ATLAS INFORMATION SYSTEMS

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Abstract

On the basis of their functionality, electronic atlas information systems can be subdivided into 3 types: View only, interactive and analytical ones. On the basis of their objectives, 9 categories of atlas information systems can be discerned. A differentiation between these categories can be realized by analyzing the special requirements they should have for narrative frameworks, structures, navigation aids and functionality. This will result in a matrix of atlas types and atlas categories showing the requirements for atlas information systems.

1. Definition

Atlas Information Systems (AIS) are computerized geographic information systems related to a certain area or theme in conjunction with a given purpose - with an additional narrative faculty, in which maps play a dominant role [1]. The emergence of different types of Atlas Information Systems (resulting from different types of paper atlases) has been expected since the ICA Morelia conference, when the first electronic atlas was demonstrated [2]. The existence of a specific set of tools, used to structure the information in atlas information systems as well as a special atlas map and other help functions that allow one to navigate through these systems have been indicated [3, 4]. The narrative which figures in the definition above works as an overall framework to which all information items are related; with the use of structuring tools the atlas is structured in such a way that information items can indeed be seen as part of this overall narrative [5].

The intention of this paper is to analyse the various types of atlas information systems that have either emerged or are emerging, and to try to link them to specific types of narrative frameworks.

2. Starting point

The development of traditional paper atlases has by no means come to an end - be it that from now on this development will be in conjunction with that of atlas information systems. If at this moment no paper school atlases are published yet that come together with a CD-ROM as their electronic counterpart, it is inconceivable that by the year 2000 these paper schoolatlases will be published without such a counterpart. The objective of school geography, as an educational discipline will by that time extend to teaching students to work with geographical information systems and the atlases of the near future will enable the teachers to perform that role.
The function of such a counterpart AIS will first be to provide background information; it can be to show the statistics on which the maps in the paper atlas are based, and thus provide the precise values - as it is not the function of paper maps to provide these (because they have other aims, such as visualizing trends).
Another form of background information consists of pictures of the phenomenon categories discerned (such as crops or landscape types), that have been abstracted and represented on maps on the basis of their location. It is to link these abstractions to the reality the students know from their own experience, that these pictures are added. Other forms of background information are accompanying explanatory texts, tables, graphs, drawings, etc.

Next to background information these electronic counterpart AISs will be able to show other graphical views of the same data. No one map can be considered as the only true map based on specific data, as

subjective decisions regarding data thresholds, classification systems, class boundaries, or numbers of classes have been made.
The counterpart atlas information system will be able to produce alternative maps of the same themes as shown in the paper atlases. This role cannot be underestimated, as it teaches students not to take maps at face value - even if produced with the best of intentions - and teaches them also to process the data themselves.

The third function of counterpart AISs will be to show additional material. The paper atlas, because of capacity and financial constraints, can only show a limited number of views or windows on the world - limited to specific areas being depicted, specific topics, mapped for specific dates- and the electronic counterpart will allow the student to extend this limited scope. Even if the development of traditional atlas types has by no means ended, and if their further development will be together with or in conjunction with that of atlas information systems, it is possible to indicate their present characteristics:

They are all deliberate combinations of and superior storage devices for spatial data sets. Even if they consist of combinations of isolating views - as said, views restricted to specific areas, topics and dates - it is possible and indeed intended to compare these views, in atlases and by allowing this they are prime tools for exploration. The comparisons are possible and useful because the basic data have been edited in a special way - for instance by making sure that all datasets displayed at a specific scale have been generalised to the same degree.

On the basis of the type of comparison they allow for, different types of traditional atlases have emerged. One would be able to discern/differentiate between:
-geographical atlases (comparison between areas)
-historical atlases (comparison between dates)
-national/regional atlases (comparison between themes)
-topographic atlases (comparison with reality/environment)
-thematic atlases (also comparison between areas)

On the basis of (communication) objectives one would be able to discern between:
-educational atlases
-navigation atlases
-physical planning atlases
-reference atlases
-management/monitoring atlases

When inquiring into the scenarios or narrative frameworks they use, one would be able to discern some basic models, for instance radial and confrontation models or regular linear , interrupted or irregular linear journeys of discovery such as described in the following examples:

radial models:

-getting to learn about the world by constantly refering to one's own habitat; or by using one's own situation as a yardstick; in this scenario the importance of other areas tends to be diminished proportionally with their distance to one's own habitat.
-getting to learn about one's own situation by showing the Earth as a consistent unit ("Spaceship Earth") and subsequently showing the role of one's own country in this unit.
-by the gradual extension of one's horizon so new spatial knowledge is gradually added to and accomodated in one's mental map.
-getting to learn about history by relating it to the situation in one's own time
-getting to learn about history by seeing it unwind towards the final, unfinished act in which oneself is situated

confrontation models:

-by confronting positive and negative forces (see for instance Kidron's *War Atlas* or *State of the World* atlas, or Haack's history atlas *Atlas zur Geschichte* which shows the fight between Communism and Capitalism)
-by confronting prospective and already capitalized discoveries of natural resources. Diercke's petroleum world atlas *Erdöl Erdgas Weltatlas* being an example.
-by confronting offer and demand - for instance the confrontation of offer and demand for recreational facilities as shown in tourist atlases
-by confronting physical and economic maps of parts of the Earth and by doing so showing the different degrees to which the physical world has been interpreted, opened up, colonized and made use of by Man
-by confronting different views of the world, such as RS imagery and topographic maps and so showing our (in)adequacies in abstracting the world graphically.

3. Relevance of traditional atlas characteristics for Atlas Information Systems

For all their relevance to exploration, paper atlases can at best provide a guided tour. Even if users explore on their own, they will still be using data that have been selected and visualized according to the insights of the map author. As already indicated, paper space is at a premium in paper atlases, and each phenomenon, each combination of theme and area will only be visualized once, while no second opinions are provided. That is another reason why electronic atlases are so important - because of their superior storage capacities they have the ability to provide more, different views of the same data, by allowing for changes in definition, in classification or categorisation, in symbolization or by providing different colour schemes.

It has been shown elsewhere what the relevance in an electronic environment is of the structuring tools developed for paper atlases [6]. Scale and map sequence, traditional means for highlighting those areas or topics that are considered most important, can for instance play only minor roles in AISs because of different access mechanisms of electronic atlases as compared to paper ones.
The role of the AIS counterpart vs the accompanying paper atlas can of course fluctuate: the AIS can have a support role or a parallel position or even be the prime information carrier, when the paper atlas only functions as an explanation device for succesful navigation through the electronic AIS.

All the types of comparison valid for paper atlases are also valid for atlas information systems. As the possibility to subdivide the monitor screen and compare different maps by pulling them down next to each other has come within our reach, with AISs, this aspect of electronic atlases is extra worthwhile. Above, as the types of comparison possible for paper atlases, we listed: geographical comparisons, topical comparisons, temporal comparisons and comparisons with reality, and indeed for most of these types of comparison conditions have improved in the electronic environment, especially so as much of the GIS functionality would be available here as well and would help in quantifying them.

Amongst the (communication) objectives of paper atlases, there are none that cannot be reached by atlas information systems as well. Indeed, examples of AISs with education, navigation, physical planning, reference and management objectives already exist.

Regarding the scenarios, atlas information systems should show more elaborated scenarios or narrative frameworks because of the additional space and functions of these electronic devices. There are few proofs yet, however, of this increased potential. The Global Change Encyclopedia [7] is one of the few positive exceptions.

4. Types and categories of Atlas Information Systems

On the basis of their overall functionality, electronic atlas information systems can be subdivided into three types [8]: -view only AISs, interactive AISs and analytical AISs.

While view-only AISs are but electronic versions of paper atlases, it is the two other types that profit from the increased electronic potential, as this allows for more scope in the analytical functions. But it is only through responsible design that most of the positive (structural) aspects of paper atlases can be retained. Interactive atlases allow users to adapt the cartographic image of the data selected by the cartographer to one that matches their own views. With analytical atlases, users cannot only visualize the available data to their liking, they can also select the datasets they want to use, and link and otherwise manipulate datasets at will.

In principle these 3 types of AISs would be available for all categories of AISs. Based on the objectives, a number of AIS categories has emerged that continue or expand the role played by paper atlases. One can discern:

1. national atlas information systems (topical comparisons)
2. historical atlas information systems (temporal comparisons)
3. reference (world) atlas information systems (geographical comparisons)
4. economic (world) atlas information systems (geographical comparisons)
5. physical (world) atlas information systems (geographical comparisons)
6. physical planning atlas information systems (topical/temporal comparisons)
7. educational atlas information systems (topical/geographical comparisons)
8. navigation atlas information systems (comparisons with reality)
9. management atlas information systems (comparison with reality)

Examples of national and regional AISs already abound: PC and CD-ROM *Atlas of Sweden*, PC and CD-ROM versions of the *National Atlas of Spain*, the *National Atlas Information Service* in Canada and a similar setup in Norway. Historical Atlas Information Systems either already exist (as in the United States where the *Great American History Machine* as well as *Milennium* have been published and the latter is continually being updated) or are being built (Netherlands). Reference world AISs are at present mostly offspin products of paper reference atlasses whose production system is converted to a digital environment. Their functionality is still rather limited (the*Times World Map and Database*; Bertelsmann's *Grosser Atlas der Welt*); DeLorme's *Global Explorer* being an exception. Economic AISs have not been discovered yet on the market, while physical AISs do exist longer already (*North Sea Transportation Atlas* , 1987). Physical planning AISs would show all the relevant datasets that allow one to monitor population and economic development as well as the environment, and match requirements and environmental constraints in such a way that the wisest use of the available land area will be made.

Educational atlas information systems are being produced at present as well, one of the producers being Freytag-Berndt in Vienna [9]. Navigation Information Systems cannot automatically be regarded as atlases, unless they possess additional functions, such as explanations, warnings, and a specific view or evaluation of the terrain. That is why not all street or city so-called atlas systems immediately qualify as AISs. A good example of the last category, management AISs, are the CLIC atlases, currently being digitized in the Netherlands: a CLIC atlas (Conduit and pipeLine Information Coordination System) have all the information on pipelines and conduits in the subsoil and perform their function by warning contractors against bulldozing along specific lines or routes, in order to prevent conduit pipes being damaged.

5. Conceptual and structural requirements of current types and categories of Atlas Information Systems

In order to link the types and categories of AISs with the corresponding software functions and structures one would end up with the following 3D matrix (see figure 1) each of the 'bricks' in this matrix can be filled regarding different requirements for scenarios or narratives, structures, navigation aids, functionality (for queries, comparisons, browsing, analysis), and for the nature of the relationships with their paper counterparts.

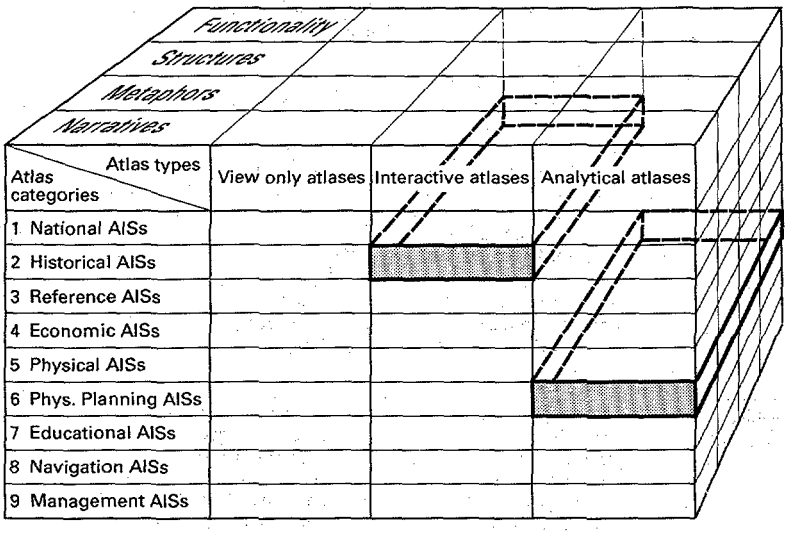

Figure 1 - Framework for conceptual and structural requirements of current types and categories of Atlas Information Systems

Finding out about the requirements of different types of AISs can best be realized by opposing different categories, for instance physical planning AISs and historical AISs.
The most important aspect of physical planning probably is the existence of modalities - especially propositional modalities (attitudes of the cartographer towards the proposition [10] and the information represented in physical planning consists of propositions and accompanying modalities [11]. It consists of proposed objects (roads, urban extensions, airports, recreation sites) with different degrees of obligation/necessity and therefore reality (agreed, discussed, proposed), witin different timeframes (to be constructed within 5, 10 or 25 years), being located with different degrees of fixation (exactly here, in this area, or hereabout).

The physical planning AIS relates to actions or measures to take that would ensure our future well-being. It is a sort of reality machine, and all objects proposed should be approached with this aspect foremost in the user's mind: how real is this object: how soon will it be here at this location with what degree of certainty?

The scenario could also be that of a design game, such as in SIM CITY, in which the user, being able to use all the information the physical planner had at his/her disposition, can design the future environment and will be presented with the financial results of the proposal afterwards.

As opposed to this physical planning AIS there are historical AISs, i.e. history or time machines, that show the political situation at former periods in time. Depending on their temporal resolution one would be able to see changes in political boundaries occur every year or even every month. There is one all-predominating structuring aspect, i.e. time. There is no geographical structuring agent, and this stimulates one to pan at random, and so to look at different areas and when the area has been surveyed to either move on (what happened next) or move backwards (what caused these developments) in time. So these historical AISs put the user in the position of a time traveller.

The differences between the two AISs are indicated in figure 2. The results can be noted down in the appropriate slots in figure 1, that have already been highlighted.

	physical planning AIS (analytical)	historical AIS (interactive)
narratives	design your future confront present and future	let history unwind until it gets to now
structures	layered: more detail when zoomed in upon layered: several datasets	linear (changes in time)
metaphors	reality machine intervene in reality as a modern Gulliver	time machine to be present always without being able to interfere
functionality	showing modalities map object query explanatory text options additional data zoom, pan, legend compare topics analytical functions (GIS)	highlight country of interest areal object query explanatory text options search machine zoom, pan, legend temporal comparisons animation function

Figure 2 - Differences between physical planning and historical AISs

6. Outlook

In the coming years, this 3D matrix of AIS types, categories and software functionality has got to be filled in further, in order to guide producers of Atlas Information Systems, as well as producers of the shells to put atlas information in, by showing the requirements for all types and categories of AISs. Indeed, the shell as proposed until now for the production of electronic atlases seems to have a functionality focused on reference AISs, and less on educational or physical planning objectives [12]. Being aware of issues such as these would help prospective electronic atlas producers. and prospective users at large as well.

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