TECHNOLOGY OF PRODUCTION OF MAPS FOR THE BLIND AND VISUALLY HANDICAPPED USING VECTOR GRAPHICS ON THE PROTUBERANT PAPER

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ABSTRACT

Commissioned by the Head Office of Geodesy and Cartography, the innovatory technology of convex maps and production plans destined for the blind and visually handicapped, has been elaborated in Poland. It is based on the research on a population of blind and visually handicapped children carried out by teachers at the Educational Centre in Owinska near Poznan.

The technology is based on the three following stages:

- electronic production and appropriate application of generalization of "flat" maps using vector graphics, applying received trough touch tyflological texture and lettering
- printing the processed graphics on the protuberant (swollen) paper using laser printer
- bulging the printed maps and plans in a special photo-thermal device.

The technology of convex maps and plans production destined for the blind and visually handicapped can be described as follows:

- the production process is economical, less laborious, quicker and cheaper
- city (town) maps designed for learning of spatial information are produced with unprecedented precision
- the technology includes maps that could be used by the blind, visually handicapped as well as people who are not handicapped and enable them to access geographical and historic knowledge and spatial orientation.

INITIATION OF THE WORKS ON PREPARATION OF TYLFOLOGICAL MAPS

The Head Office of Geodesy and Cartography started in 1983 the works on preparation and production of maps for blind and visually handicapped people. Initiation of the works on tyflological maps was then fully innovatory. Maps were prepared in close consultation with the Polish Union of Blind People and with institutions for blind and visually handicapped people in our country. First tyflological maps in Poland were prepared using thermal-vacuum method through their expression on a polyester 0,5 mm film in 6 colours, assuming at the same time their full saturation and contrast, indispensable for visually handicapped. Process of preparation, edition and expression of maps was very time-consuming, as in this technology first matrix on zinc plate was prepared and next particular map elements were soldered in order to form convex forms needed for reading by touch. In editorial phase a map was printed on the film and next the printed sheet was overlaid in thermal device on the matrix applying high temperature, which made film flexible, enabling removal of air between film and matrix. In this technology 43 physical, political and economic maps were prepared and issued for particular continents and regions.

NEW TECHNOLOGY OF PREPARATION OF MAPS FOR BLIND AND VISUALLY HANDICAPPED PEOPLE

The next initiative of the Head Office of Geodesy and Cartography, aimed at preparation and production of tyflological school "Geographical Atlas of Poland" was related to application of the other, new method of creating maps for blind and visually handicapped people.
Examining new technologies, which could ensure production of geographical atlas, attention was put to the studies carried out by teachers in the School-Educational Centre for Blind and Visually Handicapped Children in Owinski near Poznan. Alina Talukder and Marek Jakubowski worked over a year on using swollen paper, called usually protuberant paper, for making plans and maps for blind and visually handicapped. At the beginning this method was to be used only for preparing plans of teaching spatial orientation, which could be applied in everyday life by people with eye problems. While developing studies, authors of technology decided to extend their range, including small-scale maps as well. As a

result of these works a patent of technology for preparation of maps and convex plans for blind and visually handicapped was issued in 2003; The Head Office of Geodesy and Cartography became the owner of this technology.
Use of the discussed technology for map production was also related to preparation of new method of edition of tyflological maps. Form of map, process of its creation, and to some extent applied methods and cartographic signatures are subject to change, while using this technology. Therefore, authors of the technology have conducted for eight months since preparation of new method broad studies in various school-educational centers for blind and visually handicapped children In Poland, which were aimed at designing of signatures applicable on protuberant paper. As a result of these studies system of tyflocartographic signatures has been prepared; it constitutes the integral part of the patented technology.
The works of authors on new technology, which were initially conducted with the aim of its applying in teaching of spatial orientation, were transformed into works on wider application for preparing tyflological maps. Lack of suitable educational equipment for teaching orientation was then replaced by hand-drawn sketch of the way or trail on pearly on Braille paper. However, the sketch prepared in such a way was never precise. Moreover, if a copy of the sketch had to be done (in case of its damage or non-readability), it was not possible to prepare it identically. Drawing used for teaching orientation must be univocally readable, precise and ensure confidence of blind person to its quality. It must be also coloured, to enable better perception for visually handicapped people. All mentioned above features of drawing or map can be ensured by the discussed new technology of creating maps and plans in vector graphics on a special protuberant paper. The process of map preparation with the use of new technology is realized in three stages. In order to use it, tyflocartographic laboratory must be equipped with suitable devices.
Basic equipment includes indispensable devices and software needed for producing maps and convex plans. High-quality computer allows to use graphic programs more efficiently, enabling to work more effectively. Monitor with large screen facilitates work in the course of preparing particular elements of map content. In this technology colour laser printer – A3 format - was also used. It enables to make bright colour print of plan elements or of the whole map on the protuberant paper. Bright colour is essential for visually handicapped people, using maps and plans. Format of protuberant paper is also important. A3 format used in this technology allows for more precise map preparation. Blind children and young people, who tested maps prepared in such a format, put attention to appropriate size of maps. It enables both more precise and detailed presentation of map content and non-problematic study of the map. Certainly, laboratory must be necessarily equipped with thermal device and suitable, protuberant paper – both elements are indispensable for preparation of convex map. In case of this technology thermal device called Tactile image enhancer was used; it was selected as the best for making map content convex. In this device maps and plans up to A3 format, diminished by 1.5 cm margin, can be brought into relief. For map making a special paper called “protuberant” or “capsular” has been applied. This is type of a paper covered with thin layer of special plastic, which affected with temperature in places, where black drawing was made, increases its volume, i.e. “swells”. This material is vulnerable to damages (tear), but its upper surface can be cleaned with moist cloth, with no fear to damage map content. For making the detailed descriptions of legend of maps or plans for blind and visually handicapped Braille printer with two-sided printing was applied.

Technology of preparation of maps and plans for blind and visually handicapped people is based on three stages.

1. Preparation of “flat” map in vector graphics

Graphic files of flat maps for people with good vision, stored at any format of vector graphics, are the initial material for their processing in order to obtain convex map.
When teaching orientation within buildings of centers or within other constructions, existing available architectonic archives and databases can be used. Computer archives in vector graphics of cartographic and geodetic data concerning open space, buildings and particular rooms can be ideally used for preparing convex maps and plans. Processing of these data in order to produce convex maps is the essence of invention of authors of technology and the subject of patent. Archive files are most often created in AutoCad or ArchiCad software; they can be easily converted to files read in Corel or Illustrator and after processing convex plan of particular space can be freely configured. In case of making schematic maps of open space we use vector maps produced for flat printing. In case when vector graphic is not available for the area of interest, vectorization of this area can be easily done on the basis of the existing topographic or small-scale maps.

2. Preparation of “flat” map on protuberant paper

The map prepared in vector graphics should be adjusted in a proper way to needs of blind people. Consultant Group for Preparation of Maps for Blind and Visually Handicapped, affiliated to the Surveyor General of Poland, formulated general “Principles of creating maps for blind and visually handicapped people”. These principles concern way of description of names in Braille alphabet, signatures of state boundaries, continents and administrative units. They were prepared considering plastic maps produced so far. Taking into account new technology of making convex maps and

plans tyflocartograhic signatures had to be adjusted or created. It was related to the other method of map production and to possibilities of getting higher precision than on presently used maps. Apart from point signatures and map inscriptions proper selection of colours of flat surfaces is important. Bright, contrast colours are very helpful while reading maps by visually handicapped people. The discussed technology enables to present colour surfaces with convex elements of map content.
Vector map, prepared properly and adjusted to needs of blind and visually handicapped, is printed on a special protuberant paper, using for this purpose colour laser printer, producing printouts up to A3 format.

3. Bringing "flat" map into relief

The map printed on protuberant paper should be –placed in thermal device. High temperature produced by its lamp causes, that these map elements, which were drawn in black colour or in shades of grey, are brought into relief. It is related to features of the applied paper, which increases its volume - "swells" – in places, with black colour, i.e. where there is the highest temperature absorption. The remaining map elements, presented in the other colours, are kept "flat". In this way convex, colour map or schematic plan of spatial orientation is obtained, which can be readable by touch by blind and visually handicapped people.

FEATURES OF NEW TECHNOLOGY

New technology of preparation of tyflological maps enables to fulfill educational needs of blind and visually handicapped people. The advantage of the discussed method, while comparing to thermal-vacuum method, lies in shorter time needed for map preparation and in making modifications or corrections easily. Equipment necessary for making map according to technology prepared by teachers from School-Educational Centre for Blind Children in Owinski is cheaper, more available and simpler in using. Analyzing this technology from point of view of preparing school tyflological atlas, some other advantages should be also mentioned. Atlas printed on protuberant paper will not much differ from atlases used by not handicapped children. It will be light and handy, enabling pupil to bring it from home to school easily. Maps can be stitched, which facilitates work of child and prevents from loosing single sheets of the atlas.
This technology can also fulfill needs of teachers of spatial orientation, as far as preparation of precise maps with high geometric accuracy and individual needs of blind person are concerned. Owing to this technology it is also possible to adjust particular map elements, according to needs and touch sensitivity of pupil, decreasing or increasing amount of details within only a dozen or so minutes. Computer matrix, when once produced, can be very easily modified. Owing to this technology it is possible to prepare maps with various subjects and for different users: geographical, historical, geological, socio-demographic, and, according to needs, schemes of city transportation network. Lower durability of maps, comparing to maps printed on plastic, is a disadvantage of the new technology, the applied paper is vulnerable to damages and tear, but in case of making it dirty it can be cleaned with moist cloth.
After getting acquainted with advantages and disadvantages of new technology and with maps prepared by A. Talukder and M. Jakubowski, taking into account opinion of the Consultant Group for Preparation of Maps for Blind and Visually Handicapped, affiliated to the Surveyor General of Poland, the Head Office of Geodesy and Cartography decided to apply this technology for producing school "Geographical Atlas of Poland" for blind and visually handicapped people.

SHORT BIOGRAPHY NOTES

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