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Titel: Some Problems with the Use of Electronic Atlases

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Ort: Graz

Jahr: 1995

PURL: https://resolver.sub.uni-goettingen.de/purl?514854804_0005|log66

European Research Libraries Cooperation:
The LIBER Quarterly, 5 (1995), 235-244.

Some Problems with the Use of Electronic Atlases

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1. New challenges for map libraries

Being involved primarily in the production of maps by digital technology we are concerned also with the question, whether one should continue to produce maps on paper or provide the market also or exclusively with digital maps and atlases. This contribution is based on some of our experience with maps on the screens of monitors. It is an attempt to interprete the role of the mapcurator under these new circumstances. Going through the reader prepared by the organizers of this conference, one comes to the conclusion that much concern has been given already to the role of the map librarian under the aspects of the new digital map products. It seems that among map librarians there is a strong will to cope with these new challenges. In addition to what they offer already they may include a very broad palette of new services, ranging from rather simple to highly demanding ones, if we follow the information in the reader.

These duties include:

- to catalogue all available digital map data
- to collect all available digital maps and databases and electronic atlases
- to let the clients view on a screen the geographic information contained in these products
- to offer the users an opportunity to explore the potentials of digital data such as searching for specific information
- to provide hardcopies of these digital products according to user's needs
- to circulate digital map files or electronic atlases like maps or books
- to help the user in manipulating digital map data (e.g. feature selection, changes of symbolization and colour, creation new data levels, merging different files, etc.)
- to produce paper maps on demand on the basis of digital data files

- to scan or digitize analogue maps that are needed in digital form
- to allow the user to import its own files and export data in various data formats
- to help the user in the analysis of spatial data
- to assist the client in the production of maps based on available data
- to allow for the whole range of GIS activities

In view of the expensive equipment and high level of competency of the personal and large amount of assistance involved, libraries might have to charge clients for their services like any commercial organization. If all these services would be included, the competencies expected and the infrastructure needed by librarians would be equal to or even larger than those of a professional map producing or GIS organization, because such a library will have to access an extremely wide range of very heterogeneous and technically complex materials. What then is the difference between these institutions and such an upgraded map library? In fact it seems that we are heading towards a *National Centre for Geographical Information* and away from the traditional map library.

2. The physical form In which digital spatial data are available

Spatial digital data are made available by their producers or publishers in a variety of different physical forms and data formats:

- diskettes (relatively small data sets only, 2 sizes of drives, various data formats)
- DAT-streamer Tapes (digital audiotape with 2 GB of uncompressed data, various tape drives)
- CD-ROM (600 MB read only memory for text, graphics, audio, video); e.g. one disk may store approx. 25 map sheets of a map (format 70 x 50 cm) stored with a resolution of 20 pixels per mm
- optical disks
- on-line through communication networks

Therefore, if a map library intends to offer only a minimum of services, it has the be prepared to accept all these import media and provide for all drives needed to read or write these data. To do this usually specific software is needed as well. One will have to acquire know-how to handle many data formats and to convert them according to user needs. Furthermore - what is missing in the reader so far - one has to gain knowledge also in some important graphic aspects, when working as an adviser for the use of digital map data.

3. Comparison of the potentials of paper maps and atlases with digital databases and electronic atlases

Usually the advantages of digital spatial data over paper maps is emphasized. The relevant keywords are:

- quicker and easier to revise
- manipulable
- suitable for overlays
- flexible base for the creation of new map products
- presentation of dynamic phenomena, etc.

The following is a comparison of the potentials of paper maps and atlases versus digital data bases and electronic atlases. These potentials, however, are depending on the type of storage medium, with which the data are delivered and on the hard- and software available in the library to access the data.

paper maps / atlases

- proper scale for each map, usually only one scale for all items
- fixed sequence of the maps in a bound atlas
- juxtaposition only with loose leaf atlas
- overlays with tranparancies only
- large formats (70 x 100 cm) at fine resolution
- temporal sequences, by juxtaposition of maps
- highlighting by stressing previously fixed items graphically in a purely static mode
- referencing other data only with the actual content of the map (names, grid, graticule) or external media

digital databases / electronic atlases

- variable scales can be derived from the same data, however, useful only within a restricted scale range or if data are aggregated or generalized for larger areas
- sequence may be arranged according to individual needs
- limited juxtaposition by windowing sections
- overlay of feature classes on the screen limited, as within a paper map
- small formats (30 x 40 cm monitor) at a resolution of 0.3 mm only (size of a pixel on the screen); this corresponds to a paper map section of 9 x 12 cm only, but there may be a possibility to scroll through the map

- temporal sequences by juxtaposition of windows or animation, as well as adding and deleting objects in a time mode
- highlighting by blinking on the display any chosen item in a dynamic mode
- referencing also to hidden information, multilayer information, if internally structured; reference buttons, etc.

4. Resolution of digital map data on a screen

When a whole large data set is fitted to the window or a limited part of the window of the display, usually part of the data is lost. The practically infinite number of discrete xy-locations of the stored geodata shrinks down to some 1024x1258 possible pixels on the screen. The effect is that of a scale reduction. Nobody hesitates to complain about overhead or slide projections with too tiny details, but apparently people seem to accept more easily unlegible views of the full data set on the display, which are far from ideal for interpretation.

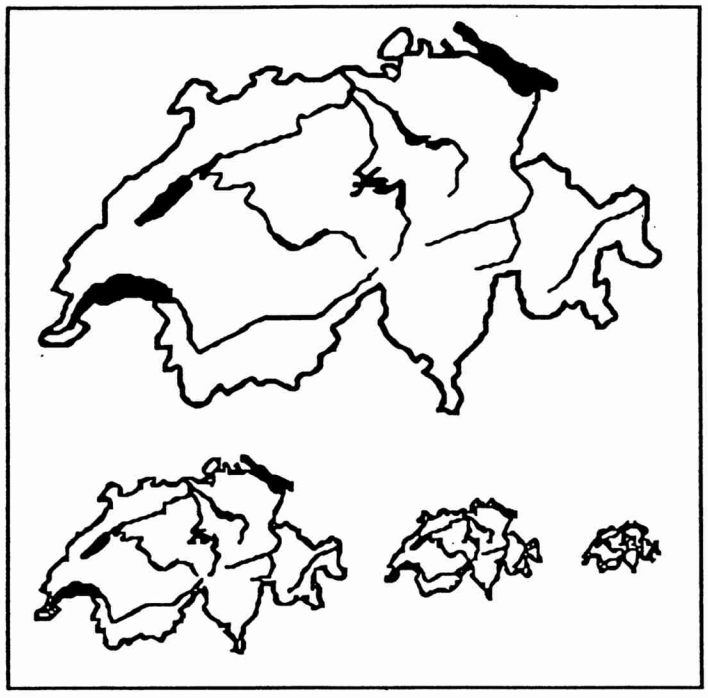

Fig. 1: Pixelresolution on a screen and scale reduction

Minimal dimensions are rather coarse on a screen in comparison to a paper map with line widths of 0.1 mm. A pixel on a 19" monitor (385x287 mm) with 1184x884 pixel resolution measures 0,28 mm. This causes rugged lines, an effect that to some extent may be mitigated by the arising technique. In a number of tests it has been shown that for clear identification of a topographic pixel map on such a screen, the paper map has to be enlarged at 250 %. In other words on such a display we can work only with sections of 12x9 cm, spread over the whole screen, of any scanned paper map. This means that we have to split up a toposheet for inspection into 30 segments. Any map image larger than 12x10 cm and displayed as a whole by pixels on the screen at its original or even reduced scale lacks for identifiable information and produces instead nothing but noise. The only remedy for such a situation is generalization. After all vector data are easier to present when the scales become smaller, because the attributes of the objects can be changed easily. But some effort has to be made to leave away those features that are not absolutely needed and to improve on the symbolization. Nevertheless the image collapses when the scales become considerably smaller.

We should not forget in this context about the need for an overall view on the entire map for quite a number of other map interpretation tasks. For all general questions the eye has to scan over the whole area, as e.g. recognizing

- he most congested areas
- he highest concentrations
- ll empty spaces
- the total evidence of a certain feature

or comparing

- regional densities
- distribution patterns, etc.

It is this kind of interpretation tasks, which can be performed most efficiently by humans. But they cannot be successful, if the overall image is illegible. Scrolling around is often a means to overcome such deficiencies, but not appropriate for this purpose.

5. Different levels of use of digital material and map library services

The library may have to cope with material for three levels of users, i.e. novice, advanced and expert users depending on the amount of interaction allowed. The data may consist of ready.amde images, **maps and images that cannot be modified,** sometimes not even zoomed in or copied. Buttons allow for simple selection. There may be referencing possibilities to comments or annotations like texts or sounds. The user is thus presented with some kind of slide show, with a guided your or a free choice of the image sequence. Opening

windows in parallel for comparisons is usually not possible in this case. The advantage versus a series of paper maps is just the quicker access but with a resolution that is worse.

A more advanced step in using such spatial data is reached when the **digital data may be edited,** amended, updated and completed. Possible operations include changing variables, regions, diagram and map types, colours by using buttons, menus and forms. The existing data may be copied and overwritten by new information. Raster data are split up for this purpose into a number of layers each of them with one feature only, which may e.g. be individually colour coded. A raster editor is needed, if such changes ought to be realized. If a vector editor is available, feature codes vector data may be edited and overlayed on raster data.

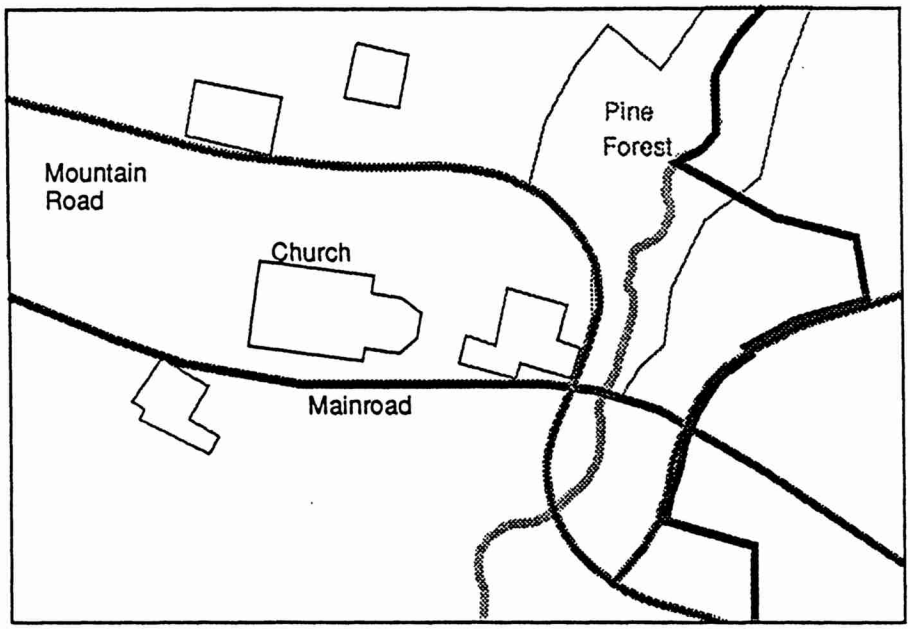

Fig. 2: Form under which a digital database is delivered

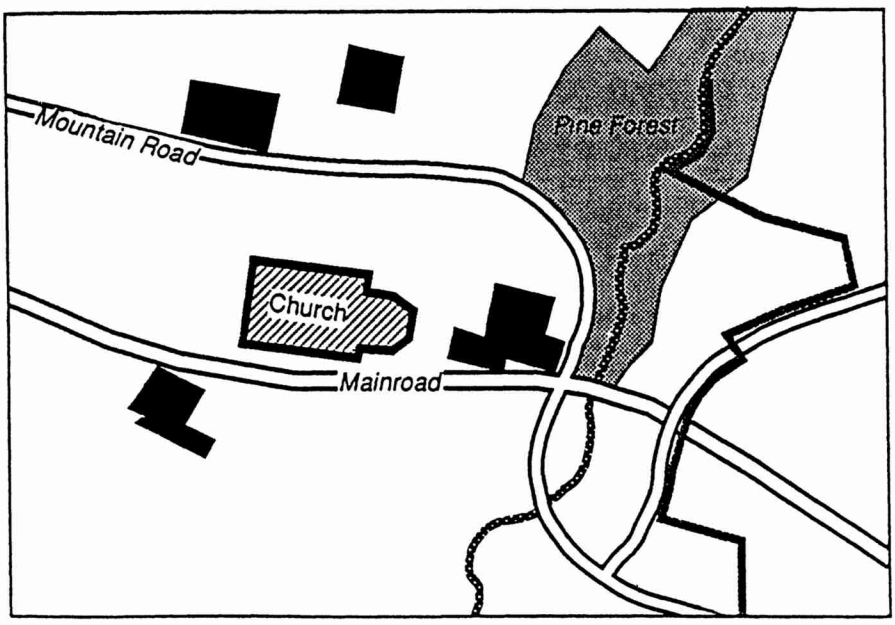

Fig. 3: Symbolized map on the base of the digital database of fig. 2

There is a gradual transition to a workstation with vector and raster editing and functionalities that allow for **statistical and spatial analysis**. It will be needed, if the spatial data to be handled includes both types of image formats and statistical background information.

One step further on the hard- and software side, including scanner and plotter allow the user to **produce ones own maps** on the basis of the available data. This means, however, a big step forward in **cartographic competency** of the staff of such a library. Digital cartography so far has not realized systems that can be left to the average user without a considerable amount of assistance. The fact is that clients will have to rely largely on staff of the map library. On the whole it is to be doubted that it is a map library's task to help unexperienced users to make their maps. Sophisticated users on the other hand will usually operate in their offices their own systems and will be looking in a map library mainly for data. It may

therefore be sufficient to give them an opportunity to use the library's facilities to inform themselves on the type of data available or to gather and retrieve information from this material.

The situation may be slightly different for **users that wish to make use of a GIS**, in order to gain information for some specific purpose. They might be assisted in logging in, querying and analyzing data that is resident in such a system set- up by the library. Its staff might help also in getting remote data through network channels onto the system. For the library this means to dispose of a powerful GIS, that is not dedicated to a limited group of applications and has access to large amounts of spatial data, databases and electronic atlases. To install such a system means asking considerable funds, and much more if we have in mind to serve more than one client a time. To be sure, people will stay the whole day searching for and browsing through all interesting data.

6. Requests for output and the copyright problem

In most cases there will be definitely a need for hardcopies of digital files, whenever possible also colour plots. Quite often clients of map libraries are not only interested in specific information to be retrieved from maps, but are looking for source maps for their own map compilations or productions. To handle these requests has been a serious problem up to now, as the necessary colour separation films or other map originals are difficult to get hold of and as access is somewhat restricted. This situation has favourably changed since digital base maps have appeared on the market.

In connection with the editorial work on the Atlas of Switzerland we have developed a set of digital base maps for the scale ranges 1:800,000 to 1:1.250,000. (rivers and lakes, administrative boundaries, hill shading) and 1:300.000 to 1:700.000 (hydrography and administrative boundaries). These features are differentiated by a number of attributes that allow for an individual design of each base map in relation to the map topic and purpose.

The librarian that disposes of such digital databases will increasingly be confronted with requests for copies of digital data sets on diskettes, tapes etc. This raises the problem of copyright. The owners of the data usually wish to see some feedback in terms of money they have spent in creating the data sets. Most of them do not allow to pass on the data to third parties. There are presently different systems of licensing or selling such data. How dramatic the situation of copyright fees in certain cases is, may be illustrated by the following figure: The cost of a vector tile for the main elements of the four sheets of the map at the scale 1:200,000 is SFr. 31,000.-. By what mechanism can the owners be assured that their data is not illegally copied and commercially utilized without their knowledge? Some distributors have found an easy means to solve the problem by

protecting their data sets from being copied. However, to look at the information only cannot be the final goal of the whole exercise.

7. Examples of digital data bases and electronic atlases

The *Global Change Encyclopedia (GCE)* project of the Canadian Space Agency and the Canada Centre for Remote Sensing (CCRS) consists of more than 2 GB of digital RS data and relevant ancillary digital data (maps, demographic information, etc.). It is available on CD-ROM and a subset of their content as a diskette version. It works on an IBM PC-AT, or compatible, with VGA graphic adapter, a minimum of 40 MB hard disk, mouse, CD-ROM reader and colour printer. The GCE contains continuous-tone images in a georeferenced raster format, maps (coastlines, land cover, climate, vegetation etc.) in vector and/or raster format, socioeconomic and environmental statistics in tabular and graphic map format by country. Photographs illustrate the local flora, fauna and landscapes and support text. Vector line work can be overlayed on raster imagery and maps. A limited set of GIS raster functions is available too. The data can also access vector data of the DCW (Digital Chart of the World). The user can access the GCE in four different modes. In script mode he is opposed to guided tours including practical exercises by varying the input parameters. The explore mode allows to select data by theme or region before downloading them to the hard disk. With the analogue functions the data can be analyzed and with the edit functions the user can prepare the data for presentation in map form.

The *World Geophysical* CD-ROM von Chalk Butte inc. contains a world map in a simple plate projection with topography and bathymetry in 24 bit colour for use on Macintosh-hardware. This same information is divided and can be enlarged into 4 and 24 fixed quadrangles. Another set of 24 files of 68 Kb each shows a circular aspect the world in an equidistant, cylindrical projection, centred 15° of latitude apart. These 53 images have a fixed size and cannot be changed in any way. The heights are divided into contour intervals; one of them may be selected at a time and coloured. Further operations are reading the elevation of a Iocation pointed at, asking for the great circle distance between two points, overlaying the plate boundaries, plate tectonic velocities or coast lines and simulating plate motions along small circles with linear boundaries. Images may be exported with a screen shot in PICT format. The usefulness as well as the precision of some of these functions must be doubted. There are severe limitations in every respect.

The *World Atlas - a multimedia view of the world* of Software Toolworks Inc. presents video sequences and 270 photo scenes of 47 cities in colour. It contains a series of ugly topographic maps of the continents and one map for each country with 10 city names and sound tracks for their English names and the national

anthem. Furthermore statistical data of more than 300 topics may be shown in statistical maps that cannot be changed in appearance. Again the limitations are severe and the printed products are not very persuading.

Since a number of years an electronic atlas project for Switzerland called *Mediorama* is in discussion. At first the intention was to produce one or two CD-ROMs with the existing national map series and the thematic maps of the national atlas. The composition of the study group led later on to a new plan with 9 CDs on various topics including a large variety of items but no maps at all. The user groups to be addressed by this project largely depend on the hardware to be adopted. In this respect CD-I-hard- and software is considered a must for this undertaking. It is only recently that we had contacts again with the project leader, the corporation that was founded under the name of MEDIORAMA AG. In our opinion a major problem, as far as maps are concerned, is that the maps to be contained on such disks cannot all of them simply be copied from existing material, but have to be prepared specifically for this purpose taking into account the observations made above with respect to viewing conditions on computer or video screens.

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