

A LARGE SCALE CITY ATLAS FOR THE BLIND

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Summary

The city of Thessaloniki -the second largest in Greece- is the first city in the country, which developed recently, an experimental Atlas of large-scale city maps for the blind. In this paper, the design and the implementation of this Atlas is discussed, with special emphasis in a number of relevant issues influencing the whole process. We mention, for example: a) the analysis of the requirements as introduced by the teachers and the students of the local School for the Blind. b) the selection of the format and the testing of suitability in using the map-sheet in the streets or the choice of the map scale to be used. In addition, the digital preparation of the map background and the choice of the level of generalization are described as well as the standardisation of the map content and the development of map-symbols especially designed for this particular city Atlas.

Introduction

Most of us have used a city map in order to locate the spatial position of certain information, to be oriented, to plan journeys, to calculate distances among destinations to help ourselves in learning a city. The need of such maps as tools providing spatial information and orientation is undoubted. Visually impaired people feel the usefulness and importance of such an aid, which did not exist for any city in Greece before our relevant developments concerning "*The City Atlas of Thessaloniki*". In meetings with local blind people, many comments have been made for the importance of tactile maps that cover some districts of the urban complex. A point worth mentioning is the high interest shown by the visually impaired in taking part in a research that was contacted for the creation of the Atlas. A large number of blinds were involved in the evaluation of the results in almost every step of the cartographic procedure. The goal that was set from the beginning was the creation of an informational and educational mean that can be used as an important orientation and mobility aid in the city. The Atlas consists of:

- 3 guiding maps of the area under cartographic consideration
- 40 detailed maps of the area
- A legend of the symbols used
- A legend of the information illustrated in the maps

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- Instructions sheets for the correct use of the Atlas

The development process of the Atlas

The development of the Atlas was based exclusively in the use of a personal computer and appropriate software as the printing was made on microcapsule paper following the stereo-copying method. The general stages that were followed are:

- Choice of the area to be represented
- Choice of the information to be included in the maps and of the map scale
- Construction of a digital base map and the generalisation of graphic forms
- Choice and design of tactile symbols.
- Construction of the legends for symbols and information as well as the placement of the framing parts of tactile maps.
- Printing of the maps on microcapsule paper using a tactile image enhancer.

The choice of the area to be represented was based initially on a research about which areas of the city considered to be useful and popular destinations for the visually impaired. In the final decision for the limits of the representation area were decisive the above research as well as our estimation for a useful presentation of some areas due to the amount and the type of information included in them. The size of the area thus covered was 4600x2500 m. In the data collection process, the users of the Atlas were involved. Initially they were questioned on the type of information they consider of crucial importance for such an Atlas. A list was created and in a later stage more information was added since it became important or useful to be represented. In the final stage the users were asked to place the information on the ordered list and in this way it became clear what they expected. A large scale of information of thematic and geometric type was represented. That was useful in the introduction of the blinds in the city and indispensable in the daily needs for orientation and mobility inside this particular urban environment. Our goal was the development of an Atlas that can compete common urban maps in detail. Much of the information that were used appear often in maps used by visually able (churches, hospitals, theatres, etc) and others are more useful for blinds and are not often presented in common maps (telephone booths, kiosks, sitting benches, record stores)

Table Fehler! Unbekanntes Schalterargument.. The tactile map-elements

Building squares	Banks
Coastline – level of sea	Churches
Street names	Hotels
Alleys	Cinemas – Theatres
Traffic islands	Shopping centres
Pedestrian crossings	Conservatories
Important buildings	Record stores
The University Campus	Telephone booths
Gardens – Parks	Kiosks

Playing grounds	Athletic centres-public gyms
Sitting benches	Police Stations
Hospitals	Public lavatories
Clinics	Traffic lights using sound signals
Pharmacies	Traffic lights with no sound signals
Post-offices	Bus stops
Entrances	

Some of the information shown in Tab. 1, can be used from the tactile map user as “landmarks” or reference-points in order to check position and orientation. These are in particular the traffic lights with sound signals, the telephone booths, kiosks and bus stops. As mentioned before, in addition to the detailed maps, three “guiding maps” were also created covering the overall area represented into the Atlas. In this guiding maps were introduced:

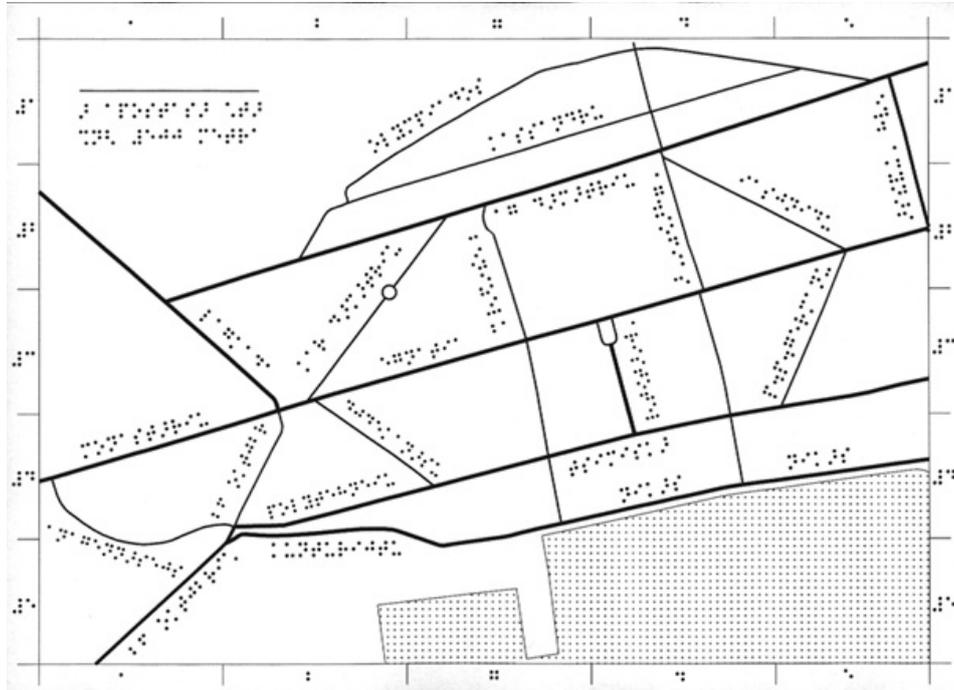
- The coast line and the sea level
- Main city streets – connection roads and their names
- The distribution of the sheets of the detailed maps

The study of these guiding maps offers a virtual image of the basic city avenues. Many blinds have never before been able to shape an overall image of the city in their minds and those who have, can check its rightness. On the other hand the basic goal of these guiding maps is the easier location of the relevant Atlas page that must use to be guided in the area of interest. The title of each detailed map (Atlas sheets) is given by using a grid of map-distribution, which is placed at the margins of each guiding map.

Scale and map dimensions

The guiding maps as well as the detailed maps are in A3 format (42x29,7 cm). The guiding maps have common areas (overlapping) and the scale is 1:6600. As points of reference, for the connection between pages, the roads illustrated can be used or even better the crossroads. In order to decide upon the scale of the detailed maps three factors were taken into consideration: a) the development of maps that will represent all desirable information, b) the final size of the Atlas after printed in visual form and c) its production cost. The final decision was the development of the Atlas using a 1:1300 scale without overlaps among the map pages. Overlapping was neglected because there was an increase in the number of pages that were needed for cartography in such scale. Some problems were also faced during the connection procedure of the maps. It should be mentioned here, that all users of the Atlas were inexperienced in using tactile maps. For the shake of continuity between map pages the primary concern was to give the users the possibility to track the continuation of roads that are set from the lines formed by the square building and to be able to continue reading a neighbouring map page. For the rest of information it was easier to track their continuity since the roads are connected. The lines of building squares are interrupted from the lines of a map frame. If two or more lines from squares are extended outside the frame, in every side of the map, “help- points” of reference are set.

Figure 1. A guiding map of the Atlas.



Working in the same manner, common points of reference are set for the connection of lines that continue from the previous map page and extended to the neighbouring map page. As a result the blind map-user can track the continuity points for the rest of the roads by counting each time the same number of lines from the common points. An important help for the connection and continuity of the roads is the readability of the road names that are repeated on the map page limits.

The digital map development and generalisation of the graphic form

For the development of the digital tactile Atlas base-maps an existing map was used^{*}. This map is a digital map for visually able people that was processed and converted in a proper digital form for the construction of the tactile Atlas. All the cartographic process was carried out using the MicroStation software. For all the information that are illustrated in the Atlas in-situ checks were performed for the updating of the original digital map. The generalisation process is necessary when the development of a digital tactile map is based upon a digital map for the visually able, such as in this case. Then is possible that an amount of information must be generalized to be more comprehensible in accordance with the scale of the two different maps. In this Atlas the coast line and the gardens were generalized.

^{*} Livieratos, E., C. Boutoura, M. Myridis 1997: *Maps of Thessaloniki in and outside the Walls*. A cultural map of Thessaloniki, Organisation Thessaloniki Cultural Capital of Europe, 1997.

The automatic Greek Braille

For the printing of names in Greek Braille, a true type font was designed and developed for the first time in Greece. With its use the printing of street names is able when using the CAD software as well as the automatic conversion in Greek Braille, names that are typed using another font (that was performed in the case of this Atlas).

Choice and development of tactile symbolism

The illustration of information in the Atlas was done using *point*, *line* and *areal* symbols. Before the final decision about the choice of symbols, the effectiveness and the communicability of a variety of symbols was tested with blinds. Initially, a variety of symbols were printed in tactile form using three different sizes. This group of symbols was designed using international standards in tactile city-cartography. In addition symbols suggested by us for this specific project were also tested. Following the results of testing the most efficient symbols were placed in the same scale as in the Atlas and the performance of the map, was again tested by the blind. Main goal for the symbols used in the Atlas was the easy recognition by all blinds. The finally selected symbols satisfy successfully the tactile perception in large-scale city maps even when a large number of information is illustrated, as it is the case in this Atlas. These symbols are thus, suggested for similar tactile maps. In summary, the decision for the choice of the tactile symbols was influenced by:

- 1) The property to be differentially recognizable by the user
- 2) The simplicity of their shape
- 3) The more effective, when possible, perceptual representation of their shape by blinds.
- 4) The ability of correlating the symbol with the corresponding information that represent.
- 5) The symbols that are often repeated should be of minimum size.

Factors 1 and 2 contribute significantly for the symbols used to be readable and easy identified as well as to be easily recognizable between them. Factors 2, 3 and 4 contribute significantly to the easier remembering of the symbols from the visually impaired in a way to be less needed the use of legend. Factor 5 helps in dealing with a large density of information with its negative effects as far as the effective readability of tactile maps, especially by inexperienced users, is concerned. The tactile symbols were created using a CAD software and were placed in a symbol library so they can be easily used in this project as well as in future development of tactile maps. Numbers used for the coding and the representation of additional information, follow many of the point symbols (bus stops, churches, banks etc). For example the numbering of churches helped in the presentation of their names as it is done in the legend.

Design of the map-legend

A common legend was designed for all Atlas maps due to the difficulty in placing a legend in every map aside. In the legend of symbols it is explained the property represented by points, lines and surfaces. A graphic and a “per cm” scale are also given. This dual use of scaling was obligatory since it was observed, following testing, that some blinds correspond better in calculating distances using the graphic scale and others using the length of the “per cm” scale. The names of the thematic information included in the legend are given in Figs. 3 and 4.

Figure 2. Detailed maps in spatial sequence. Arrows indicate the lines which are extended to help map-sheet connection.

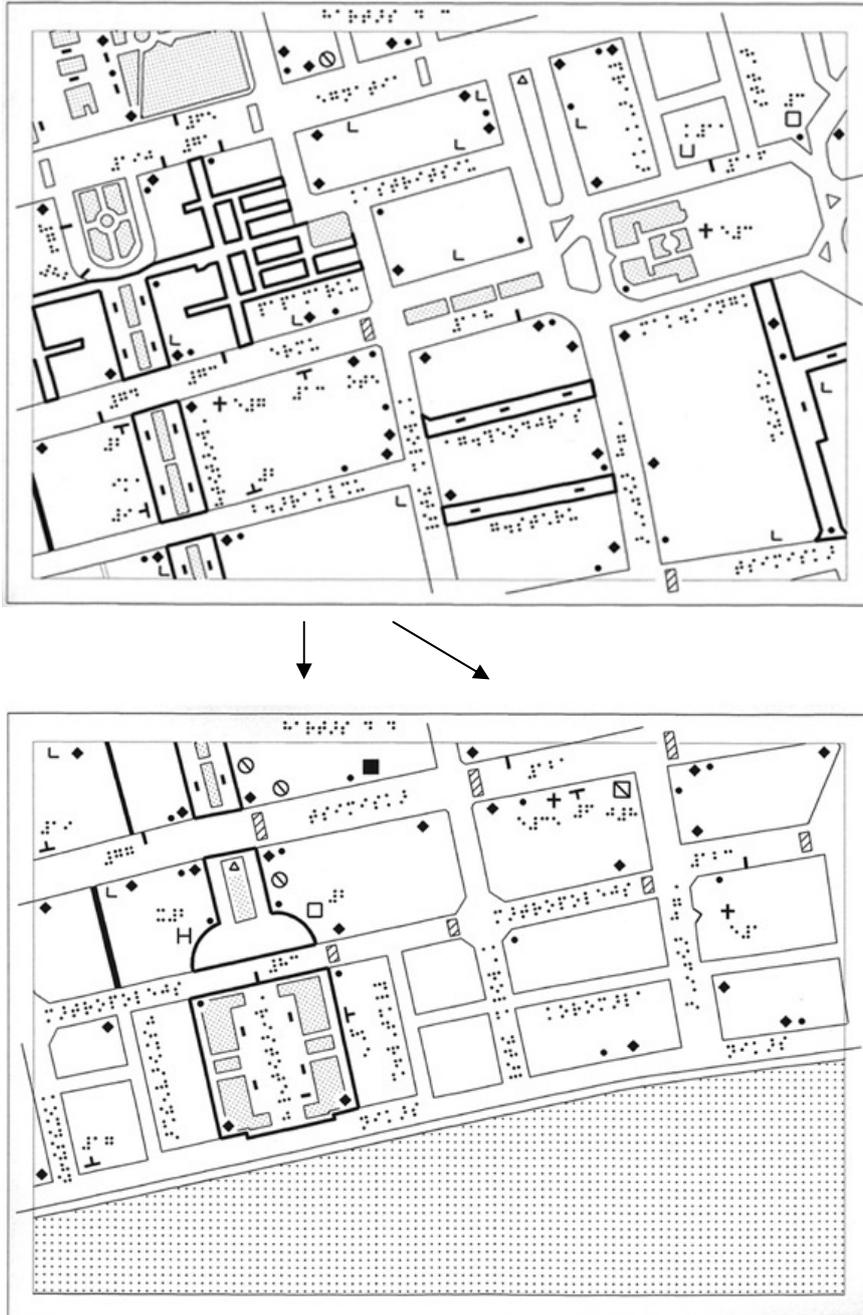


Figure 3. The areal and linear symbols used.

	Sea level		Building squares
	Gardens – Parks		Pedestrian crossings
	Buildings		Traffic islands
	Alleys		

Figure 4. The point symbols used.

	<u>From up to down:</u>		<u>From up to down:</u>
	Hospitals; Clinics; Pharmacies; Post offices; Cinemas – Theatres;		Churches; Banks; Shopping centres; Hotels; Sports – public gyms;
	Conservatories; Police Stations; Kiosks; Bus stops; Traffic lights		Telephone booths; Public lavatories; Entrances; Sitting benches; Playing grounds; Traffic lights with no sound signals
	using sound signals		
			
			
			
			
			
			
			

Atlas ergonomics and use

In the design of the Atlas ergonomics, the possibility of selecting easily a specific Atlas-map was taken seriously into consideration. The same also holds for the case of putting back this very map to the proper order in the Atlas sequence. Special care was also paid to the design of the right order of presenting the maps, to the legend and to the introductory instruction pages for an effective use of the Atlas. The legend of symbols is presented first, followed by the guiding maps and the detailed maps leading at the end to the legend of information. Among these sections information pages are presented for the correct and easy handling. The amount of information and its presentation in detail, gives the Atlas a property of a significant aid of orientation and mobility apart from its

informational use. Besides, this was the initial goal of the project. With the correct use of the tactile city Atlas the blinds enjoy the following important advantages:

- Shape new mental city maps or keep record of the existing ones using other senses.
- Form a mental image of routes that are composed by series of points and landmarks that exist on the mental area map.
- Plan and program courses that will follow, calculating simultaneously the time required for their accomplishment making the reductions of distance-time.
- Shape mental distances and calculate distances between points of space.
- Locate the position of landmarks that have already used and simultaneously decide for the use of new landmarks that are included in the maps.
- Comprehend relative point positions and spatial information and record their orientation easier and more accurate.
- Move in the city with less danger to get disorientated and lost.
- Better psychology in deciding to move among people with vision.
- Expand their living environment.
- Helps city navigation.

Concluding remarks

The main strategy of the project was to design, develop, implement and test the efficiency of a city Atlas for the blind, which includes a rather large amount of thematic information. This information concerns the number and the shape of symbols in point, linear and areal form and a rather complicated orientation and navigation system, both for the movement in the city and for finding the Atlas map sheets, in their sequence, according to a specially designed finding tool. These choices, in combination to the large map scale and the A3 format of the sheets, surprisingly turned to be acceptable by the users due to the easiness in using and handling the Atlas demonstrated by the more or less educated blind and especially by the younger generation attending school.

In the ergonomic side, the whole package was properly studied in order to be easily portable. On the software part of the development of this Atlas, the whole design carried out in a regular CAD, e.g. the MicroStation platform. In addition, a computerised translation interface, it was developed and applied indeed successfully, for the automatic transcription of the Greek language characters into the Greek Braille-characters. In this way writing fonts in Greek -letters, words or text- the interface is drawing automatically in Braille. Finally, the actual production of the sheets was carried out and the quality control plus the evaluation of the whole product were tested, in an every-day life environment of the blind.

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