STANDARDIZATION OF TACTILE MAPS IN BRAZIL

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ABSTRACT

There are not worldwide accepted standards for maps or cartographical conventions in terms of tactile cartography the way same way as it can be applied to conventional cartography produced for people without any kind of vision disability. This way, it is necessary for each country to create its own standards and to establish norms for tactile cartography, using as basis the existing raw material, the degree of technological development, the accessibility and the training of the visually impaired (VI) to use these products. Thus, some considerations are proposed here concerning the standardization and production of tactile maps in the Laboratory of Tactile and School Cartography at Universidade Federal de Santa Catarina and also in Brazil. The methodology adopted in two processes of production and reproduction is described and the results from the standardization of tactile maps deriving from a research project in this laboratory are presented.

1 INTRODUCTION

In Brazil, there are some public organs and philanthropic entities that support disabled people, such as Instituto Benjamin Constant (IBC) (Benjamin Constant Institute), in Rio de Janeiro, which is associated to the Department of Education; Fundação Dorina Nowill para Cegos (Dorina Nowill Foundation for the Blind), and Larama – Associação Brasileira de Assistência ao Deficiente Visual (Brazilian Association for the Visually Impaired) – both located in São Paulo, which produce, adapt, and distribute several materials for pedagogical activities and also for the daily life of the blind or for those who have some vision impairment. Among such materials, it is possible to find a few maps, and graphics. However, despite of the praiseworthy efforts that these institutions make in what concerns the tactile maps, neither have they been able to achieve an efficient cartographical pattern or a sufficient cartographical pattern to teach Geography and History, nor have they been able to meet the national demands. Some of the causes which might be tackled are the lack of specialized people in Cartography or Geography involved in this production, a total handmade way regarding the production, the lack of an efficient policy or other inherent system problems. Consequently, there is too little in terms of tactile cartography in most Brazilian schools, and, besides that, the special education teachers are not ready to teach by making use of these tactile maps (LOCH, 2008).

Besides the organs mentioned above, some initiatives to produce tactile maps in state or city organs are known and also from some researchers professors spread all over the universities in our country, such as Vasconcellos (1993) and Vasconcellos (1996), Sena & Carmo (2005) and Ventorini & Freitas (2005); Ventorini (2007), among others. They have been researching and developing theses in which the topic is tactile maps and models to teach Geography. Other professors have been trying to present solutions when the school community contacts them to help in the production of tactile maps for education. Nevertheless, despite of the willingness, it is possible to perceive that most of them are not acquainted with the cartography and these kinds of maps and then, for this reason, they have not been able to come up with effective answers.

In 2005, the Brazilian Department of Science and Technology (Ministério da Ciência e Tecnologia do Brasil) (MCT, 2007) released for the first time a public notice to financially support research and development projects of assistive technologies, to which the researchers of tactile and school maps of the Geosciences Department from UFSC submitted the project "Tactile Maps: social inclusion instruments of people with vision impairment". This ministry characterizes the assistive technologies as "developed to permit the increase of the autonomy and independence of elderly people, impaired people, or people with reduced mobility in their household or occupational activities in everyday life" (MCT, 2007).

Our project is one of the two hundred and fifty projects which were approved, and with these financial resources, we have researched and proposed standards for tactile maps in Brazil. In order to do that, we installed a laboratory for the research and extension practices in a specific area at Universidade Federal de Santa Catarina, called Laboratório de Cartografia Tátil e Escolar (LabTATE) (Laboratory of Tactile and School Cartography). This laboratory made it possible to develop the project that had been approved by MCT, but its function is larger than developing a project. LabTATE is aimed at providing interested researchers and other people in need of any special representation with an appropriate place to develop researches intended for teaching Cartography and Geography and Tactile Cartography. LabTATE still aims to: a) integrate vision impaired people in the formal teaching and urban environment; b) create products which might help tactile and school cartography learning processes; c) assist vision impaired people in terms of Web inclusion.

2 THE CONCEPTION OF TACTILE MAPS

In the conception of tactile maps as well as conventional maps, two moments are considered: the moment of elaboration and the moment of use. This means that some points must be taken into consideration, such as the map's purpose and target audience, that is, their users. In order to provide a better understanding of the involved factors, the most important implications to be considered in this process are presented in Figure 01. That is an attempt to show these implications synthetically, and afterwards, brief remarks are made about each one of them.

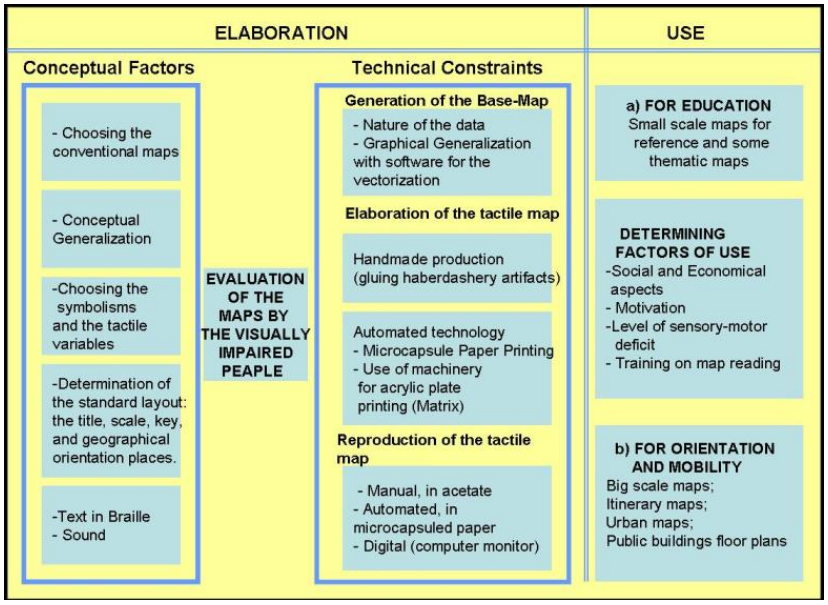

Figure 01 – The conception of tactile maps.
Source: Loch (2008).

2.1 THE ELABORATION OF TACTILE MAPS

Conceptual Factors Considered

The conceptual factors which were considered in the elaboration of the tactile maps are related to Cartography per se; for instance, the choice of conventional maps which originated tactile maps and the procedures in the generalization – once not everything in a conventional map can be transcribed for the tactile reading. Small elements or areas may undergo four types of generalization: fusion, selection, enhancement or dislocation, according to its importance and the quantity of cognoscible information by a visually impaired person on a map. Determining rules is also important about how to do symbolizations considering that it is necessary to transcribe what is visual into tactile, that is, to transform the Bertin variables into the graphical tactile variables. The texts about the map are as important in the tactile cartography as in the conventional cartography, since a map has to be understood from the texts it brings on its body and legend.

Determining a standard layout is likewise important, that is, in the scale, in the title (which will indicate what the map shows) and in the geographical orientation (the mark of the north direction). The latter is extremely important for the positioning of reading of a small scale tactile map; and the graphic scale is also important, once it helps the visually impaired (VI) to imagine the dimensions or the extensions in the reality. In this project, we have not yet used a sound device to locate places, that is, a device which would be able to say the place's name when the user touched a certain point of the map.

Technical Constraints

Despite of the variation in the way that the tactile maps are produced, it is highlighted that, besides the costs which make the maps accessible to the VI, the sophisticated technology may not be the most appropriate if the maps are not easy in terms of cognition. The elaboration of tactile maps can be totally handmade, since the maps' design to make up the matrix until the making of the matrix itself, which is manually constructed by sticking different materials, such as the cork, rubbers, strings, and junk jewelry materials. It is also possible to use graphic design software to transform the conventional map (in ink) into a reference to the tactile map. The advantage of creating maps on the computer lies in the possibility of standardization of forms, sizes, themes, and layouts of maps which will be stored in digital formats and will be able to be printed anytime that one wants to design the matrix of a tactile map. In the project "Tactile Maps", the base-maps were generated by the graphic design software and manual generalization; in relation to the matrix production, it was handmade. For the production of matrix, the Thermoform machine was used, which heats an acetate sheet (*brailex* or *braillon*), and molds it with a vacuum pump in order to produce the relief map.

Another way to produce the tactile maps in LabTATE was to use a microcapsule paper as a means of map representation. After digital elaboration, the map is then printed on microcapsule paper (brands: Zy-tex, Flexipaper, or Piaf) by a DeskJet printer. This special paper contains on its surface some alcohol microcapsules that may create textures when heated. Thus, lines, points, polygons, and texts in Braille printed over it in black or dark-grey are heated by a special machine (*Tactile Image Enhancer*) until the explosion of microcapsules which elevate and construct relief textures, that is, the tactile map. In this method of elaboration, the map does not need a matrix. After the digitalization, it can be stored in a digital file in any interchange format (LOCH, 2008).

2.2 THE USE OF TACTILE MAPS

The tactile maps are made up to accomplish two needs mainly: the education and the orientation/mobility of the visually impaired or the blind people. Thus, for the first need, the maps are those of general reference, in small scale, such as the maps for atlas, and the geographical maps for walls, as well as the maps for textbooks. In order to tackle the second need, the maps need to be made in big scales, such as the big urban centers' maps and in a bigger scale, to help with the mobility in public buildings where there is a great flow of people.

In the project developed in LabTATE, standards for both maps were exposed, those for the education and those for the mobility in the urban environment, as it will be soon explored in this paper.

3 METHODOLOGY FOR THE CREATION OF TACTILE MAPS

The entire research to define what could be standardized in terms of tactile maps in Brazil both for education and orientation/mobility, as well as its production, was carried out with the direct participation of the visually impaired, who were volunteers from two organs: Associação Catarinense para a Integração do Cego (ACIC) (Association for the Integration of the Blind of Santa Catarina) and Fundação Catarinense de Educação Especial (FCEE) (Association of Special Education of Santa Catarina). In order to achieve the objectives of the public notice, it was necessary to carry out a research so that it could be replicated in any place of our country, that is, the patterns that would be developed and the way of producing and reproducing the maps should be adoptable by other people in different regions of Brazil. This was one of the demands of the project sponsor.

Once aware of that, we decided to carry out the standardizing process using graphic software, named Corel Draw®, in order to turn the ink maps into tactile maps. Therefore, the standards which were created were then stored in digital file with format and extension of the program itself and in the format of image, that is, with the **.jpg** file extension. With the maps in digital format, it becomes easier to use any kind of reproduction over them. We chose two specific ways of production and reproduction for the maps: a) handmade; and b) microcapsule paper.

Several cognitive tests were run with the help of the volunteers, since the differentiation of texture over each of the maps' substrates (in plastic or microcapsule paper) up to what concerned the maps' components (which ones were necessary and their position in the layout). We also proposed some symbols so that the VI's could distinguish, considering, thus, several forms and sizes, so that patterns for some elements of the maps could be chosen, such as the Equator Line, the tropics, the different oceans, etc.

We consider that the distinction of the layout and the text over the map is as important in the tactile cartography as in the conventional one, once a map is understood from the texts it brings in the body and in the legend. Other components that are also important: the geographical orientation (the mark of the north direction) for the positioning of reading of a small scale tactile map; and the graphic scale is also important, once it helps the VI imagine the dimensions or the extensions in the reality. Such statements are grounded on the several cognitive tests of tactile maps run on VI's. The choice of places in relation to these components and their importance on a map were also pointed out by them, so that we could come up with a standard.

Another important factor to be taken into account is in relation to the number of attributes and classes that a map might have. In the tactile tests, it was verified that the VI's understand a map more easily, that is, they make the distinction of the different classes (or attributes) presented in areas whether Braille is used instead of textures (such as letters and numbers) to identify each one of them, using the legend to decode them.

4 THE STANDARDIZATION OF MAPS IN THE PROJECT "TACTILE MAPS..."

The proposal for standards of tactile maps was conceived from three main perspectives: a) technical constraints available for the production and reproduction of tactile maps anywhere in Brazil; b) the financial resources of the organs or the VI's to acquire the maps; c) the portability of the maps.

In this sense, the standards proposed for Brazil, exhaustedly studied in the project "Tactile Maps…" in LabTATE concern the methodology of production and reproduction, the layout, and the symbolisms used in each of the types of tactile maps: those in small scale – for the education; and those for the orientation and mobility – tactile plans. For instance, the Figure 2 shows a standard layout for education tactile maps.

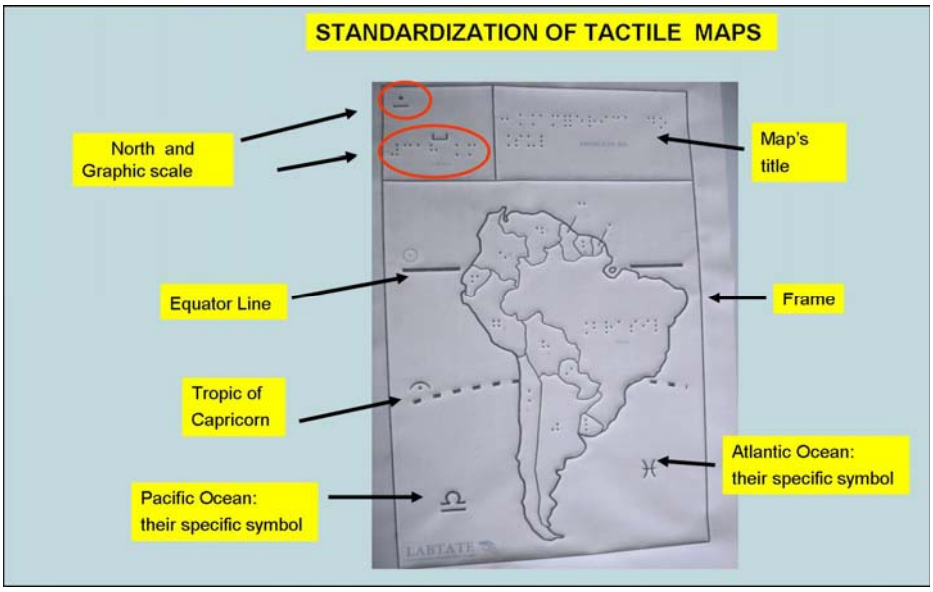

Figure 2 – Standard layout for the small scale maps produced in microcapsule acetate paper and the example applied to South America in microcapsule paper, whose original size is that of a A4 paper format

It is possible to observe in Figure 2 that the map and its components are contained in a frame that limits the point where the tactile map user will find information to read it. The north, standardized as a punctual element and composed by a point and a line, also assumes a standardized position on the upper-left corner to facilitate the positioning of the map. Right below the north, in the same box, it is possible to perceive the scale in graphic form that represents only a part of it, which is enough to understand the reduction that was made.

The map's title in Braille will be placed in the other box, on the left. All of these components will always be in the upper part of the sheet. Therefore, the user will position the map for the reading using the north, recognize the scale and then get to know the theme or topic the map is about and then she is able to explore the map. The legend follows a similar pattern, but it is made separately, on a separate sheet, and in the place of the scale, the word "Legend" will be written in Braille, as it is shown in Figure 2. In some cases, if the legend and the title are small, they might be placed together in the same box.

This arrangement of elements follows the most ergonomic reading format – the reading of a text in western languages and also in Braille language is performed from left-right, up-down direction. Moreover, it facilitates the tactile exploration, once the VI first explores the whole map, that is, the contours of the mapped area; afterwards, with the legend's help, the user interprets the parts: the punctual elements, the internal limits that constitute areas and the linear elements, in case they are on the map. The VI needs help to understand how to position a map to read it and what this kind of graphic representation means; once the VI has learned, when faced with other maps with the same configuration of elements, he/she will be able to explore it by himself/herself, departing from the north position to start the reading.

In addition to the layout standardization, other patterns were created in relation to the elements, as shown in Figure 3. Thus, for example, when exploring the South America Political Map in Figure 2, the visually impaired will perceive through the sense of touch a line that cuts the map on the east-west direction, identified in its origin by a specific symbol. If s/he was taught and the meaning was acquired, s/he will know that the line is the Tropic of Capricorn. The same will happen to the Equator Line and each of the oceans, which do not require any Braille markedness, but their specific symbol.

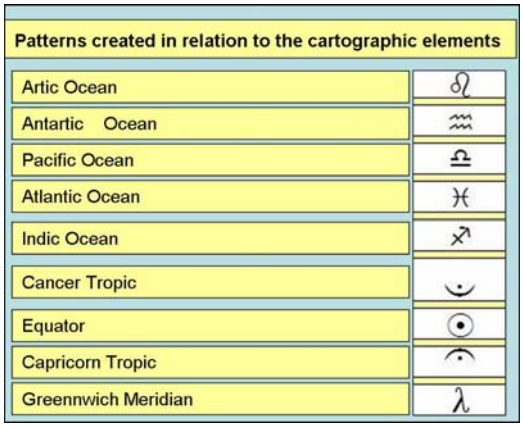

Figure 3 – Some standard symbols for small scale tactile maps
Source: Loch (2008) and LabTATE (2008).

Following this rationale, the symbolism for tactile maps was researched in terms of public buildings and urban centers – the big scale maps. These maps are aimed at the orientation/mobility and need to have standard symbols for several public urban equipments, such as squares, streets, payphones, and other devices which VI's need to have access to, such as tactile ground surface, sinks, fliers, chairs, tickets, etc.

5 SOME OF THE PROJECT RESULTS

Some of the products from the project are: the tactile maps for the bus terminal, the bus station, the airport, and the downtown, all of them related to Florianópolis-SC (LabTATE's headquarter), and the tactile maps for education. A tactile geographic atlas with 34 maps, and a version for the low vision people, tactile geographic model, a tactile globe, and an accessible website were generated in the project. All of these products may be reproduced by those who access LabTATE's webpage on the Internet, by downloading the digital files of the maps and the other products which were developed, as well as the instructions which are available on the website. In the Figure 4 there is one example of the products which were crated (the legend are on separate sheets, but they are not presented here). The website www.labtate.ufsc.br can be accessed in order to get to know other standardized maps which were developed in the project.

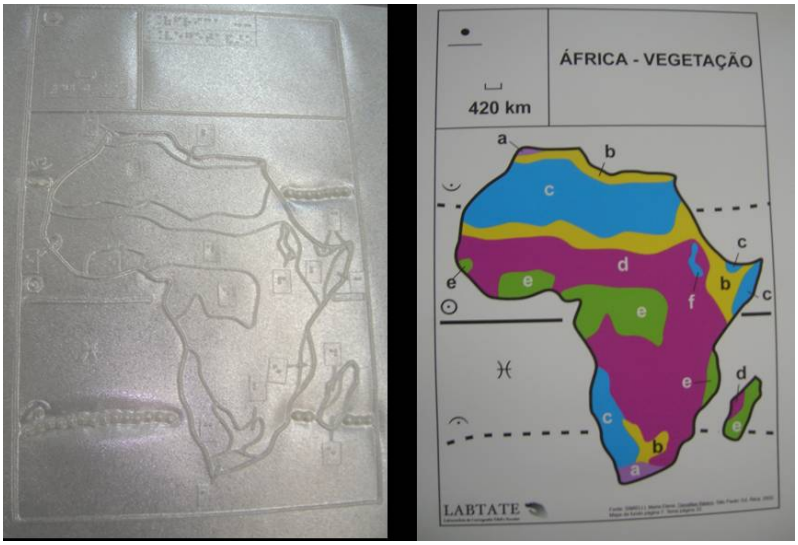

Figure 4 – An example of a map produced for the tactile geographic and low vision atlas (the original ones measure 25 x 35cm long)
Source: LabTATE (2008).

We are sending the models of standardized tactile maps to the Department Culture and Education of Brazil, so that we can disseminate the results of the project that was developed and also show that it is already possible to support all of the country in relation to tactile maps. Each State Department of Education may be self-sufficient regarding the production of tactile maps for the education, if the models that were developed and made available on the website www.labtate.ufsc.br are used and put into practice. There are two options of production to be chosen from and three different scales with regards to education tactile maps. Furthermore, it is also possible to access the maps for mobility which were developed for the downtown area of Florianópolis and inner parts of public buildings which were already mentioned previously in this paper.

6 FINAL REMARKS

The Project "Tactile Maps..." allowed for a profound study to propose standards for tactile maps in Brazil. This research, developed under the guidance of this article's author and also by interns of the project from the Laboratory of Tactile and School Cartography at Universidade Federal de Santa Catarina, also allowed for the creation of other cartographical products and a website accessible to the visually impaired people, in order to present the results from the project. Some of them were presented and discussed here.

The two methods for production of tactile maps adopted at LabTATE were described here, with examples of standardizations proposed for the small scale maps, that is, those for educational purposes, as well as those of big scale, used for orientation/mobility purposes. Among the factors that were considered in relation to the standardization for the production of tactile maps, we emphasize the issues of cost and technology to be used; sometimes, the most expensive and sophisticated technology is not the most effective. If the maps are not of easy cognition, they will not accomplish their purpose. Thus, the maps must be produced by specialists, on a multidisciplinary perspective whenever it is possible, and, more importantly, tested and approved by the visually impaired people.
The standardized tactile maps by LabTATE are possible to be reproduced all over the country. Besides that, other cartographical products which were developed in this project, over 60 prototypes, are available online on a specific website: <www.labtate.ufsc.br>.

The institution elected to hold the methodology for the production of maps and reproduce these maps to help the public schools' demands was Fundação Catarinense de Educação Especial (FCEE) (Association of Special Education of Santa Catarina). As this project was recently concluded, we are spreading it on online Geography magazines, journals, and scientific events.

The execution of this project does not put an end to researches on the production of tactile maps in LabTATE. We have established partnerships with the technological sector which produces engineering solutions, in order to create devices which can permit the development of sound interfaces for special maps for the environmental education in ecological tracks. Researches about these tactile maps using sound devices are being carried out in a project of regional development called *Sapiens*.

ACKNOWLEDGEMENTS

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