Graphical Information Access for Visually Impaired

Alena Galajdová, Jaroslav Majeník, Dušan Šimšík

Technical University of Košice, Faculty of Mechanical Engineering, Department of Instrumental and Biomedical Engineering, Letná 9, 042 00 Košice
e-mail: alena.galajdova@tuke.sk

Abstract: This article deals with possible methodological and technological solutions to improve access of visually impaired people to various forms of graphical information. Graphics play an increasingly important role in today's world of communication and they enhance interpretation and understanding of complex various information data. In general, the graphical information as produced for sighted people is inadequate for people with low vision and not accessible for blind persons in almost all cases. Therefore, it is important, that the visually impaired have access to the graphical information they need.

Keywords: graphical information, visually impaired people, assistive technology

1 Introduction

The central principle considered here is that the visually impaired people have a right to information in an appropriate form and without facing excessive changes and/or long time delays. Before we discover possible approaches for the methods of graphical information access, we have to consider to whom it will be designed for. There may be two main user groups of visually impaired, namely partially sighted people; and blind people.

This consideration is important, as partially sighted people can use the information designed for blind people, but it may not be true vice-versa. To give an example, it means that both the blind and the partially sighted person can read the information printed in Braille, but enlarged printing “non-tactile” cannot be “seen” by blind persons.

The knowledge about visual impairments convinced us that it is not a simple task to find an ideal solution of graphical information access for all. However, development and advances in the field of technology brought a number of new approaches. One of them is using of human computing interaction. Of course, there are still many computerised ways, and the companies are looking for the

most appropriate form of graphics interpretation via PC for particular type of visual impairment. Special emphasis is given on complexity reduction to cover larger group of users even these no technically skilled. The very important is also the equal opportunities issue. The visually impaired people are then able to communicate with authorities, to find plenty of materials on the Internet, to get study material and so on.

2 Graphical Information Access

As many varieties of visual impairments exist, even so there exist many possibilities of graphical information access for visually impaired. Some people benefit from using additional lighting, while others find that strong light exacerbates their difficulty. Some people use magnifying aids, whereas to others they represent no help. Many blind and partially sighted people have sufficient sight to be able to make out large print. For those unable to read print, alternative/additional methods and solutions must be found. One alternative for solving this problem is to represent the data using other modalities, namely touch and hearing. Direct audio/tactile access methods are necessary. They allow partially sighted and/or blind people to "see" graphically displayed information.

The type of eye condition will significantly influence the choice of appropriate format. The most appropriate format will also depend on the content of the information, and what it will be used for. It is clear that partially sighted people can use all three forms, while blind people can only use the last two. Therefore, the methods suitable for blind people will be considered here as methods also suitable for partially sighted people.

2.1 Alternative Adaptation

Graphics are designed with the visual communication channel in mind. Partially sighted people cannot fully use this channel and blind people cannot use it at all. Therefore, alternative adaptations of b_bede@yahoo.comcommunication must be found. It can be defined two possible adaptations of graphical information: alternate format; or alternate mode.

The traditional alternate text formats for visually impaired are enlarged print, Braille (a code of six raised dots), audiotape or talking books, and computer text.

Alternate mode access means that the people can use the material as it exists with some assistive device like magnifying glass and heavy lens, monocular and telescopes, CCTV (Closed Circuit TeleVision), electronic reading aids, adapted personal computers, magnification, speech synthesis systems, Braille systems, note-takers and text handlers.

2.2 Interaction with Graphical Information

There exist several methods of interaction with graphical information. In general, it can be described the following steps that should be undertaken to enable the interaction with graphical information: 1. Decide on the purpose of the graphics/interaction. 2. Choose the communication channel we want to use (tactile, acoustic, other). 3. Choose the information structure for the output (text - Braille and/or speech, non-speech sound - musical or "ecological" (real world) sounds, tactile graphics - interactive (e.g. with a touchpad) or perceptive only, any combination of the above). 4. Get the model (underlying abstract structure) of the visual graphic. 5. Select or construct an appropriate computer system (hardware or software).

3 Production of Tactile Graphic

Visually impaired people are routinely provided with text materials in Braille, audio or large print, but the pictures, diagrams and maps, which accompany the text materials, are often omitted or only very briefly described. It is often mistakenly assumed that all blind or partially sighted people will have difficulty in interpreting tactile versions of graphical material. Yet visual graphics can be very effectively converted into tactile graphics, even for the highly graphical information contained in scientific materials and maps, and can be a very valuable resource.

Converting the visual graphic to an appropriate tactile graphic is not simply a matter of taking a visual image and making some kind of "tactile photocopy". The tactile sense is considerably less sensitive than the visual sense, and touch works in a more serial manner than vision. Therefore the visual graphic needs to be re-designed by experts to make sense in a tactile form. The tactile graphics can be made in a number of different formats.

3.1 Swell Paper

A swell paper is a special type of paper with a special coating of heat reactive chemicals. Microcapsules of alcohol embedded in the paper burst when exposed to heat and make the surface of the paper swell up. The use of swell paper is versatile and invaluable as the graphic can be modified during the educational process.

Swell paper can be used to create tactile graphics in a number of ways including: photocopying, printing, marker pens and heat pens. Once an image has been transferred to the swell paper, it can be passed through a fuser or heater.

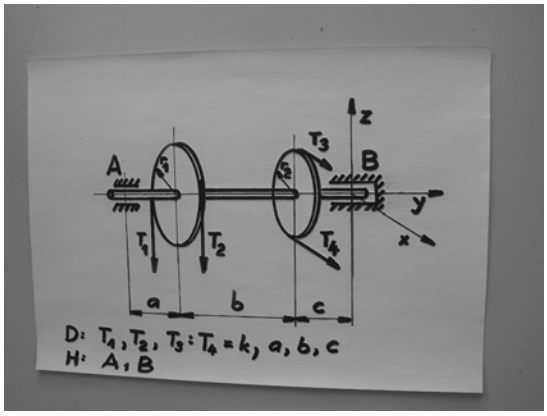

Figure 1
Example of relief image on swell paper

Some producers recommend the use of a spray varnish or hairspray on the finished raised graphic for a surface which is less prone to smudging. Colour ink does not swell, so can be used for labelling graphics in print.

3.2 Vacuum Formated Tactile Graphics

An inexpensive, relatively simple method called "Vacuum formatted tactile graphic" was developed by prof. Hončariv and his colleagues at the Faculty of Sciences, P. J. Šafárik University in Košice. The base of this method is production of silicon models, which consists of two main phases. In the first phase, a negative relief matrix is made from plaster of Paris. The second phase is to make a positive relief marker for thermoform printer. The created silicon model is soft to touch and therefore it is excellent for reproducing pictures in a vacuum printer. It is also possible to use it immediately in the educational process.

3.3 Embossed Graphics

Embossed graphics is also known as Braille graphics. The principle is that a printer punches dots into paper, and those dots can be placed in such a way as to form graphics. Embossed graphics are images made up from dots usually produced on some Braille embosser, and some embossers are specially designed to produce graphics. Most standard embossers can produce graphics, although those produced with variable dot, or specialist embossers can lead to better results. Special image file formats can be imported into Braille translation software.

3.4 Graphics for Technical Subjects

Problems with graphical information for blind students in the technical fields of study are major barriers to overcome during five years of study. This might be one of the main reasons why we find that, in the past, blind students at universities studied law, philosophy, sciences like math and so on; but very few if any studied technical sciences.

At first it is necessary to have a look into the contents of the subject and analyse it. This can better help to imagine the importance of graphics for the study of technical courses. The graphical information in the technical field of study is connected with calculation, technical drawing, design, and construction.

The students are able to use some of the many types of talking scientific calculators. Really helpful tool is the AGC (Accessible Graphing Calculator from ViewPlus Technologies). The equations can be quickly entered into the AGC, and the students can listen to the audiowave and immediately tell the differences between y=3*x+4, y=x^2, and y=3/x+2. Additionally, the blind students can also emboss each graph very quickly.

Drawing which is connected with calculation in such courses as Math, Physics, Chemistry and others can be sufficiently interpreted by relief pictures. For some courses, the graphics are interpreted by relief pictures and also by models made from paper, plastic and wood. There are no limitations in understanding of such pictures and their interpretation.

One big limitation for blind students is the impossibility of drawing a technical drawing. Usually there is at least one course whose output is mechanical drawing in study program of technical field. The students have to learn basic rules and standards for technical drawing, read and understand the technical drawing from relief pictures, to find mistakes in technical drawing etc. In other subjects, the drawing is connected with plan into project planes. In this case we use low technology solution in the creation of plan into project planes with different kinds and thickness of strips and pins on the wooden pad.

Blind students should not be excused from study in the technical fields because they are blind. Blind students can't graph and blind students can't do geometric constructions, or so sighted people imagine. But when they have some facilities, they can graph and do some geometric constructions. According to our experiences, the knowledge of our blind student is at the same level as, and imagination is even better in some cases than, their able-bodied colleagues.

Conclusions

Both the partially sighted and blind people have individual needs and preferences, so the most important thing is to listen to what each individual wants. If we know a little more about the variety of blindness and partial sight forms, it can help us to better understanding of visually impaired people’s needs.

Although the systems considered to be devices for people who have limited vision, many people with learning disabilities have benefited from alternate presentations of the same material. Indeed, these accommodations may be useful in providing information to students whose primary learning style excludes high rates of data absorption by reading. Many people suffer from visual dyslexia so severely that they can understand virtually nothing in print even though they may have perfect vision. It is also well understood that a substantial fraction of people are "audio learners" who understand what they hear better than what they see. All these people benefit from availability of speech and other audio output instead of, or in addition to, the normal visual display. However speech or other alternate access is presently limited largely to unformatted text.

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