Mapping for Change

Tactile Map of UBC

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I. Introduction

Mapping for Change is a joint project between the Campus Sustainability Office (CSO) and the Disability Resource Center (DSR) to increase the accessibility of UBC facilities for visually impaired students, faculty, staff and visitors. The present report offers a review of the available literature on tactile cartography including the use of the Braille system and guidelines for tactile map design. It also presents the project itself and reviews the resources and challenges of the project.

Being a representation of the 'real world,' maps help to organize information, movement and location. Maps play a major role in shaping one's understanding of the world. As Robinson puts it, by looking at a map, the map percipient "augments his understanding of the geographic milieu, that is his previous conception of the real world" (7). Cartography, being a communication system, transmits information from a source to a destination through a medium constituted by a map. Nevertheless, the process is not straightforward: information is not transmitted purely form one stage to the next. Instead, along the communication process noise entering the system prevents complete understanding. Maps are never "hermetically closed off from [their] context" (Arheim 5); therefore, the process of cartographic communication is embedded within a larger framework shaped by culture.

Among the different sources of noise that can impair cartographic communication include:

- Distortion arising as a result of incorporating "complex processes of selection and interpretation in both the source (the cartographer) and the destination (the percipient)" (Robinson 9). Reality is complex and its representation always involves a process of simplification: not all can be represented. As a result, the cartographer, through a process of decision-making, selects what to represent and how to do it. Perceptual and technical barriers that prevent a complete representation of reality limit the process of encoding. In the same way, the map percipient goes to a process of decoding in order to assimilate what is being represented. This later process is also limited by the percipient's intellectual background or past experiences.

- The context in which the communication takes place also shapes the ultimate success of the system. In tactile cartography this is particularly relevant. For example physical conditions such as temperature profoundly affects the percipient's sensibility, e.g. in cold winter days, the sensibility in the finger tips of visually impaired percipient is greatly reduced. Some claim that it may take up to an hour to recover the full sensibility and 'reading' capacity.
- Culture also influences cartographic communication. Post-structuralist readings of communication systems have emphasized the role that culture plays in shaping how reality is conceived and how it is represented. It is often claimed that truth is always relative within a cultural paradigm, and no map can actually present the milieu without the bias of culture or background.

III. Tactile Cartography

Tactile cartography is a communication system. In **Mapping for Change** the potential sources for noise entering the system is even greater. As sighted cartographers we can only have an indirect learning of how visually impaired people 'read' a map. We also have indirect understanding of how they perceive space; how a mental representation of their milieu ‘looks’ like.

Spatial understanding differ among sighted people and visually impaired people for which each have to develop different abilities so that the person’s mobility is not curtailed by this physical disability. Spatial mobility is an essential aspect in a visually impaired person’s life. It must be “purposeful and goal-oriented” (Fleming 9) so that he or she can travel safely by discovering and inferring spatial extension, arrangement of objects and states of motion. Visually impaired people have to develop more their senses, like touch or hearing to compensate for vision, in order to integrate all the information of their surroundings. However, blind people have the same cognitive spatial abilities as sighted people, but their configurational knowledge is less complex due to different access to information and past experiences (Perkins 1). A visually impaired person has to code in sequential operation and as Brambring argues, he or she needs to have information about the relation “between the self and the aspects of the environment, rather than to have descriptions of the environment without such relations” (Fleming 5).

A visually impaired person’s internal spatial imagery is different form that of a sighted person due to the different methods used to understand the relationship between the environment and oneself. Tactual perception is a “fragmentary and serial process of obtaining useful information about the environment” which requires active exploration of localizing landmarks and routes through the skin (Fleming 8). For this reason, space is sequentially perceived in a functional manner and requires the use of memory to learn the order of turns and distances. Emphasis is on the sequence of landmarks rather than on the aerial distribution as it would be for a sighted person. As a result, spatial knowledge of the visually impaired has to be understood as conceptual rather than perceptual.

Deprived of spatial abilities, visually impaired people are curtailed from abilities that help to be able to move safely and independently. Fleming argues that in order for a tactual map to serve its purpose of enhancing spatial mobility, the 'traveler' has to have knowledge of its own location, the desired route and the destination. In this respect, orientation becomes a pivotal skill. It is defined as the capacity of "ascertaining distances and directions from the self to specific objects" (Fleming 10). Visually impaired people operate form 'egocentric perspectives' as their spatial knowledge depends on the localization of objects in respect to oneself rather than from a general geographical reference system that result in spatial distortions (Millar as quoted in Fleming 34). There are different levels of visual impairness according to the age of onset, which in turn, affect the level of previous sighted experiences and the acquisition of perceptual element. In addition, people with partial sight might be able to see different objects that can help for directional orientation. However, it becomes difficult for visually impaired people to keep directional orientation on routes that have merging paths, and the only available landmarks are concrete and grass.

During the 1980s, Fletcher developed three theories that address the relationship between visually impaired and sighted people's ability to understand the concept of 'space' (Fleming 46). The first one is called deficiency theory. It claims that visually impaired people do not have the ability to develop a spatial reference system. The second theory is the inefficiency theory that states that visually impaired people have the ability to create a spatial reference system despite that it is not as complex as one of a sighted person. And his third theory is the difference theory that explains that in visually impaired people the spatial concepts are only partially curtailed, but not eliminated. They enhance other capabilities like smells, sounds, changes in path gradient, and texture (Castner 8). This last theory has gained wider acceptance and as a result, the distinct characteristic of tactual mapping is on portraying information that will enhance movement and location of the map user by incorporating elements that will help to create accurate knowledge of distances and directions in the layout.

Once acknowledged that tactile maps are representations about movement and location, the themes to place more attention are distance estimation, map-memorization, recall symbol layout, self-location, and route knowledge. However, these will vary firstly, according to the purpose of the map: if it is for creating a general idea of the place layout, if it is for route taking and if the map will be used before or during travel. Secondly, it will vary according to the map user abilities and necessities. Nevertheless, Millar points out that there are three essential abilities required for any successful map reading (Fleming 33):

- Discrimination of spatial objects or shapes
- Location of objects in relation to the self
- Location of objects in relation to each other

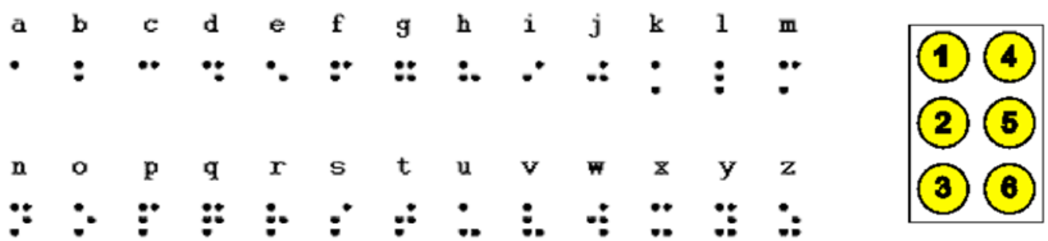
Anticipation is an essential element for a visually impaired person's mobility. The map user has to judge the distance he or she has to travel according to the time it takes to get from one reference point to another landmark. The map user has to dedicate some time to read and understand the map beforehand by using their fingertips to "explore and read raised images" (Gardiner). This process is physically explained as an "alteration of [the fingertip to] usual contours through contact with a surface, provid[ing] stimuli to nerve endings in the skin (Gardiner). During the tactile exploration, readers are only able to understand what is represented if they are able to feel each part of a raised image, and discriminate between them. Therefore, the importance of symbol clarity and distinction will be the basis for correct anticipation and learning of the spatial distribution of the area mapped.

Labelling a tactile map can be done in two different ways. The first consists of raised print while the second one comprises both enlarged print and Braille. The method used depends on the map user's preference. However, Braille is commonly regarded as the standard system used by visually impaired people. Braille is a "tactile system of raised dots representing letters of the alphabet" (CNIB). Reading of Braille is done through physical sensory of the fingertip over the raised Braille code. This system has a basic element known as the Braille cell that is comprised by six dotes numbered in two vertical rows. As a result, each dot or combination of dots represents a letter of the alphabet. Moreover, there is a contracted version of Braille which is considered de equivalent of the sighted people shorthand and aids for an easier reading and writing. The Canadian National Institute for Braille explains that Braille can be produced in a number of ways:

- It can be transcribed from the original printed text on a machine that resembles a typewriter. The Braille writer has six keys which correspond to the six dots of the Braille cell.

- Computers are also used to transcribe and reproduce Braille texts. The electronic revolution is changing the way Braille is produced, stored and retrieved, making it easier to use.

Braille Alphabet:



IV. Map Design in Tactile Cartography

The common thought of a tactual map is to design it as a direct translation of the visual design to a raised tactual equivalent (Campbell quoted in Fleming 3); or as Gardiner expresses: as an extremely simple version of a visual image. However, because the focuses should be centered upon mobility direct transliteration of a visual map into a tactual map can result in confusion for the map user. For this reason, there is the need of a thoughtful design to reduce problems like illegibility, cluttering, figure-ground confusion, and unclear symbolization. It is important to select only the relevant data so that the map is both efficient and effective. Gardiner suggests that a tactile map package should comprise the map, a separate key, and a "'how to read' information in sound format" in addition to a printed version for sighted assistants. The idea of this package is to provide all the necessary information without making it heavy or hard to manipulate.

One of the most challenging issues in communication through a tactual map is the representation of distance on a map. There are two types of scale that can be used in a tactual map: “fixed-scale map, which is orthographically equivalent to the conventional visual map, or flexible-scale map, which presents a topological representation of space” (Fleming iii). Because visually impaired people organize information through the cognition of space and distance, Robinson argues that “the scale on a map must vary from place to place and will commonly also vary even in different directions at a point” (Fleming 20). Moreover, Gardiner argues that “scale may have to be distorted in some sections of a map to enable tactile discrimination between symbols and therefore, the scale of a tactile map should be loosely interpreted.” Nevertheless, Fleming’s study result’s showed that neither scale proved to be more effective (141). Therefore, scale variation should be consulted with the map user to find out how comfortable they feel with it.

The choice of the scale impacts the size of the map and in turn the amount of information that is going to be displayed. It has been argued that if maps are made using smaller dimensions, an holistic impression will be easily obtained by the reader and with less reliance on memory to integrate essential information” (Fleming 6). For this reason, tactile maps should be larger than visual maps if they want to represent the same areas with the alternative to create several maps. Maps should not be clustered and the symbol size has to be larger than its visual equivalent. In this respect, symbol production depends largely on the technology used (Perkins 523). In addition, symbols should suggest the object they are representing, as it is easier to relate them cogitatively and should be separated for clear tactual legilibility. Tactile discriminability depends on the “quality of symbol and map designs, particularly the spacing between each part of a map or diagram**”** (Gardiner).

Attention has been directed to the importance of a close relationship between the map maker and the map user as their respective activities and needs have to be fully understood in order to make an effective and efficient map. One of the main problems with tactile mapping is that research is done by sighted, western people and in an urban context (Perkins 525). Working consciously of the spatial perceptions of visually impaired people is pivotal in the design of a tactual map to aid people to go beyond the self-centred approach and to gain spatial knowledge and more importantly, to enhance their mobility with the aid of a map that is effective in communication shape, distance, location and direction.

In order to start the map several issues have to be addressed: (Gardiner; Amick)

- What is the purpose of the map? Is it going to be used for independent travel? Is it to represent routes or to give an overall distribution of the place? Is it necessary to create several maps to convey the purpose?
- Will it be used by individuals with or without guides (canes or dogs)? Is it for a group activity? Does it has to be portable? Will it be used indoor or outdoors?
- At what point is it going to be used? Before or during the visit? Where it has to be more clear?
- What will be the map content? Which will be the page layout? What type of reproduction technology can be used?

V. Recommendations

Despite that the design of a tactile map has not yet been standardized, organizations like the American Printing House and the American National Library Service for the Blind have published several guidelines for design that provide insights for the design procedures. We came up with the following set of recommendations:

- Above all avoid frustration.
- Do not overload the map.
- Make an important landmark the initial reference point to start reading the map.
- Maps should be produced for both raised print and large print/Braille.
- Font should be sans serif which is easier to read and matches the Braille character size and line spacing.
- Large print should be at least eighteen points in size for use by low vision persons.
- The map should consist at least of two separate parts (map and key) so that the map user does not confuse the map and the key.
- A third part should comprise the instructions: title, scale bar –if necessary,- position of the layout and how to get to the initial reference point and any other relevant information.
- Make the map users concerns and needs the central element in map design, as this is the only fact that will actually make the map efficient.

VI. Mapping for Change

Mapping for Change is a joint project between the Campus Sustainability Office (CSO) and the Disability Resource Center (DSR) to increase the accessibility of UBC facilities for visually impaired students, faculty, staff and visitors. Through the creation of a tactile map of UBC both institutions come closer to their mandate and goals. On the one hand, the map builds upon the Disability Resource Centre commitment to a more accessible campus and to the elimination of structural and behavioural barriers for persons with disabilities. On the other hand, the map contributes to the Campus Sustainability Office's goals of enhancing the social sustainability of UBC, and of facilitating a more equitable campus for all.

a. Partners

I. Campus Sustainability Office

The University of British Columbia was the first university in Canada to implement a sustainable development policy. One of the first actions included the creation of the Campus Sustainability Office. UBC aims to be a leader in campus sustainable development. Committed to the promotion of social sustainability on campus, the Sustainability Office is collaborating with the Disability Resource Centre in the creation of a tactile campus map. This partnership is canalized through the SEEDS program, which is later explained.

SEEDS

Social, Ecological, Economic Development Studies (SEEDS) is a program where student, faculty and staff work together to implement sustainability strategies at UBC. Approximately 200 members of the UBC community have participated in different projects. SEEDS bring together students looking to gain experience and academic credits, staff looking to collaborate and faculty willing to contribute to particular projects.

II. Disability Resource Centre

The DRC mandate is to “eliminate structural and attitudinal barriers to those with disabilities.” It works together with other areas of the university to facilitate the accessibility of UBC campus. In regards to visually disabilities, the DRC supports the Crane Centre, which offers a collection of texts in Braille. In addition, assists students with special needs by hiring note-takers and arranging examinations. The DRC contacted the UBC office through the SEEDS program for the creation of a tactile map of campus.

III. Professor Sally Hermansen

Sally Hermansen is a Professor from the Geography Department at UBC. Her research focus is GIS and Cartography education in post secondary school programs. In the department, she teaches GIS and cartography courses. Advanced Cartography is a fourth year course, where she encourages students to get involved in mapping projects. The present project emerged as part of her final assignments and relies extensively on the learnings from the course.

IV. Brenda Madrazo and Juan Gabriel Solorzano

Juan Gabriel and Brenda are both undergraduate geography students with cartographic experience.

b. Target Group

A tactile map of campus will benefit not only the current students and staff that is visually impaired, but also newcomers and even visitors to conferences. In addition, it will facilitate the recruitment of future visually impaired students. UBC attracts a large number of students with visual disabilities because the Crane Library has a significant collection of texts in Braille and offers a variety of accessibility programs through the DRC. In the first place, the present project is targeted to current UBC members. Approximately 50 current students, faculty and staff are blind; many others are visually impaired. In second place, UBC and the DRC offer a number of conferences with substantive participation of visually impaired students. Therefore, the purpose is to tailor a map that will strengthen UBC Conference Services in organization and accessibility capacity. In addition, the need for a map of the Bus Loop as well as one of the SUB has been widely expressed as this areas are pivotal for university life and access. Finally, the maps will be used by current and future students, and can be cited by UBC Recruitment Services as one more reason for students with visually disabilities to study at UBC.

c. Objectives

- **Strengthen UBC accessibility for students, faculty and staff who are visually impaired**. The University of British Columbia is committed to increase the accessibility of its campus for those with disabilities. By supporting the creation of a tactile map, UBC explicitly manifests this commitment, and facilitates the orientation and navigation for those with visual disabilities.
- **Facilitate the organization of conferences and congresses for the visually impaired.** To create a map of the main facilities, buildings and landmarks that

visitors with visual disabilities will require. Although this part of the project will rely on the research, information and base map used to create the UBC tactile map, it will be tailored for the specific needs of visually impaired visitors.

- **'Open' new areas of campus to student with visual disabilities**. Students, faculty and staff with visual disabilities are often *de facto* excluded from some areas of the University campus, as they lack from a map that allows a mental spatial representation of the different features of UBC. Maps play a major role in shaping the spatial representation that other students have of UBC campus. In the same way, a tactile map will play a significant role on a safer mobility; therefore, on how visually impaired students conceive their university.

d. Resources

- Monty: He provided us with information about his navigation around campus as he is visually impaired. i.e. landmarks he used, preferences for routes. He also provided us with examples of tactile maps.
- Michelle: She helped us in the preliminary test of the sample map and has offered her help for further development of the project.
- Provincial Centre for the Visually Impaired (PCVI): Seema Kapoor has created numerous tactile maps for elementary schools in the GVRD.
- Canadian National Institute for the Blind (CNIB): Mike Nicholson, Coordinator of Client Services of the CNIB in Vancouver has also offered advice on the project.
- Tactile Colour: This Company produces maps and other products for the visually impaired. Lois has provided invaluable advice on the importance of incorporating

map users into the creation process, and how to conduct the survey. She has also offered to assist us in later stages of the process.

e. Challenges

- Initially none of the team members had experience in tactile cartography. So how to create a tactile map? How a tactile map actually looks like? What type of technology is used?
- Define the scope and purpose of the map. What type of map is needed? What to map? What size? How many maps are needed?
- What organizations could provide support for the creation of the map? How much would it cost?
- Poor response from the potential map users. We aimed to create a product that actually reflected their needs, and avoid a unilateral approach to the project where we defined what needs to be mapped and what does not. To achieve this goal we invited all the visually impaired students, faculty and staff that of the DRC list serve. Unfortunately, very few people responded to the e-mail, and the TA strike and protests led to the cancellation of two meetings. This remains as one of the greatest challenge for the project: how to get potential map users involved in the project, so that their actual needs are addressed.

VII. Future Development

Some of the most important remaining tasks include:

- To meet with potential map users so the sample map is evaluated by a greater number of persons. With the help of a survey, this has the purpose of collecting relevant information and feedback about the content and design so that the final version of the map that will result in a more user-oriented map.
- Integrate a resource group with some visually impaired students who will be interested in providing feedback in the creation of the maps.
- Have the map evaluated by personnel from the PCVI, the CNIB and Tactile Colour.
- Look for funding and sponsors within and outside university. Some options include AMS, Conference Centre, Recruitment Office, Medical Companies…
- Go through the printing process that includes doing some graphic design.
- Talk to Conference Centre and design a map tailored to their purposes.
- Create a sample map of the Bus Loop and the SUB.
- Decide if there is the need of a single or multiple maps of these areas.

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