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Neo-cartographic interlacement as barrier for Cartographic Heritage

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Summary
Neo-cartographic characteristics, like ubiquitous cartography, user participation and geo-communication, are new paradigms in modern cartography. These new paradigms mainly base on digital technologies, especially Service-Oriented Architectures (SOA) and network topologies. In terms of a prospective cartographic heritage these modern developments lead to a starting dilemma on the archiving of involved digital technologies and map contents. Even if new archiving methods for digital applications and data were developed in the past decade, SOA and distributed network applications still wait for appropriate archiving procedures. Initial considerations and questions on removing this archiving barrier for a prospective cartographic heritage are this discussed in this contribution.

Introduction

Historic geospatial contents form an important part in actual planning, documentation and cartographic applications. Spatial planning situations take historic developments or states into account and therefore use historic maps, cartographic applications and geo-reference data. The main dilemma with historical geospatial content occurs, when the required content cannot be accessed, understood or (geo-)referenced, which is a result of technological dependencies, loss of semiotic description and loss of metadata descriptions. Analogue maps, like paper maps, offer a visible depiction at any time and request a legend and reference frame in order to be spatially usable. Simple digital maps need much more: beside an application that offers some interaction with the digital map, the format, the data´s reference frame, transmitting media and transmitting media´s characteristics / requirements need to be supported in order to receive a visible map. This requirement´s complexity is also true for (primary) digital geoinformation, which is mainly stored in bits and bytes. This ongoing investigation within the commission on digital technologies of cartographic heritage focuses on the latest developments of modern maps, which lead to neo-cartographic environments and its related archiving concepts. The steps from digital maps to multimedia-, web-, and Service-oriented maps result in real-time content which is affected by user participation in ubiquitous environments. It becomes obvious that these distributed, interactive, multimedia and real-time maps can hardly be archived by following old archiving paradigms: to keep the application/content in a save place forever. Instead, new methods have to be developed in order to keep digital contents "online", accessible and thus ensure historic applications of tomorrow. Accompanied by technical methods, legal issues and the interdisciplinary understanding of archiving have to be adapted to the prospective historic use of digital geoinformation and modern maps. This is a starting point to remove the main barrier for the prospective history in modern cartography.

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Towards the understanding of modern cartography

Modern cartography is heavily influenced by digital approaches. Reproduction processes as well as dissemination procedures make use of digital mechanisms that mostly enhance traditional processes. This technical changes lead to new and extended applications as well as use cases. Thus the access to geospatial information becomes public and even the creation of maps can be done by public too, as it is shown with the OpenStreetMap (www.openstreetmap.org) initiative. In terms of cartographic heritage these technological developments of neogeography result in new challenges for enabling sustainable cartographic heritage for the future. Their conceptual structure, intermedial dependencies and technical requirements lead to a more complicated framework. These technological developments of cartographic visualization come up with new notions, which should be briefly explained in order to provide an overview of the successional meaning.

Geovisualization includes scientific visualization of geospatial content, which is mostly derived from data analysis [Andrienko et al 2007]. Geovisualization focuses on the use of computer graphics to create visual images which aid in understanding of complex, often massive numerical representation of geospatial concepts or results. It emphasizes knowledge creation by different information visualization and therefore extends knowledge storage. The combination of GIS (analysis) and geovisualization allows for a more interactive exploration of data with the base functionalities of map layer exploration, zooming, altering of visual appearance and digital interfaces [Jiang et al 2003]. Additionally, geovisualization advantages concern the ability to render time- and space-changes in real time, expand the visual exploration to n-dimensions and allow users to adjust mapped data abstraction in real time [MacEachren et al 1997].

Web mapping describes creation and dissemination processes for maps that make use of the Internet. These processes cover the designing, implementing, generating and delivering of maps via the World Wide Web [Peterson 2003]. Beside the technological issues of how to establish Internet maps, theoretic aspects concern additional studies of web mapping: the usability of web maps, the techniques and workflows' optimization and even social aspects [Kraak et al 2001]. Therefore web mapping serves as presentation media with an increasingly amount of analytical capabilities (Web GIS, Web Services). In addition developing client devices, like PDA, hand-held or mobile phones, expand web mapping to ubiquitous cartography, where maps are time- and space- independently available [Raper et al 2007].

Geospatial Web Map Services (WMS) focus on a server sided processing of geospatial information with the general aim to render simple images and send these to the client. Variations of Web Services (WFS, WCS, WPS, WPVS,... www.opengeospatial.org) even enable direct manipulation of geospatial database contents and analysis, which simulates full GIS functionality via the Internet. As effect these services have great impact on expert's and layperson's user experience.

Location Based Services (LBS) make use of Web Services by reason of utilizing the geographical position of a device and offering location and task relevant information and entertainment services. Thus LBS incorporate services to locate the device, to access content gazetteers, which enable the use of various information and to possibly track user moods. For example LBS include personalized weather services or location based games [Reichenbacher 2004].

Locative Media describe media of communication that are bound to a location. Accompanied by the technical possibilities of Web Services and LBS, digital presentation media (pictures, video, sound, ..) can be virtually applied to locations. This leads to a triggering of real social interactions. Although mobile positioning technologies, like GPS or mobile phones, enable the intense spreading of location media, these technologies are not the main aim for an ongoing development in pro-

jects in this field. Instead the social component, which provides information on the relationship of consciousness to a place and other people, forms the framework to actively engage, discuss and shape spatial bound topics in a very wide public environment [Galloway et al 2005].
The notion neo-geography subsumes public use and creation of geospatial data. It can be seen that the public use of web technologies is a major development in cartography that opens new opportunities. Neo-geography is a notion for "new geography", which bases on a public access to geospatial data and participation in geographic applications [Turner 2006]. The access to geospatial data is executed via the Internet and various Web Services. One does not have to load complete datasets to the client computer, but receives simple pictures according to the requests of Web Services that may be used by specific applications (like Google Earth). The participation in geographic applications describes the user's possibility of recording and sharing geospatial data, which have special personal/individual importance.
In addition to the public recording and exchanging of geospatial data, the notion neo-cartography combines neo-geographic characteristics with ubiquitous cartography and geo-media techniques. Beside a time- and space-independent access to maps and modification of geospatial data, neo-cartography takes the characteristics of transmitting media, the impact of information-content and user needs for the presentation of geospatial information into account. The new aspects of neo-cartography indicate the possibility to directly access mental imagery by using user inputs. The ubiquitous existence of maps and a public participation develop a social imagery of space that should be used for the abstracted and simplified presentation of space.

A cartographic heritage structure of modern cartography

The characteristics of modern cartography and its paradigms lead to a strong interlacement of all components that have to be born in mind if sustainable archiving should be done. The following depiction of a conceptual cartographic heritage architecture shows main dependencies of considered core components. On one hand this graphic additionally shows the grade of digitalization, on the other hand cartographic heritage depth can be defined.
The grade of digitalization starts with content and its storage media. In principle this categorization begins with analogue media, like a paper map on its storage media paper and a printed content. As soon as a digital content has to be processed, the device and format of the data become important. Consequently the processing application and its dependencies have to be considered. Cartographic heritage depth covers content-based- and artistic-based parts of historic values.
Thus, a very first description of cartographic heritage starts with storage media, its material, fabrication and condition. In a next step the content with its syntax, pragmatics and semantics adds to storage media. Storage media and content form an artefact, which allows suggesting the resulting application and usability framework. Finally full cartographic heritage depth for a digital cartographic tool additionally covers device, format, application and most of all the interface of the map.

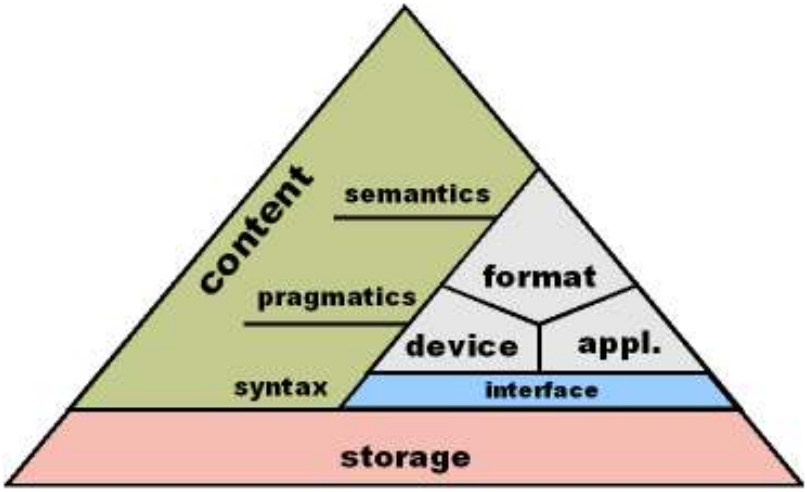

Figure 1. A simple cartographic heritage structure that depicts dependencies for digital based technologies.

However, the described graphic from above can only depict a first conceptual architecture of digital cartographic heritage. In fact more aspects have to be considered, when looking into detail. For example storage strategies vary for applications, formats, content semantics or devices [Borghoff et all 2003]. Instead of one single technique to comprehensively save cartographic heritage, different methods are needed for the different parts. From another point of view a lot of questions arise when thinking on service-oriented architectures [e.g. Hagedorn et al 2007]: How can we archive service-oriented applications, that depend on the Internet, communication protocols and ad-hoc connections? The conceptual architecture may help to keep the main dependencies within the range of vision when going into more detail. Cartography that relies on SOA, which heavily uses a corporate network or the Internet, additionally calls for archiving the SOA structure and contents. This means that a mapping of the network structure or at least its functionality, protocols, actuality and integrity needs to be solved.

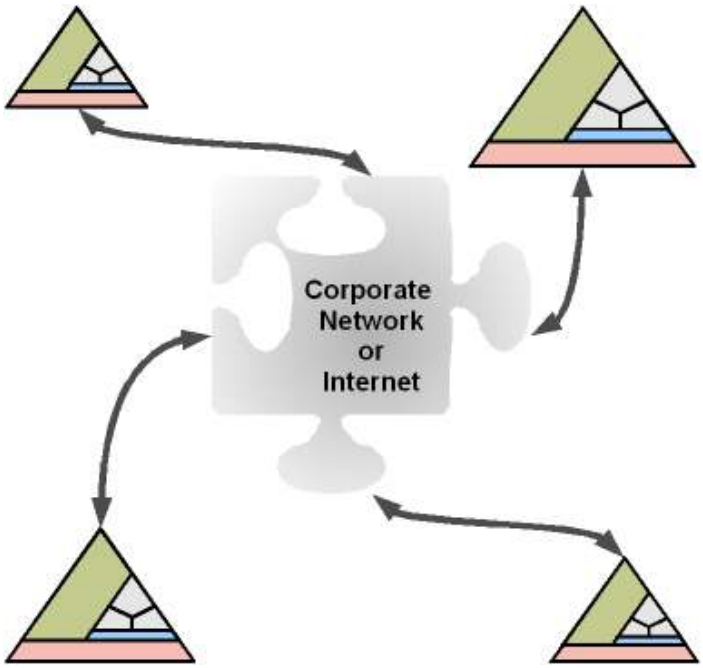

Figure 2. The conceptual cartographic heritage structure in a distributed (Service-oriented) architecture. In addition to the complex single cartographic applications, the network structure or at least its functionality, protocols, actuality and integrity needs to be mapped.

The archiving of a SOA structures does not only concern technological means. In point of fact the responsibility and process methodology for the protection of geodata and maps has to be discussed in order to structure a technological framework. Assume a working archiving framework, like specific Services in the Internet, and no one who is responsible for parts of the cartographic heritage structure (content, meaning, format standards, ...), then the digital content and entire sequences within the SOA network will definitely be lost. In order to overcome this barrier of cartographic heritage, main important aspects that exist today and are needed for a prospective archiving of SOA have to be identified.

Main aspects for archiving geospatial data, information and applications

The focus of a workshop on "archiving in geoinformation and cartography" was to identify main aspects for a prospective cartographic heritage in an international and interdisciplinary group of experts, which covered librarians, archivists, computer scientists and cartogrpahers. The contributions of the archiving workshop reached from practical approaches to theoretical concepts, which were mixed with detailed and active discussions. This mixture led to an active incorporation of all participants, whose occupational background finally demonstrated needs and prospective developments. The main aspects for archiving digital geospatial data, information and applications were the protection of data, a differing of "analogue-born" versus "digital-born", regulations for the selection of "save-worthy" content and the complexity of information portfolios.

Protection of Data

The discussion on protection of geospatial data based on the conclusion that open formats (including appropriate norms and standards) have to be used in order to keep accessibility to functionality and content. Nevertheless it has to be anticipated with a massive loss of data due to human factors (lack of knowledge), missing descriptions, software-based- and hardware-based damages.

- Human factors

Human factors, especially the lack of knowledge, predominantly concerns relocation of interest. For instance a dataset becomes declared as unimportant because these data are not used for actual tasks anymore or the data are beyond the field of activities due to a change of administration structures. Then the elimination of this dataset is a next step that is mostly argumented with saving on resources. A prospective use of these dataset, prospective historic values and future importance (in order to answer prospective questions) are generally not considered. One main solution to overcome this problematic aspect is a precise and sustainable regulation of responsibilities as a political regulation or legal framework.

- Missing descriptions

Missing descriptions in terms of geospatial data lead to the main loss of temporal and task-oriented reference as well as loss of geospatial references (geodetic date, reference systems, specific offsets, …). In general geospatial data become unusable and get lost for further applications. A possible solution for missing descriptions is the establishment of standards for metadata and meta-metadata, which allow for embedding and direct linking inside the original data formats. In addition appropriate search algorithms are needed to keep an efficient access and "online" knowledge to information.

- Software-based damages

Software-based damages lead to "sneaking" deformations of original data. For example the copying of data or transformation to another data format may lead to a different data structure and thus also to a change of coding or even changing description of geodetic reference (in the internal mathematical description of data). It is obvious that this imperceptive procedure is not reversible. It mainly causes a pragmatic loss of the dataset. A possible solution to avoid software-based damages is an usage and establishment of possibly open standardized data formats in order to avoid transformation to new formats.

- Hardware-based damages

Hardware-based damages often lead to unreadable data carriers (storage media) and thus a loss of all contained data/information. Nowadays the only possible solution to keep alive content on digital data carriers are constant copying to new data carriers considering their technical requirements in terms of compatibility and their expected lifetime.

Difference of „analogue-born" and „digital-born"

The determination if geospatial data analogically exist and were digitized afterwards (analog-born) or were digitally created and do not have any tangible original (digital born) has generally to be made. Whereas analog-born data can follow the predominant paradigm of archiving (store and save), digital-born data call for new methods in archiving. The reason is that analog-born data can be created by the original template anytime, often with much higher quality due to improvements in digitizing technologies. Digital-born data do not have an original master, which can be used for "digitalization". Instead concepts for long-term preservation are needed in order to access these digital originals.

Digitalization of analogue data enables an easy dissemination, access and professional analysis. Just the step of digitalization cannot be seen as "archiving procedure" of the original material! In fact the original is needed for a renewal of the digital representation. In contrary a reconstruction of an original (the rebuilding of an analogue master) out of a digital representation calls for appropriate qualities: in case of maps, which mainly consist of graphics and line art, reproduction specifications will need about 1200 dpi.

Geospatial data and -applications, that only exist as digital-born artwork, need new archiving strategies, like for instance migration or emulation. These copying- and accessing-methods try to keep digital born content read- and accessible although the technical framework changes.

Selection of Geoinformation and Maps according to „save-worthy content"

The growing amount of geospatial data and applications leads to the question of "archiving appropriateness": What kind of content should be saved? What criteria are used for content selection? Who is responsible for selection (archivist, librarian, information scientist, cartographer,...)?

A main discrepancy can be observed between professional aspects for archiving depending on archivist, librarian, cartographer and geoinformation producer. Especially the understanding on the "save-worthy content" varies with the professional background. Whereas a selection of geospatial basic data appears incomprehensibly because these data form the fundament for answers to various (not yet defined) questions, a selection of geospatial applications and products seem to be useful. In this context it becomes obvious that the question for "save-worthy content" has to be solved. Geospatial products provide a definite reference number (e.g. ISBN) according to their date- and place of publication and publisher. For this reason these products can easily be cata-

logued and put into a library. Of course the technical effort for archiving digital products needs to be evaluated (with interdisciplinary help). An exclusion from the catalogue may be associated with the use of open standards, open source and appropriate data carrier for the specific geospatial product. In addition an inclusion of digital maps into the library´s catalogue calls for the technical equipment and its update to read and store the digital content. Equally legal issues for geospatial content restrict their incorporation in libraries: the free and public access to geospatial data depends on copyright laws and may be possible after 30 to 70 years (depending on the national legal framework).

Complexity of Information Portfolios

Several contributions showed future requirements for the analysis of cultural landscapes and long-term availability of information inventories quite plainly: the complexity of geospatial datasets is growing exponentially. Comparisons with homogenous datasets, like those resulting from scanning, clearly show additional requirements if not only the file-size of datasets is growing, but also interrelations of features and attributes concerning e.g. cultural landscapes, become important. Additionally the access methodology to these complex structures need further investigation, as the UNESCO convention for intangible cultural heritage (http://www.unesco.org/culture/ich/) explains the importance of a sustainable handling of nature, universe and cultural developed techniques. Herein the indemnification of interoperability, consistent archives and ad-hoc analysis of complex applications are main foci for further methodical developments.
These main aspects which are crucial to structure administration, legal and political frameworks for archiving digital geospatial data, information and applications lead to further proceeding and necessities for the establishment of a prospective cartographic heritage. An ongoing discussion and publication of best practices, related problems and needed standardisation will help to normalize methodologies, procedures and their related technological influence.

Further proceeding and necessities for the establishement of a prospective cartographic heritage

The main result of the archiving workshop and discussions with all participating professions was that it is urgent to make long-term availability and archiving of geoinformation and cartography to a main subject of interdisciplinary and public discussion. Main demands for clarification are a clear legal situation, assigned competencies and manuals for best practices (as wiki website, in form of books, lectures, ...). At the moment the minimum to keep cartographic heritage can be depicted by the motto “keep it simple and online”, where geodata should be kept as simple as possible (standardized and additionally as image information) and “online” describes the actual state of knowledge about geodata, their metadata and meta-metadata. This actual state has to be kept alive with changing technical requirements in order to keep the access to these data. At least the big aim is that archiving in scientific, legal and economic areas should be as self-evident as breathing: it is always done without thinking.
In order to go on with the agile discussion and define next branding milestones following steps were planned:

- To keep up an intense and interdisciplinary commutation a discussion forum including a newsletter were established. Further information and registration can be found at http://www.kbx7.de/?lid=18531&c=list.

- All authors of archiving workshop´s contributions and members of the commission on digital technologies for cartographic heritage of the ICA were invited to participate a book project on the prospective cartographic heritage, which will be printed by Elsevier or Springer. Further information and deadlines can be found at: http://www.cartography.at/heritage/.
- The results of virtual discussions and latest developments should be visualized in the Internet. Therefore a "blog" website is in preparation, which will be found at „http://blog.cartography.at" in the near future.
- We invite interested groups and experts to report on her/his own field of activity in archiving and cartographic heritage and provide these reports for the community. A pertinent collection of these activity reports will then be published as "best practices" , e.g. best practice for scanning ancient maps, data management or similar, as reviewed e-journal with the title "Archiving Perspectives in Geoinformation and Cartography".

Resume

Concluding this first valuation for the expected history of modern maps it becomes clear that a legal framework will help to structure responsibilities. According to these responsibilities technological archiving procedures can be adapted and implemented. Thus an intense discussion concerning the prospective cartographic heritage within an interdisciplinary environment has to be firstly done to clear next urgent steps to overcome barriers of the interlaced neo-cartographic technologies. The archiving of distributed networks and modern cartographic applications as well as digital geographic base data call for oncoming legal, administrative and structural solutions.

References

Andrienko, G., Andrienko, N., Jankowski, P, Keim, D., Kraak, M.-J., MacEachren, A.M., and Wrobel, S. 2007. Geovisual analytics for spatial decision support: Setting the research agenda. International Journal of Geographical Information Science, 21(8), pp. 839-857.

Bergeron B. P. (2002) Dark Ages 2: When the Digital Data Die; Prentice Hall PTR, New Jersey

Borghoff U.M., Rödig P., Scheffcyzk J., Schmitz L. (2003) Langzeitarchivierung – Methoden zur Erhaltung digitaler Dokumente; dpunkt Verlag; Heidelberg.

Galloway, Anne and Matthew Ward (2005): Locative Media as Socialising and Spatialising Practices: Learning from Archaeology. Forthcoming Leonardo Electronic Almanac, MIT Press.

Hagedorn B., Döllner J. (2007) High-Level Web Service for 3D Building Information Visualization and Analysis, in ACM 15th International Symposium on Advances in Geographic Information Systems (ACM GIS), Seattle, WA.

Jiang, B., Huang, B., and Vasek, V. 2003. Geovisualisation for Planning Support Systems. In Planning Support Systems in Practice, Geertman, S., and Stillwell, J. (Eds.). Berlin: Springer.

Kraak, Menno-Jan and Allan Brown (2001): Web Cartography – Developments and prospects, Taylor & Francis, New York, ISBN 0-7484-0869-X.

MacEachren, A.M. and Kraak, M.J. 1997. Exploratory cartographic visualization: advancing the agenda. Computers & Geosciences, 23(4), pp. 335-343.

Peterson, Michael P. (ed.) (2003): Maps and the Internet, Elsevier, ISBN 0080442013.

Raper Jonathan, Gartner Georg, Karimi Hassan, Rizos Chris (2007) A critical evaluation of location based services and their potential, in Journal of Location Based Services, Volume 1, Issue 1 March 2007 , pages 5 – 45, Taylor&Francis, London.

Reichenbacher Tumasch, (2004) Mobile Cartography - Adaptive Visualisation of Geographic Information on Mobile Devices (PhD), Munich University of Technology.

Turner J. A. (2006) Introduction to neogeography, O'Reilly Media, ISBN 978-0-596-52995-6.