TACTILE MAP PRODUCTION FOR THE VISUALLY IMPAIRED USER: EXPERIENCES IN LATIN AMERICA

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ABSTRACT

This paper presents the results of an interdisciplinary work on tactile cartography, coordinated by a team of researchers from Brazil, Chile and Argentina, with support of PAIGH and OEA. Entitled “Cartografía Táctil en Latinoamérica: Capacitación, Sociedad y Tecnología Multimedial para la Persona Ciega del Siglo XXI” and “Diseño y Producción de Cartografía para las Personas Ciegas de América Latina”, the main goal of this project is to help visually impaired people in developing their spatial abilities through maps and other graphic resources, such as atlas, charts, diagrams, images, tridimensional graphics.

The authors have been previously involved with tactile cartography and research carried out at the Laboratory for Geography Education of the University of São Paulo, which has worked in this field for 15 years, both producing tactile maps and giving workshops and courses on cartography.

From this experience, there is enough evidence to prove the need for cartographic knowledge both to teachers and assistants working with the blind and visually impaired user.

INTRODUCTION

Most of the population of Latin America is uninformed about visual disabilities, and, despite publicity in the media, articles on the visually disabled that distinguish themselves in the labor market, arts or sports, this disability and its implications are not very well known.

According to statistics from the World Health Organization (WHO), 90% of the world’s 38 million blind and 110 million with some kind of visual impairment live in developing countries. These figures illustrate the urgency of scientific, technological, educational and social support as well as training for people with visual disabilities and their educators in Latin America.

Visual disability and the role of Tactile Maps in helping the blind and visually impaired is one of the most relevant issues in Latin American and other developing countries. Up to now, few countries in the world have attempted to develop methodologies, especially in the area of map making, that make a significant contribution to this issue.

Over the last 15 years, the Teaching and Didactic Material Laboratory (LEMADI), of the Department of Geography at the University of São Paulo (FFLCH-USP), has been developing a research project on the production, application and evaluation of tactile graphic illustrations for students with visual disabilities. Among the research carried out to date, we can highlight the Doctorate thesis by Prof. Regina de Araújo Almeida called “Tactile Map Production and the Visually Disabled: an evaluation of the stages of production and use of tactile maps”; the Geography teaching projects for the visually disabled, including production of material about the Amazon Region and the State of São Paulo; Carla Sena’s Master’s dissertation, called “The study of means as a teaching method: uncovering the Jaraguá Peak for the visually disabled”; and the PAIGH-supported international projects developed in conjunction with researchers from Argentina and Chile.
Recently, the authors of this paper have participated in two international projects called “Cartografía Táctil en Latinoamérica: Capacitación, Sociedad y Tecnología Multimedial para la Persona Ciega del Siglo XXI” (“Tactile Map Production in Latin America: Training, Partnership and Multimedia Technology for the Blind in the 21st Century”) and “Diseño y Producción de Cartografía para las Personas Ciegas de América Latina” (“Conception and Production of Maps for the Blind in Latin America”), supported by the PAIGH and the OEA respectively, and coordinated by the Metropolitan Technology University in Santiago, Chile. Besides these projects, the LEMADI-USP team is elaborating a website on which the research and material that has been produced to date will be made available. The team is also assisting in the “Application of Tactile Map Production: construction and evaluation of a Historical Atlas of the city of São Paulo for the visually disabled” doctorate project.¹

BRIEF HISTORY

In 1990, a research project on map production and the teaching of geography to the visually disabled was begun by LEMADI. It has been oriented and coordinated by Prof. Regina Araújo de Almeida, and divided regionally. Initially it covered the Amazon region, several aspects of which are common subjects in the country’s schools. The goal was to offer an innovative method of teaching geography to the visually disabled, highlighting the role of the graphic illustration in the process of spatial perception and the learning of geographical concepts. A series of didactic articles were produced: maps, models (depicting landscapes and the animals of the region), children’s books, an illustrated dictionary, games and activities, a time line and a teacher’s manual containing a text about the Amazon and the historical occupational process of this region. A evaluation of this material was carried out involving dozens of blind and visually impaired students at public schools in São Paulo, which in turn enabled a thorough evaluation of different construction techniques and a deliberation on the difficulties of using tactile graphic illustrations in the classroom.

As a continuation of this project, the State of São Paulo was chosen as the subject for the production and evaluation of new tactile illustrations. In this stage of the project, training and updating courses for geography teachers and others specialized in visual disabilities were carried out. Through the experience gained from this project, LEMADI became a reference for tactile map production throughout Brazil as well as Latin America.

In 1994 Prof. Regina Araújo de Almeida presented her doctorate thesis in which she had developed steps for the use of tactile maps with visually disabled students and highlighted the necessity to prepare professionals to work this issue with these students. Her work was pioneering in Brazil and served as inspiration for further research carried out in other countries in South America.

Figure 1: Tactile model to Geography building in University of São Paulo

In 1994, the “IV International Symposium on Maps and Graphs for the Visually Disabled” was held in Brazil. It was a joint initiative by the São Paulo University (USP), the International Map Producing Association and the World Organization for the Blind. Researchers from Brazil, other Latin American countries, Europe, the United States, Japan and Australia participated in this event, which was organized by LEMADI. As well as an exchange of experiences, it fomented contact between the team from LEMADI and similar institutions from Argentina and Chile, which led to a series of joint international projects.
In 1995, the researchers from LEMADI got involved in two international projects: “CARTOGRAFÍA TRIDIMENSIONAL PARA EL USO Y EL ADIESTRAMIENTO DEL DESCAPACITADO VISUAL” (“three-dimensional Maps for Use by and Training of the Visually Disabled”), (1995-1998) and “CARTOGRAFÍA TÁCTIL COMO INSTRUMENTO DE APOYO PARA LA MOBILIDAD ESPACIAL DEL CIEGO” (“Tactile Maps as a Supporting Tool for Spatial Mobility of Blind People”) (1999 a 2001). The highlight of the latter was the “Latin American Meeting on the Teaching of Geography to the Visually Disabled – 5th Expedition in Tactile Map Production”, held in Brazil and organized by LEMADI in conjunction with CAP (Pedagogic Support Center for Assisting the Visually Disabled). Researchers and teachers from Brazil and other Latin American countries participated in this meeting.

![Figure 2: construction tactile map in workshop](image)

**CURRENT PRODUCTION**

Currently the authors of this text are working on two international projects. The first, “Cartografía Táctil en Latinoamérica: Capacitación, Sociedad y Tecnología Multimodal para la Persona Ciega del Siglo XXI” (“Tactile Map Production in Latin America: Training, Partnership and Multimedia Technology for the Blind of the 20th Century”), has the support of the PAIGH, and began in 2002 with the following main goals:

- To train a group of high-school history and geography teachers in the production and interpretation of map material. These teachers are from different regions of the three countries involved in the project.
- To prepare map and didactic material to an international standard using different scales and symbols that were studied in the last project developed.
- Apply computerized audio technology and multimedia resources previously tested in another project for the production of map material in different scales, whilst also encouraging the training of users with visual disabilities in the use of these resources.

The results so far are as follows: a set of tactile graphic illustrations about concepts related to the physical structure and geological dynamics of the Earth, globes and layers of the atmosphere. Also three working meetings (Chile 2002, Mexico and Argentina 2004) and a course entitled “Tactile Maps for Teachers Geography, History and Other Disciplines” (Mendoza, Argentina, December 2004) were held.

The second project, “Diseño y Producción de Cartografía para las Personas Ciegas de América Latina” (“Conception and Production of Maps for the Blind in Latin America”), has the support of the OEA and the following general aims:

- To lend support to people with visual disabilities in the development of the special skills using mapping and didactic tools, like atlases, maps, three-dimensional graphic systems etc., in order to optimize their formal education and improve their mobility.
- To produce and distribute products that provide thematic information (on eco-systems, social, economic and cultural aspects) at different scales (world, continental, national, regional and local).

The proposed products are:

- Set of world, continental and country maps, showing political boundaries;
- Set of world, continental and country maps, showing aspects of physical geography and a didactic text about the basic concepts pertaining to geographical maps;
- Set of country maps, showing population distribution.
- Production of other thematic country maps.
- Large-scale maps portraying the areas surrounding those inhabited by the professionals and family members of the visually disabled that will be trained by this project.

The expected results include the following:
- Access for people with visual disabilities in Latin America to special map products elaborated by the project’s professionals.
- Training of teachers, parents and the visually disabled in the administration and handling of the map material on both small and large scales, through workshops and seminaries to held in OAS member nations.

The main results of the project can be summarized as:

The elaboration and production of a set of tactile world, continental and country maps showing political boundaries. Besides a world map, maps of the Americas (Central, South and North) and of the OEA member nations (Argentina, Bolivia, Brazil, Colombia, Costa Rica, Chile, Equador, El Salvador, Guatemala, Honduras, Mexico, Nicaragua, Panama, Paraguay, Porto Rico, Peru, Dominican Republic, Uruguay e Venezuela) have been produced. Copies of the maps were sent to institutions and schools that deal with the visually disabled in the above countries together with an evaluation questionnaire on the material to be filled out by the teachers involved.

![Figure 3: Termophorm copy](image)

The production of a set of world, continental and country maps showing physical geographical aspects and a didactic text on the basic concepts of geography (geography terms), above all those relating to contour features. This document has been printed in Braille and large print, in Spanish and Portuguese. Also, several models representing contour features have been produced to help with the understanding of the material.

![Figure 4: Construction tactile model](image)
Research for information on climate, vegetation and population of the countries that have already been mapped, as well as statistics and graphs about the aforesaid subjects. These maps will later be produced with textures and will go to make up the map kit conceived by the project. Besides this, age pyramids for the 18 OEA member nations were also produced by the Brazilian team.

To date three training courses have been held, with the researchers from Argentina, Brazil, and Chile as teachers.

In 2002 (18 to 22 November), the course “Geografía Táctil para la Comprensión de la Dimensión Espacial por Parte de las Personas con Discapacidad” (“Tactile Geography for the Understanding of Spatial Dimension by Disabled People”) was held at UTEM in Santiago, Chile.

Over the period of 24 to 28 November 2003 the course “Primer Curso-Taller Internacional de Capacitación en Cartografía Táctil” (“First International Training Course/Workshop in Tactile Mapping”) was held at the Map Department of the Technology of Social Communication and Humanities Faculty of UTEM in Santiago, Chile.

The course “Segundo Curso-Taller Internacional de Capacitación en Cartografía Táctil” (“Second International Training Course/Workshop in Tactile Mapping”) was held over the period of 6 to 10 September 2004 at the Headquarters of the Pan American Institute for Geography and History (PAIGH) in Mexico City.

The main objectives of the courses were:

- To introduce geographical and mapping concepts that would permit teachers to use the tactile mapping material when teaching the geography of the territories in their respective countries to students with visual disabilities.
- To introduce criteria and tools for the analysis of tactile map material, as well as the elaboration and low-cost production of map models.
- Understand the importance of tactile didactic material in supporting the teaching and learning processes, as well as the role of modern information technology in the education processes involving people with visual disabilities.

![Students working in aluminium_ Workshop Mexico_2004](image)

To reach these objectives, the international team of researchers shared its efforts and each country was responsible for one stage. The authors of this paper in conjunction with the participants of the courses developed maps and illustrations using aluminum as their raw material.

The technique employing aluminum is based on the transposition of the map, back to front, onto the aluminum sheet which is then marked with linear instruments (cutters of different sizes), pointed objects (tweezers or pen nibs and dentistry instruments) and zonals (textured sheets). The result is a contoured representation that will be useful to the visually disabled on the front side of the aluminum sheet. The map is then completed with information written in Braille and a key that can be drawn either on the map or on a separate sheet. The latter is customary, because most of the space on the map is occupied by the graphic illustration and the information in Braille. The aluminum sheets, imported from the USA, are strong and have one side painted white, which makes drawing on them easier. The domestic equivalent is thinner and doesn’t have a white side, but can still be used with good results.
One of the advantages of this material is the ease of reproducing punctual and linear information with more precision. However, the aluminum doesn’t allow a very wide variety of textures to be used, which limits the effective variables in this kind of illustration. The aluminum maps can be copied in plastic, either transparent or white, thus making the reproduction of maps possible for distribution. This technique has been well received by the students, despite not being as cheap as the material used in hand made maps, made with a collage of material like fabric, sandpaper, thread and other recycled textures.

Figure 6: Aluminum map of North American rivers

By the end of the project, the team intends to put together a kit of thematic maps of the countries in Latin America highlighting aspects pertaining to climate, vegetation and population dynamics. These will be complemented by graphics and models with adapted illustrations, and will make use mainly of a collage of various textures. It is important to reiterate that all the maps are reproduced in plastic (Thermoform copies) and copies are sent to all the OAS member nations, and, following an international agreement signed in 2004, also to the archive of the Library of Congress in the USA.

Another training course for teachers is scheduled to take place in Peru (September 2005), with the participation of the team responsible for the development of the project and professionals from the countries of Latin America that work with the visually disabled.

Besides participation in international projects, the LEMADI team is cataloging all tactile graphic illustrations from the laboratory’s archive in order to simplify access to this material for researchers and the general public. From this organization, the material and the research work, for both under-graduate and graduate work on Tactile Mapping and the teaching of geography to the visually disabled at the geography department of USP, will be available on a website that is currently under construction. The site will contain links to specialized institutions that assist people with special necessities and a discussion group on the subject of the visually disabled in Latin America. The team’s goal is to improve communication between researchers and others interested in this subject, thus encouraging an exchange of information and improving the work of schools and institutions that assist visually disabled students.

The latest research developed at the Laboratory is a doctorate project by the researcher Carla Sena, on the application of Tactile Mapping techniques to historical maps. The objective of this project is to produce, from the techniques and methods previously evaluated, a series of historical maps, taking the city of São Paulo, Brazil, as the pilot area.

This area was chosen because the city of São Paulo has a very rich history, beginning with the arrival of the first Jesuit priests on the Paulista Highlands, who came to catechize the local Indians during the Portuguese colonization of Brazil. From those humble beginnings, it grew into the economic center of Brazil and one of the largest metropoles in the world. The urban area of this city grew at a staggering rate from the second half of the 20th Century, and like many other cities in developing countries, this growth was not accompanied by an expansion in compatible infrastructure, which has resulted in myriad social problems.

Based on this subject, a set of maps will be produced, together with illustrations and ideas that help students understand the changes that have occurred in the geographical space that is the city of São Paulo. This material will be evaluated by teachers specialized in visual disabilities, blind and visually impaired students, both adults and youths, as well as geography and history teachers.
After the initial evaluation, a second phase of the project will be carried out, in which the subject area will be widened with the creation of a Brazilian and Latin American Historical Atlas.

FINAL CONSIDERATIONS

All work carried out to date and the proposals of continuation go to show the importance of Tactile Mapping in the comprehension of space by the visually disabled. According to VASCONCELLOS (1993), “Diagrams, illustrations, models and maps can, despite being abstractions of reality, materialize space, and organize information received by touch. Maps can be used to locate and orient oneself and to move around. For people with visual disabilities, these resources can be used to help them move around in their everyday lives, to school or around the neighborhood. In this way, the map is fundamental to the perception and construction of space by the user, mainly because s/he cannot receive spatial information through sight”.

Tactile maps are important for mapping and the teaching of geography, not just for the visually disabled, but also for normal students. Tactile illustrations can be used in classrooms that have students with and without visual disabilities. This is a work of real inclusion for people in our society with special necessities.

REFERENCES


http://www.utem.cl/ctactiloa/
BIOGRAPHY

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Geographer, graduated in 1993, from the Department of Geography of the Philosophy, Arts and Human Sciences Faculty (FFLCH) at the University of São Paulo (USP); during her course, she participated in several research projects concerning the teaching of geography and tactile maps to the visually disabled, and is part of the Teaching and Didactic Material Laboratory (LEMADI) team. She has been a geography teacher at the middle school level for the Bradesco Foundation since 1994.

Since 1998, she has represented the LEMADI team in a series of international projects coordinated by the Metropolitan Technology University of Chile, with the support of the Pan American Institute of Geography and History (PAIGH) and the Organization of American States (OEA), that involve the participation of researchers from Argentina, Brazil and Chile.

In 2002 she defended her master’s degree entitled “The Study of Means as a Method of Teaching Geography: uncovering to Jaraguá Peak for the visually disabled”. Currently she is working on her doctorate project entitled “Applying Tactile Mapping: production and evaluation of an Historical Atlas of the city of São Paulo for the visually disabled”.

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Bachelor in Geography from the Department of Geography of the Philosophy, Arts and Human Sciences Faculty (FFLCH) at the University of São Paulo (USP) and Licentiate of geography from the Education Faculty of the University of São Paulo.

She was a middle school geography teacher for three years. Since 1995, she has been a specialized technician in charge of the FFLCH-USP Geography Department’s Teaching and Didactic Material Laboratory (LEMADI). In this position she assists the public and participates in research projects. Currently she is responsible for the coordination of the Brazilian team involved in the “Diseño y Producción de Cartografía para las Personas Ciegas de América Latina” (“Conception and Production of Maps for the Blind in Latin America”) project and a researcher for the “Cartografía Táctil en Latinoamérica: Capacitación, Sociedad y Tecnologia Multimedial para la Persona Ciega del Siglo XXI” (“Tactile Map Production in Latin America: Training, Partnership and Multimedia Technology for the Blind in the 21st Century”) project.