VISUALISATION OF GEOGRAPHICAL DATA
- A HYPERMEDIA BOOK FOR EDUCATION

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Abstract

Visualisation of geographical data is the main tasks of cartographers. Its significance grows with the development of computer based systems like GIS and with the availability of digital data. From the educational point of view the fast development of these techniques causes difficulties to find probe lecture material for the education of cartographers.

Computer assisted learning (CAL) has become increasingly important technique of teaching. Helsinki University of Technology has under the recent years supported the development and use of CAL applications. The Institute of Geodesy and Cartography has used own CAL applications since 1993. The hypermedia book "Visualisation of Geographical Data" described in this paper includes text, graphics, images and animations. The material is based on the lectures given in the visualisation course at Helsinki University of Technology.

The idea was to produce a compact learning material of GIS visualisation. One of the main conditions by the development of the application was to use the means of hypermedia. Hypermedia technique gives a possibility to produce "books" with a wider form of information. The size of the application was limited in one diskette to make the delivery as easy as possible. Students of the visualisation course have been interested to install the application in their own personal computers and to study the material at home.

Keywords: Hypermedia, GIS visualisation, education.

1. Background

Computer assisted learning in teaching cartography is not a new idea. Some applications have been introduced even in 1980's. The development of application development tools has now made it possible to maintain various applications for customized situations in the universities.

The economic crisis at Finnish Universities during the early 1990's forced several institutes to rationalize the teaching and think about how to make savings but keep the teaching standards high. At the same time the world-wide wave of hypermedia development tools became available in developing teaching applications. In 1992 the Institute of Geodesy and Cartography in the Department of Surveying at Helsinki University of Technology started a project to develop a hypermedia application containing basic concepts of map production process and a tutor for CAD-software. The second project, a hypermedia "book" about visualisation of geographical data was started in 1993.

The first application was developed for the basic cartography course "Introduction to computer aided cartography" and was taken in use in 1993. The main task of this application is to guide an exercise to produce a thematic map. The application includes two parts: the first part introduces the CAD-

software used in the exercise and the second part gives the instructions for different stages of the exercise. The user is guided through the application with texts, graphics and animations. [4, 5].

2. Hypermedia in teaching visualisation

"Hypermedia is a Theodor Nelsons term for storing and searching information in free organized form. Hypermedia contains linking and navigation trough information, that may consist of different kinds of media like: text, graphic, sound, music and video." [2]. "Hypermedia is any computer-controlled system that allows the user to interact with media that can contain text, graphic, animation, film, etc. The interaction has to be very flexible, so that the user can pass trough the material the path they wish." [3].

New methods are often seen as an easy solution for old problems. Hypermedia as a tool is one of this kind of new methods in teaching visualisation. The development of computers has made it possible to utilize hypermedia in a wide sense. In teaching visualisation of cartography hypermedia applications can be much more effective than traditional books and in some cases even replace the lectures. The use of pictures and moving pictures as well as possibility to link different pictures and text fields to related subjects give good possibilities to describe geographical data. The link between subjects gives the reader a possibility to remember subjects together better than in printed books. The effective use of hypermedia application also requires good index of the information. In the application described here the indexes were made in various levels. Hypermedia book can be a sequential application with associative links as well as it can contain advanced searching possibilities and lists of subjects.

An application that gives a possibility to computer aided learning, has to be both easy to use and easy to deliver. By developing of the application described in this paper, one of the problems was how to limit the application in the size that could be packed in one diskette. The picture material had to be limited to the most important material. The text material takes minimal disk space compared to the pictures. Thus the structure and the navigation of the text was considered very important. Sparingly the text material was written in typical book structure: Chapter 1, Chapter 2, etc. (see Table 1). The main task was to find the most effective hypermedia structure and how to situate the linked subjects.

3. Development of the application

The development of the hypermedia book was made in four parts: processing of text, creation of structure and links, processing of pictures, and programming of packing and installation. The texts were written by Ass. Prof. Artimo [1] based on the lectures of the course "Visualisation of geographical data". The lecture material was also used in selecting the pictorial material for the application. The basic material was the text, some pictures and the structure of subjects in form of lectures.
The structure of the application was created with the hypermedia development tool ToolBook (Assymetrix Corporation), which has an object-oriented programming language. The pilot version of the structure was used through the programming. The application was originally planned to be an open version, so that the readers could have a possibility to add their own texts. This idea, however, has not been realized.
The packing of the application was made in Microsoft Compress/Expand free licence. The installation program was made in C-language.[5].

The application was taken in use for the teaching of GIS visualisation in autumn 1994. The hyper-media book was produced in English. In this case the lack of suitable printed books was one of the reasons that lead to develop this application. Combining text and pictures and making suitable links

that give the user a possibility to go trough the information in his or her own sequence. The updating and adding both the text and the pictures are also very important attributes by the development of the hypermedia application. The delivery of the application was decided to make in diskettes. The system requirements to run the application were supposed to be as common as possible, so that the students would be able to install the application in their personal computer at home. The university provides some PC:s that would contain the application for those students, who do not have a computer of their own.

4. Structure of the application

The structure of the application (see Figure 1) contains one "book", one "background" and ca. 60 text pages, each of which contains its text and "hotwords" as links to the pictorial material, to the related subjects or to the subjects of the indexes. The navigation tools, most of the pictures as well as the fields containing the text material are all placed on the background and are in this way easily available for the whole application. The hotwords can contain a picture or a textual link, and these two link types are differed from each other by colour. Some automatic functions have been put both on the page level and on the background level. One of these functions is to move additional pictures taken to scene on the page to a hidden position when the page changes. The main index contains the main subjects and the subindexes can be seen by pressing the subject button. Also some alphabetical indexes were made. The references, the pictures and the subject in alphabetical order are this kind of lists that were planned to help the user in the navigation.

The text material is based on remaining lectures. The text (see Table 1) was first gathered in English in Word for Windows -format. This was practice because the text once written in some Windows applications was easy to move to the development environment. The text was selected in suitable parts and added to the application. The links between subjects were made as so called hotwords, that contain a link to the subject, picture or animation. "Link is a pointer from one part of the text to another. A link has to show the user, that it has a connection to this other part of the information" [2].
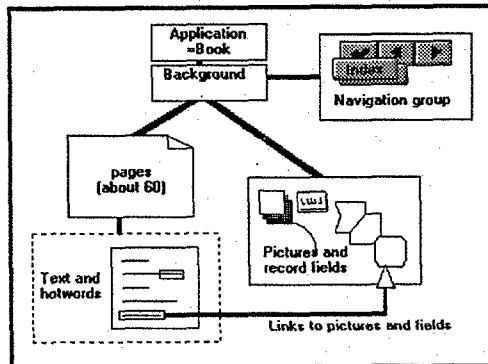

Figure 1: Structure of the application.

Table 1: The table of contents.

The pictures were mostly worked up with ToolBook tools. Most of the pictures are formal graphical presentations of some cases in thematic cartography. The examples of geographical symbols, diagrams and thematic maps are the most common picture subjects. Some animations and colour system examples are also available. The picture material from the exercise works of the students is not used directly but it was modified in some common format or drawn again. The raster map material is very limited and contains only examples of Base Maps and Geological Maps of Finland and an example of a digital guide map. These kinds of examples of raster maps were not widely included to the application because of the size limitations. The use of scanned pictures requires also the copyright, which can be sometimes very complicated and expensive. One solution is to draw the pictures self and gather material from public picture libraries.

5. Conclusions

The hypermedia book described in this article has been delivered for the students as a reference material for the course "Visualisation of geographical data" during the autumn term 1994. The students were very interested in the new method of learning and most of the about 30 students installed the application in their own computers. The delivery was easy to organize because the application was packed in one diskette. The system requirements have not produced additional work for the use of the application.

The teaching with hypermedia gives new possibilities both for the students and for the teachers. Hypermedia books have advantages compared to printed books. After the structure of the application is ready, updating of the text or adding of new material is easy to do. The future plans for the development of the application will deal with the text updating. In the present version the section of the spatial data analysis for example is discussed very short and will be extended.

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