origins of cultural change, Blackwell Publishers Ltd., Oxford, pp. 201-203.

'Enlightenment' that made it possible to represent all spaces of the world, seen from 'above' the world, as abstract, homogeneous and universal in its qualities. This frame of thought associated with the Euclidean geometry furnished an objective and neutral language of representation that facilitated the transformation and ordination of the natural landscape according to its technical representations.[231]

To be able to represent and measure space it is necessary to abstract from space itself. This capacity of abstraction is founded in our human condition. Our standing position in the world, our possibilities of movement, our capacity of seeing, hearing and feeling the world are the basic foundations of our essential spatial notions about directions, forms and dimensions. They make it possible for us to represent and to create spaces in the world. Not only do we forget this, but we also usually take for granted the importance and power of spatial representations of the world. Spatial representations are not just neutral 'means' employed to register, analyse, communicate and conceive spaces. They are very powerful instruments of control of space. And both in the choice of what is represented, as in the ways 'things' are represented, spatial representations reveal unexpressed assumptions about what kind of relations in space are significant for the design of spaces. The first of this notions is that the objective representation of space, through the scale reproduction of its orthogonal and physical dimensions, corresponds to the real space represented. And the second one is that new spaces built according to their representation fully correspond to what is represented there.

These two assumptions have various consequences. The first, and more obvious consequence is the reaffirmation of spatial representation as means of control and power over space.[232] Technical drawings rather than technical means of communication can be used in conflicting situations as instruments to manipulate those who do not understand a highly conventional and abstract language, and that cannot be related to experienced spaces. And the second one, which I am arguing here against, is that these *essentially dimensional representations do not necessarily coincide with the existent sensible spaces, nor with their future sensible*

[231] Ibid., pp. 240-259.

[232] Sack, Robert David (1986), Human Territoriality: its theory and history, Cambridge University Press, Cambridge.

quality. And this because, the very simple fact that the geometrical properties of an object are the ones which tell us less about its qualities.[233]

NEW WAYS OF STUDYING AND REPRESENTING SPACE

The very absence of non-visual attributes in architectural spatial representations, in spite of the already existent new media possibilities of representing them, like virtual reality, is one more evidence of how disregarded they are as important elements for the conception of space. Their need is seldom addressed as a necessary dimension in the teaching of design professions. And what can be usually observed is that a 'visually-centred' standpoint still dominates the ways of analysing, representing and conceiving space. Drawings and photographs promptly communicate visual and dimensional features of specially designed spaces, where very often no human beings can be seen to disturb the perfection of architectural beauty. The usual design instruments, for analysis, register and conception of space, are seldom adapted for the representation of non-visual attributes. How can we record, for instance, in urban maps the specific sources of non-visual information used by the blind? The very scale of detail, that is needed, and the essentially dynamic character of these spatial attributes are only supplementary difficulties to their representation.

In spite of these restrictions, I seek to develop methods and tools to understand and analyse the problem of how the visually impaired could perceive urban spaces, and which conditions the urban space offered for their perception. This dialogue, with the people and with the spatial situation, showed me that it was possible to register, consider and evaluate the importance of non-visual aspects not only for them, but also for everyone. In order to reach this approach, in first place it was necessary, to overcome my own preconceptions and disabilities to understand the design situation, being able to place myself in the place of the other. Secondly, it was important to relate to the pros and cons of the other parties' ability to communicate and take part in the design activity, being conscious of the power and limitations that different actors did have. Thirdly, it was important to take into account the existent general difficulties in getting insight, articulations insight and communicating insight about the situation, especially when these come from participants with different abilities and life experiences.

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[233] Merleau-Ponty (1945), p. 351.

A non-visually based analysis of environmental properties for the evaluation of spatial perception was proposed in this thesis. Some basic points constitute the basis for the development of such an analysis. The first one is that spatial perception depends on the integrated work of all our senses. Consequently the consideration of both manifest and discreet attributes of spatial elements are essential for spatial quality. The second point is that orientation should not be confused with independent mobility, but that is based on purposeful movement and understanding. The third point is that spatial knowledge is based on individual and environmental frames of reference, and also on cognitive processes of learning. Subsequently, it was necessary to further examine main environmental spatial elements responsible for the perception and understanding of spatial structure. The importance of routes and their intentionality was stressed and further discrimination of the concept of landmarks was needed. Landmarks were thus classified according to their reliability as spatial reference, and to their significance in the understanding of the meaning of space. And the importance that permanent features of urban spaces and dynamic and cyclical events have as landmarks was stressed. Also concerning the perception and mental representation of the urban structure was suggested the importance of the permeability of open and closed urban spaces. Finally a differentiated classification of urban spatial elements over non-visual basis is proposed.

These concepts and methods can be starting points for the development of a design conception considering all senses. The restrictions I felt in trying to communicate these results while using the traditional tools of representation suggests that further research is needed. Consequently, to develop more appropriated means for analysing, representing and conceiving non-visual attributes in the design practice is necessary. But prior to the technical aspects of developing such means, comes the need for recognising these attributes as essential for the total quality of space. The consideration of human life with all its potentialities is a first step for a change in our conceptions of what is space, and how to design better spaces. Yet often disregarded, the consideration of all spatial attributes is crucial, not only in the design of special environments accessible to impaired citizens, but also as a necessary condition to guarantee a better spatial quality considering all users.

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