NAVIGATION IN SCHOOL ATLASES: FUNCTIONALITY, DESIGN AND IMPLEMENTATION IN THE "SWISS WORLD ATLAS INTERACTIVE"

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Abstract

Today, students are taught geography by means of 2D maps from printed atlases. Beside maps, interactive atlases provide novel representations such as globes and perspective views for enhanced visualization of spatial and thematic relations. In addition to new contents and representations, the most important advantages of interactive atlases are the manifold possibilities to search for maps and map-like representations. Efficient working with an interactive atlas is only feasible, if searching for contents and switching to different contents are as intuitive as possible.

In this paper specific methods are proposed how existing traditional navigation approaches can be transferred from printed to interactive atlases and how they could be improved essentially.

Introduction

The most commonly used teaching aids in geographic education are printed school atlases (Hemmer & Hemmer 1997). Such atlases are didactically edited, systematically arranged and consist of a bounded collection of maps, often supplemented by pictures, explanatory texts and graphical illustrations (Ormeling 1996).

According to recent developments in cartography as well as trends towards interactive media in school, printed atlases such as the "SWISS WORLD ATLAS (SWA)" are currently supplemented by digital versions. The SWA is widely used in Switzerland at secondary school level. It is characterized by a versatile collection of high quality maps and appears in German, French, and Italian. The Institute of Cartography at ETH Zurich is currently developing an accompanying web atlas, the “SWISS WORLD ATLAS interactive (SWAi)”. The new and innovative form should further increase the attractiveness and usefulness of the atlas.

In most printed atlases the contents are regionally and thematically structured. Different ways to search for maps guarantee the efficient, tailored use of atlases. To easily find a desired map, the map sheet index in the cover pages, the table of contents, or the place name index can be used.

These three possibilities of access maps are realized in the SWA (Swiss World Atlas 2008). Different frames indicate specific map sections on the map sheet index. The map sheet index in the cover pages of the printed SWA is a spatial overview. Within these frames no differentiation is made as to map topics. For better clarity and readability, not all of the existing maps are contained in the map sheet index. Therefore, only topographic and relief maps on a continental level as well as city maps are included. The table of contents is regionally structured, proceeding from Switzerland, to the neighboring countries, Europe, the remaining continents, the world maps and finally the solar system. Within this hierarchical-regional structure, maps are ordered thematically. Aside from the place name index, the SWA includes a thematic index. Both indices are alphabetically ordered. Searching for place names (e.g., “Atacama”, see figure 1) or thematic terms (e.g., ”Salzwüste“, figure 1, likewise) directs the user to the corresponding map (here “Südamerika” on page 159). The linking of maps is based on page numbers. Searching via the place name index, the page number refers mainly to a topographic map on continent level. Simply by browsing the atlas, related maps are presented on the neighboring pages, due to the regional and thematic order.

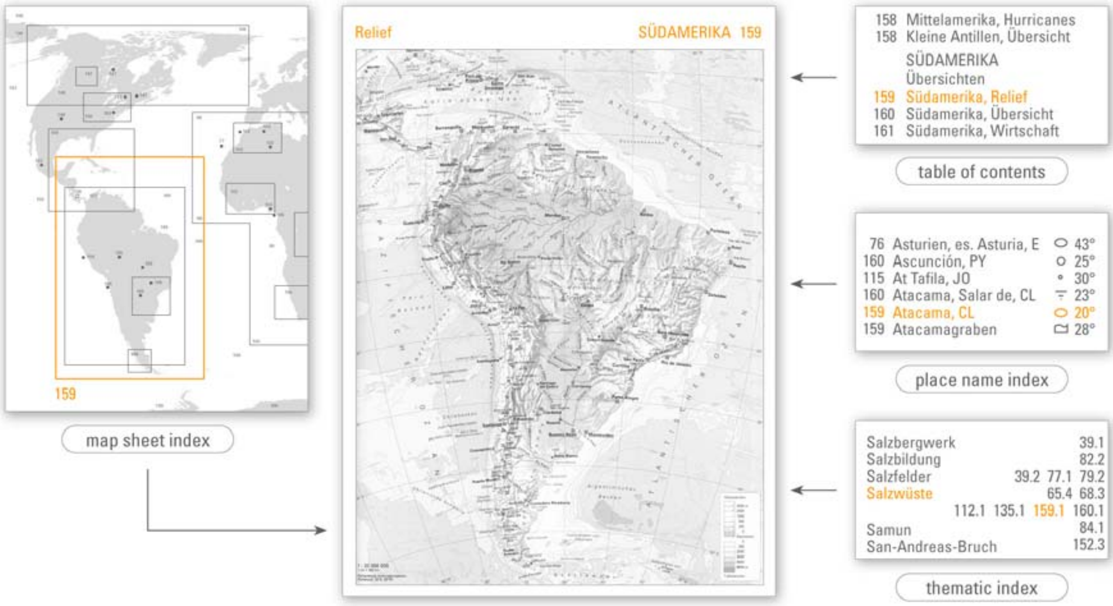

Figure 1: Traditional methods of accessing maps in the printed “SWISS WORLD ATLAS”:
Map sheet index, table of contents, place name and thematic index and requested map.

In addition to the regionally arranged table of contents some school atlases own a thematically structured table of contents. The individual maps are often assigned to color-coded regional or thematic groups. This color-coded categorization is sometimes reapplied in one or several map sheet indices. Generally there are many ways to integrate traditional methods. A wide variety of illustrative examples can be examined in: Diercke Weltatlas (2008), De Grote Bosatlas (2004) and Canadian Oxford World Atlas (2004).

This paper shows how the existing approach to navigate (search and switch to other maps) can be taken from printed to interactive atlases. Improvements of the traditional approach are illustrated by the example of the SWAi. Additionally, the paper considers new forms of navigation for representations, which are new with interactive atlases. Spatial and thematic navigation within the already accessed and displayed maps (such as for instance zooming, panning and manipulating layers) is not covered in the paper.
Navigation is as good as it is made understandable. For that reason, the design of the required navigation elements and its integration into the graphical user interface will be considered besides related technical aspects.

Methods of Accessing Maps in Interactive Atlases

Finding and displaying maps as quickly as possible plays a key role in every interactive atlas. This has also been revealed by an investigation of the Atlas of Canada. Participants of a user test were asked to employ the atlas. The users reported detailed impressions and their reactions to the site, navigational behavior, search strategies and issues with the user interface were conveyed. The participants agreed on the ability to find and display a map most quickly as the vital user preference (Williams et al. 2003). The optimization potential of the existing traditional access methods via map sheet index, table of contents, place name and thematic index and the added value of the new approaches such as browsing for maps via keywords and context-dependent navigation is significant for interactive atlases. An intelligent search mechanism can be crucial for the success of a product as seen by the example of Google.

Map Sheet Index, Table of Contents, Place Name and Thematic Index

The traditional methods of accessing maps by means of a map sheet index, a table of contents, a place name or a thematic index relates to linking maps and searching in a list. Adapted to the limitations of the screen, the map sheet index from the printed atlas can be used similarly in the interactive version. An extension would be adaptive zoom levels and the inclusion of all map frames, not only the frames for the topographic maps. By clicking on a frame, a link directs the user to the desired map. Likewise, maps can be linked to a table of contents, place name or thematic index.

Solutions to provide an "easy-to-use-access" to the atlas' content via a table of contents are mouse-over activated pop-out menus. A further possibility is a hierarchical tree structured table of contents where users can expand and collapse the nodes or a menu over which users can re-sort the contents, e.g., by page numbers, alphabetically, hierarchically, regionally or thematically. With the advantages offered by an interactive web-based medium, it would be possible to re-sort the table of contents depending on the user's location (e.g., all New Zealand maps appear at the top of the table of contents when the user accesses the atlas from New Zealand, followed by the Australian maps etc.). Only a web connection and the connection to a database are required for such an adaptive regionally ordered assortment.

Starting the SWAi for the first time, the map sheet index is presented to the users. The table of contents is implemented as a hierarchical tree within a resizable tab. Sundry re-sorting possibilities are offered via a drop-down menu within the atlas' content tab. It is possible to save the last accessed atlas window, which will appear again after restarting the atlas application. The map sheet index can easily be opened any time via a button in the contents tab.

A new feature, offered by the interactive atlas version is the combination of map sheet index and table of contents (figure 2). A synchronization of both elements within the atlas user interface causes the corresponding entries in the table of contents to be highlighted by a mouseover on a map frame. The map access can take place still faster if only the corresponding map titles of visible map frames of a zoomed map sheet index are shown in the table of contents. The inverse ways work quite similar.

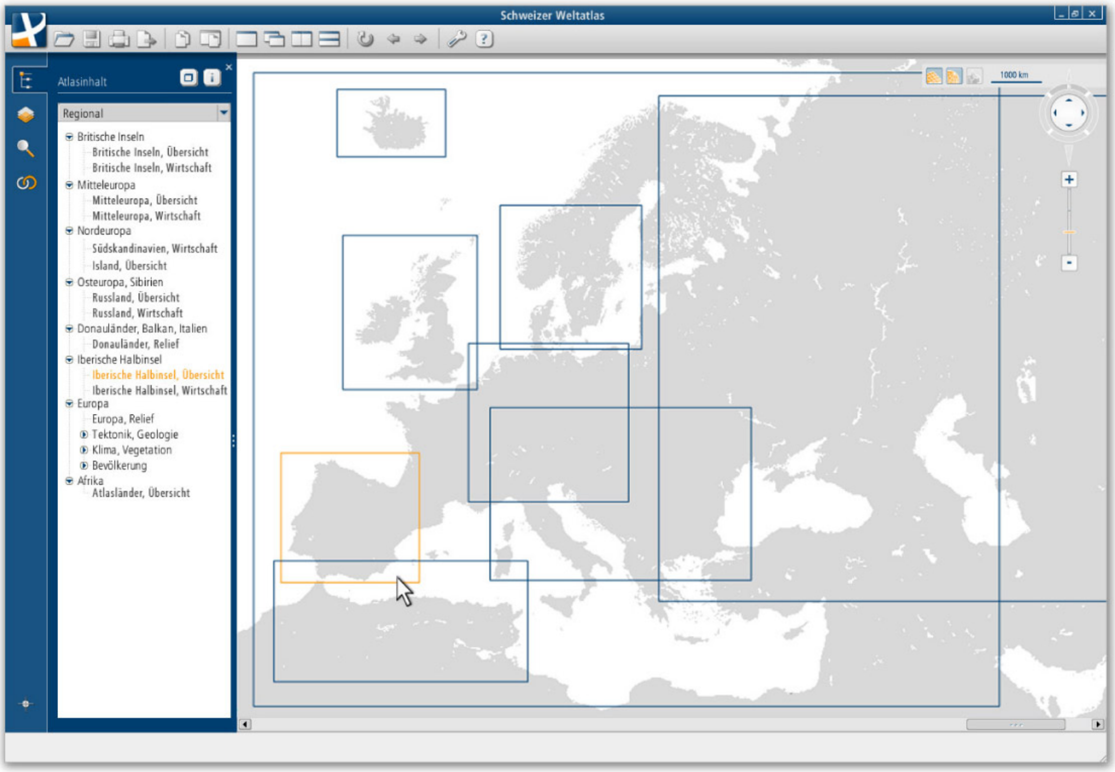

Figure 2: Combination of map sheet index and table of contents in the SWAi.

The indices are realized as hierarchical trees. A separation in place name and thematic index is further favorable. The indices can be shown via a button in the content tab. An alphabetical, regional or thematical sorting is possible similar to the sorting of the table of contents by a selection via a drop-down menu as mentioned before. An index may grow fast and quickly gets large just like in printed atlases. Since there is no size limitation, the indices in an interactive atlas can be extended at any time. The disadvantage is that a large list is confusing and not very user friendly. A solution would be a regional and thematic adaption of the indices (according to zoom level, selected topic etc.). Entering the indices into a search database, referring to maps by keywords would be an even better solution.

Browsing for Maps via Keywords

Further possibilities to access maps are by means of a dedicated database or a web search engine. The access via database asks a user to enter a query in a search box. For every map, editors are requested to enter appropriate keywords and the geographic extent. These keywords are analyzed during the search procedure. Matching search items will be displayed as a list of maps. The user then chooses the desired map via mouse click. All results remain visible until a new search is started or a new map is retrieved. Similarly, the geographic extent of the maps can be used to search for maps containing a specific location or area.

An advantage of the database solution is that the database can be extended at any time without affecting the atlas' internal structure. Unlike with the map index, a user will not be confronted with unmanageable large list. A database can also include place name and thematic indices and therefore enable a user to combine spatial and thematic queries (see figure 3, "Vulkan", "Europa").

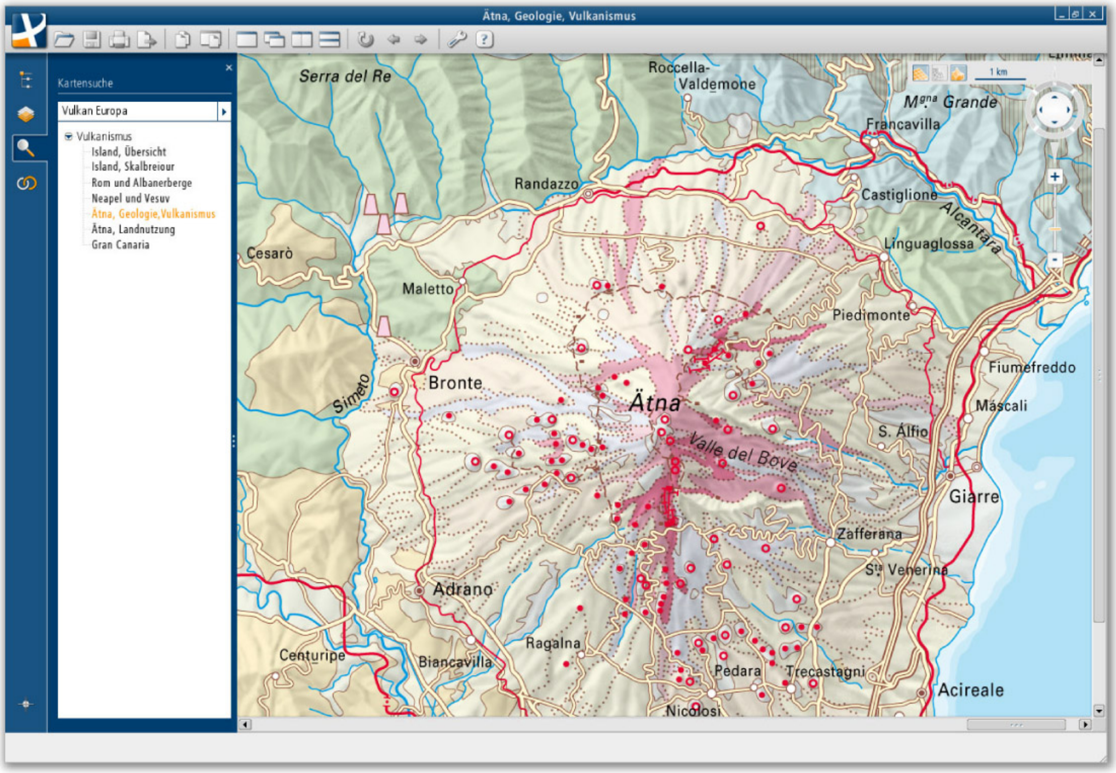

Figure 3: Map access via keywords in the SWAi.

A common problem with interactive atlases is that its contents possibly remain isolated from the Internet. A different approach would be to let an external web search engine (such as Google) do the indexing of the atlas' contents. Creating a precise description for every map in the atlas containing the most appropriate keywords will suffice then to redirect a web surfer to the desired map. Likewise, a user of the atlas can use the same search results to navigate within the atlas.

Context-Dependent Navigation

Another way to access the atlas contents is the context-dependent navigation, which can be combined with the methods mentioned above. It simplifies switching between different maps. The current map on the screen is supplemented with additional information about related maps (thematical and spatial). The indexing can take place via keywords from the database again.

A concept to display the related maps as user-friendly as possible and to make the access to the maps as fast as possible, is a grouping of all related maps in a list in a separate tab similar to the realization of the table of contents. Since relationships are structured hierarchically, it makes sense to organize the list analogous to the regional-hierarchical or thematical table of contents. Besides the list content of the related maps, the organization depends on the currently accessed map. For example: All maps of Europe are regionally related to a map showing the population density of Europe. Likewise, all population density maps are thematically related, independent from the area they cover.

In addition, a fusion of the list of related maps with the map sheet index could be done. It is possible to show the frames of the regionally and thematically related maps within the currently displayed map in the main atlas window (figure 4). Related maps outside the visible map extent could be referred to using an arrow.

The context-dependent navigation can be extended to a user-adapted navigation. This means that not only the currently accessed and displayed map is considered as the context. The current session or all maps, which a user ever accessed, will actually be considered. Maps depending on the context of the user would be displayed in a result list from previous hits or in a list of the most recently used maps. Users get a list, which is adapted to their needs and preferences.

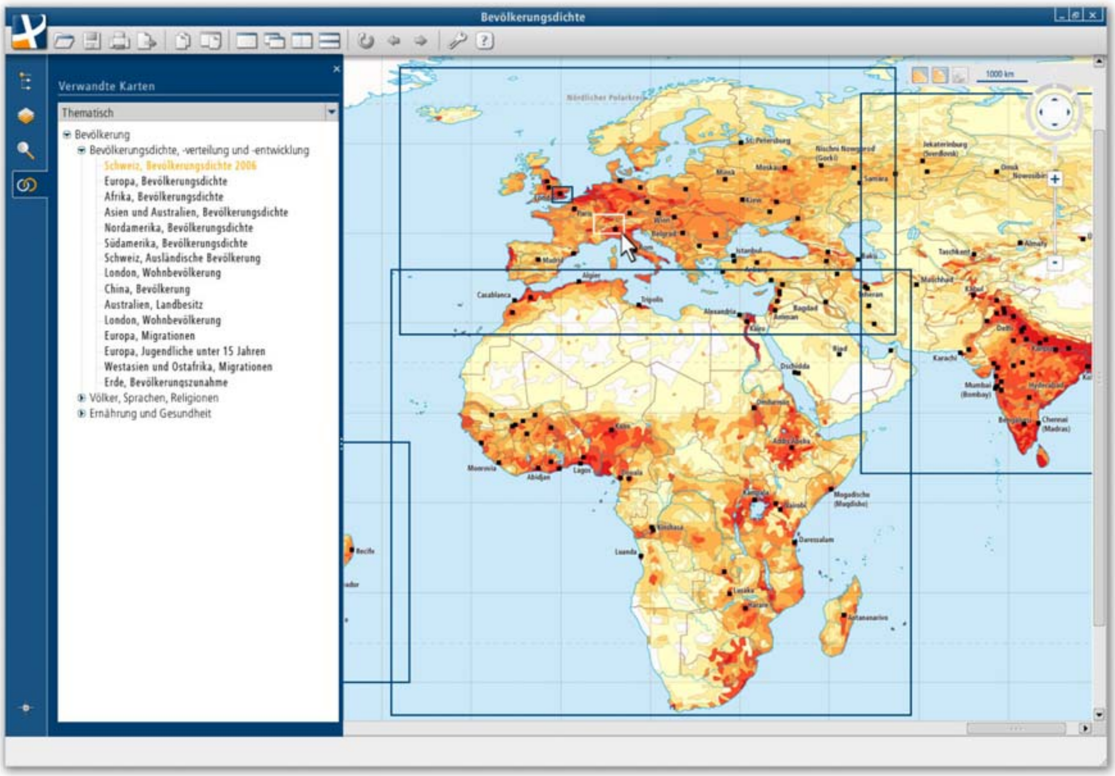

Figure 4: Synchronization of thematically related maps and map sheet index.

Basis for the realization of the user-adapted navigation approach would be an automatic storage of the user data/the user profile on the atlas-server. If a user selected e.g., only European maps so far, then the system would offer all Europe maps with other topics. If he has only accessed maps showing population density, a list of population density maps from any region will be offered.

The more frequently the atlas is used, the more detailed the matching results will be, i.e., the user profile can be built up more accurately. So far, such concepts are used only by online stores such as Amazon or search engines like Google. Interesting approaches for the exemplary realization of such best match algorithms concerning a current context are particularly present in the computer science environment, as e.g., Kocaballı and Koçyiğit (2007).

As far as is known within the scope of multimedia atlas cartography only two variants will be applied for user-related adaptions:

- The atlas editor adapts the atlas contents as well as the interface according to the user group (e.g., teacher or student).
- The atlas user adapts the atlas contents – mainly the interface – by himself according to his preferences.

MacEachren et al. (2008) provided and summarized ideas for a modular web-based atlas. But why shouldn't it be also possible that the system adapts the content by itself? User-adapted navigation generally relies on a system that does something hopefully useful for a user. This unfortunately pushes the user into a rather passive role. The opposite is therefore a justified claim: to give a user an appropriate tool to actively organize the contents of an atlas. The SWAi takes this into account as it offers the user a way to put maps into his or her own hierarchic table of contents. Alternatively, a user can interactively create a table of locations on different maps and retrieve them later.

Display Representations

Data access options in terms of different display representations means to let users choose different views of the same content. Examples of such views are maps, perspective views (e.g., block diagrams), or globes.

In the SWAi the switch to different views is realized through a variety of buttons. The basic access to the atlas content in form of the map sheet index, table of contents, place name index, thematic index or keywords remains much the same as mentioned above. After selecting and displaying the desired map, available views will be indicated by enabled buttons. The view changes by clicking on one of these buttons. Instead of "block diagram Klus of Moutier" (see figure 5), users select "Klus of Moutier". Or, as an alternative, the keyword “block diagram” may be typed into the search panel. All available maps in block diagram view will be displayed in the search panel.

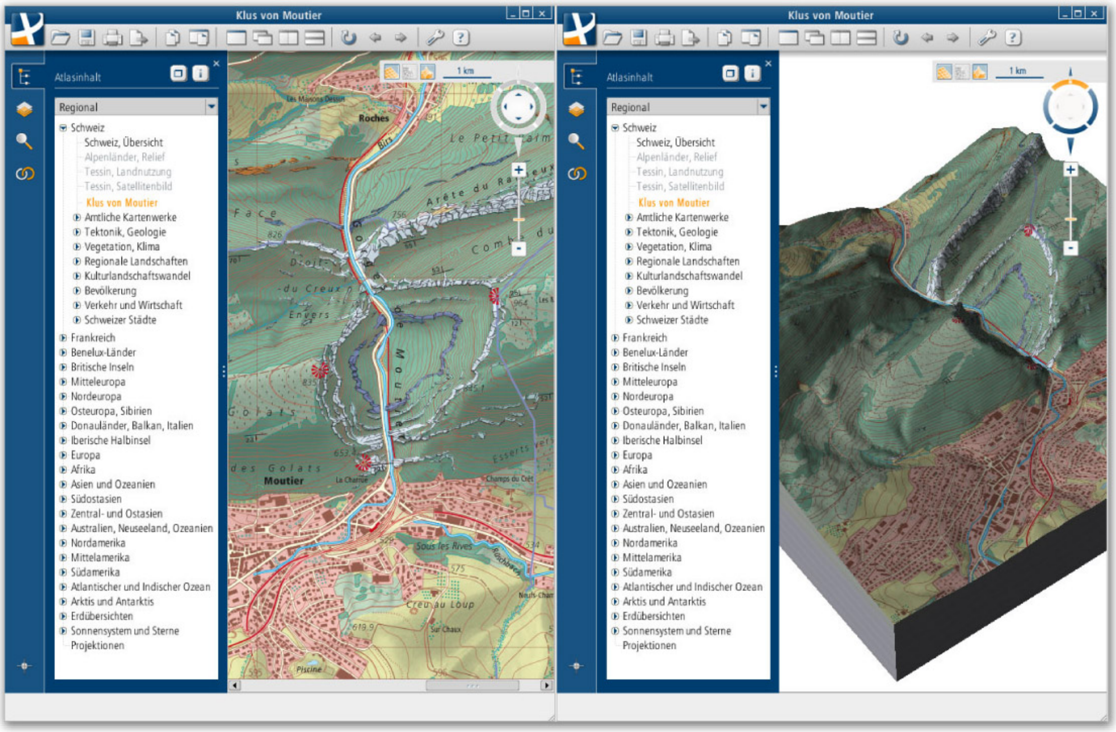

Figure 5: Two views of the same content (transversal gorge valley at Moutier in the mountainous Swiss Jura); Activated buttons for map and block diagram view, deactivated button for globe view.

Since all functionality is implemented in one single user interface, the access to the desired information is kept simple. Basically, the use of all general functions (e.g., printing) and map manipulation functions (e.g., toggling layers, zooming) are the same in each view. When a specific view is loaded, certain functions are deactivated as they become obsolete (e.g., rotation and tilting of a map in the map view mode). The described variant of implementation enables the integration of further views at any time. Realizations of additional information (e.g., encyclopedias) in an own specific, yet-to-be-determined view are conceivable.

Conclusion and Outlook

Searching und selecting maps and map-like representations can take place similarly to the possibilities offered by a printed atlas via map sheet index, table of contents, place name or thematic index. Furthermore, in interactive atlases, it is possible to search for content via keywords, which are stored in a database. Switching to related maps and representations can be simplified by assigning the same keywords to maps showing the same topics or the same region. All described types of navigation are realizable and the performance is fast and efficient. The interface can be integrated in a single search window including the display of the results.

The differences between the various search processes taking place in the background are visually not necessarily noticeable to the user. He or she can only chose between the selection via map sheet index, the table of contents, and the place name or thematic index via selection list or the input of a search query with the appropriate selection of the map from the result list.

With regard to accessing various maps, an interactive atlas offers many more possibilities than a printed one. The maps can be linked to each other by keywords. The atlas content is dynamically configured and makes the work more efficient. For example, the user has not to reopen the map sheet index or the table of contents in order to proceed to the next map.

Furthermore, the place name and the thematic index can be extended at any time, resulting in an improved search mechanism. Due to this fact, it is a disadvantage that the references must be editorially determined and manually assigned. An automatization of this process would be desirable. It would also be conceivable to register the user's access to related maps and to bias the linking of maps by listing popular maps at upper positions in the search result list. An additional advantage of the interactive version is the enhancement with alternative views.

In recent times, both the user and its needs take on greater significance in cartography. It can be expected that user-adapted/user-context-related software will increasingly find its way to the cartography market in the future. Thus, it is not far-fetched to assume that user-adapted features in interactive atlases would raise additional benefits in terms of efficient utilization and usability. Users arrive quickly and straightforward to the desired information. On the one hand, users are able to customize the very information they want. On the other hand, automatically generated user profiles could be created by the system and used to offer specific user-adapted information.

The disadvantage of user profiling and automated redirection to corresponding information is that a vast amount of atlas information is left unexploited unless users look for them explicitly. A random view of various maps or an approach using a byproduct such as "atlas-news of the day" may prevent users from ignoring the wealth of information in atlas systems and, on the contrary, arouse their interest for new horizons.

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