Oliver Gondring[*], Susanne Rau[*]

Designing the GlobMapLab: Using maps as an entry point to the Perthes Collection

Keywords: Perthes Collection, old maps, digital maps, history of modern cartography, history of modern map-making

Summary: The Perthes Map Laboratory "GlobMapLab" is a step towards the long-term goal to unfold the scientific potential of the Perthes Collection Gotha as a resource documenting the activity of the Perthes publishing house, a major international hub of geographic and cartographic knowledge in the 19th and early 20th century. The Perthes Collection comprises a map collection of over 180,000 sheets. The GlobMapLab will be a customized web interface making digitized maps from this collection available online, thus not only facilitating access for a wide scholarly as well as amateur audience, but also providing features for enhanced handling and analyzing of the maps within the broader context of the Perthes Collection.

Introduction

The Perthes Collection in a nutshell

The Perthes Collection is the material legacy of the Perthes publishing house that was founded in the residential city of Gotha in 1785 by Justus Perthes and remained there until 1992[1]. The collection comprised mainly the company archive, the map collection and a considerable geographic company library. During the 19th century, Perthes became one of the major European hubs of geographic knowledge. It extended its portfolio to include several atlases, with the *Stieler Handatlas*[2] being premium product among them – now considered a milestone in the history of atlas cartography –, and *PGM*[3] as one of the leading journals worldwide collecting the latest geographic news. The *PGM*'s publications include many primary and exclusive reports about explorations in – from the point of view of European geography – less well known world regions such as Africa, Asia, Australia and the Polar Regions. With its acquisition by the Free State of Thuringia in 2003, the Perthes Collection was integrated into the Gotha Research Library, which is a unit within the University of Erfurt.

The Perthes Collection is a uniquely rich resource for research on map-making, the mechanisms of creation and distribution of geographical knowledge as well as the evolution of geography and cartography as academic disciplines in the era of globalization during the 19th and early 20th century.

[*] Gotha Research Centre, University of Erfurt [oliver.gondring@uni-erfurt.de; susanne.rau@uni-erfurt.de]

[1] For a detailed account of the history of Justus Perthes publishing house and a comprehensive overview on the Perthes Collection, see Weigel (2011), but for a short introductory overview, see Perthes (2012).

[2] The complete German title, which translates into *Handy atlas of all parts of the world according to the most recent state, and of the whole universe*, is abbreviated here, following a widespread convention, as *Stieler Handatlas* or, even shorter, the *Stieler*. For an encyclopedic description of the atlas, see Espenhorst (2008).

[3] The acronym PGM conventionally used for the journal refers to *Petermanns Geographische Mitteilungen*, the second of the three titles the journal bore during its publication period (1855–2004). For additional background information on PGM, see Demhardt (2006), Lenz & Ormeling (2008).

It enables researchers to explore in depth the publishing house and the residential city of Gotha as a space of cartographic discourses, knowledge exchange and practices (cf. Brogiato 2008).

GlobMapLab: The Perthes Map Laboratory

The GlobMapLab (GML) is a web application supporting access to and analysis of digitized maps from the Perthes Collection which will be presented online in the near future. In the kickoff phase of the project, an amount of 1,000 representative items from the overall set of more than 180,000 maps will be scanned by the Gotha Research Library. Long-term archiving of the digitized maps will be provided by the Thuringia University and County Library (ThULB). The GML itself will provide a map-oriented interface, adding specific interactive functionality beyond the library catalogue text search and plain image display.

The maps serve as an entry point for the exploration of the diverse materials contained within the collection, which are related to the production, distribution and reception of the maps themselves. The GML thus only accounts for a specific, necessarily restricted and map-centered perspective on the Perthes Collection. It does not claim to be an all-encompassing tool covering every aspect of the material and supporting all possible research questions. It also bears only remote references to some parts of the collection (not primarily related to geographical topics) such as the archival material concerning the genealogical-statistical *Almanach de Gotha*, a biographical encyclopedia of European nobility (cf. Weigel 2011: 13ff.), which is nevertheless of great importance for the company history.

As the Perthes Collection has originated from the archive, library, and map collection of a private company, both of which were part of its economic capital and constantly used in everyday business, it lacks the ease of access that a scientific, well-ordered stock of assets usually guarantees. The map collection, for example, was not ordered according to a scheme assigning individual signatures to each map; instead, the contents of the map folders were sorted by geographical regions, time and subject into 550 functional groups. Finding and accessing the materials within in collection and matching specific user requests therefore presently is and will remain a laborious task for the years to come until all the individual maps will have been catalogued.

The digitization of part of the maps will, for this reason and even more than is usually the case, significantly enhance ease and speed of access to the maps for more users (thanks to remote access) with less manual effort for the Gotha Research Library. Additionally and equally important, the digital derivatives have the potential to release the Perthes maps “from the static confines of their original printed form” (Rumsey & Williams 2002, cf. Knutzen 2013) and to enable users “to do what librarians have long-feared: shuffle sheets around in the collection, mix them up with other departments of the library and, still worse, cut them up and scribble on them” (Southall 2013: 3), features that the following design outline of GlobMapLab will further illustrate. Nevertheless, the material qualities of the maps (surface texture, haptic properties of the paper) are difficult to communicate when encoded as immaterial metadata attached to no less immaterial digitized images. As a consequence, the digitized maps are not conceived as a replacement to the printed originals that are kept in Gotha/Erfurt in their full materiality, but rather as a supplement facilitating the discovery and initial screening of the material by interested users.

The following sections summarize the current state of the GML design development, which will subsequently be tested and evaluated by implementing a first prototype. The first section outlines the

distinguishing key properties of the Perthes map collection. Based on those properties and an evaluation of the current state of the art of web-based presentation of old maps, the second section identifies suitable core elements and functionalities of the GML. The third section will discuss some technical issues, followed by a conclusion giving an outlook on possible directions of future development.

Key Properties of the Perthes map collection

The online presentation of a map collection has to take into account the specific properties of the collection. The design of the GML is therefore derived from the distinguishing characteristics of the Perthes Collection compared to other map collections. These key properties are summarized below.

Composition and relations within the map collection itself

Map collections differ substantially in their composition, due to their origin, history and the collecting person or institution. There are collections that result from the special interest of an individual collector (*DRHMC*[4]), collections illustrating a certain subject (*CWM*), collections conveying an idea or narrative or covering a well-defined geographic region (*MOS*, collections of ordnance survey maps).

In the case of the Perthes map collection, the collecting institution was a private enterprise producing maps for international expert and lay mass markets. The cartographic portfolio of the Perthes publishing house (which makes up for part of the map collection) was evidently shaped by the goal to generate profit with maps – among others. The collection was built up as a routine of internal documentation and accumulation of cartographic knowledge (mostly topographical maps) that could be further capitalized on in the future.

Originally, the collection consisted of third-party cartographic reference material that was used as a source and reference for in-house cartographic production. The reference maps not only served as immediate sources, but were also part of a contemporary cartographic discourse, which constitutes a broader context for the original Perthes maps. Today the reference maps enable researchers to reconstruct the origins and the processing of cartographic information and to identify the authorities the Perthes cartographers took into account for their own work. Although copies of many of these reference maps can also be found in other collections, many of the Perthes copies are still unique because they bear the traces of the internal processes of administration and processing in Gotha (Weigel 2011: 58). In the course of time, the ratio changed gradually in favor of original Perthes maps which were also archived in the map collection and increasingly used as sources for new maps.

Among the maps produced in Gotha, some particular relationships are worth mentioning here: for instance, many maps can be regarded as belonging to a series of subsequent revisions, such as the sheets of the various Perthes atlases which had been revised time and again over publication periods of decades, or even a century. As every map is not only a snapshot of a certain state of geographic knowledge, of map design and map-making technologies, but also of other aspects framing the

[4] The URL of the corresponding website and those of all the websites referred to in this section (in italics) can be found in a separate subsection among the references. Long website titles are abbreviated for better readability.

production and shaping of the 'metaphor and rhetoric', a series of subsequent revisions enables a highly instructive diachronic perspective. As member of a series, each map is the result of one cartographic design process and point of departure for another at the same time.

Another important distinction within the map collection can be made between the maps which have been finally delivered and intermediary draft versions (or page proofs) reflecting different stages of the production process.[5] Draft maps often bear revealing notes or sketches indicating intended changes and corrections, comments or references to sources to be used for different parts of the map (cf. Siegel & Weigel 2008).

There are also derivatives among the maps, such as the modified *Stieler* maps that were used for other atlas products in the Perthes portfolio, often undergoing changes such as alterations of format and/or scale and generalizations of the map contents in the process of derivation.[6]

It can be concluded that inside the Perthes map collection there is a diversity of relationships that should be accounted for in models and analytical tools for its online presentation. As the cartographic practices producing the materialized final products – the maps – unfold in time, the chronological dimension is crucial for the Perthes map collection.

Context materials related to the maps

The most striking characteristic of the Perthes Collection is the close entanglement of the different groups of materials meticulously described by Weigel (2011: 63ff.). It does not seem necessary to repeat Weigel's complete listing of the diverse materials here. From the specific point of view of the GlobMapLab, it seems sensible to categorize the material into two different layers of context centered around the maps: (1) documents and objects directly and mostly explicitly related to the map-making process such as explorers' field notes, correspondences with geographers and travelers, published memoires (from 1855 on in PGM, see Schunka 2011) as well as internal notes (e. g. cartographer Bruno Hassenstein's detailed working diary) and (2) documents concerning the frame of the actual map-making – the social, economic, technical, political factors (to name just a few examples) shaping the activity of the publishing house and of its employees. Among the second group, there are advertisements, business reports, account books, payrolls, personnel documents, descriptions of workflows in the workshops and so on. The reason for this distinction will become clear in the following section.

While the GML is not explicitly building on any theoretical assumptions about maps and map history, the composition of context materials in the Perthes Collection still seems to imply a preference for theoretical frameworks that put a strong emphasis on the process of map-making (as opposed to the static final map). The conceptualization of mapping *as a process* framed by actors, discourses, materials, social and economic contexts has consequently been taken up by recent research papers on the Perthes Collection (cf. Siegel & Weigel 2011, Schelhaas & Wardenga 2007 and 2011, Schelhaas 2009, Perthus & Faehndrich 2013). Maps are in this view regarded as sociocultural or socio-technical constructs explicitly and implicitly conveying opinions, values and political points of view as summarized by Brian Harley as the "metaphor and rhetoric" in maps (Harley 1989: 3). Harley and

[5] However, it has to be mentioned that not all draft maps are dated, so that it might not always be possible to arrange them in an assured, definite chronological order.

[6] Or, as Weigel puts it, "reduced, newly configured offshoots of Stieler maps" (Weigel 2011: 59, transl. OG).

other representatives of critical cartography (Crampton & Krygier 2006, Kitchin et al. 2013) even see maps as creating spaces themselves and thus serving as instruments of power (cf. Rau 2013: 127f., Schneider 2004).

The context given by the materials related to the map-making process renders these aspects to a certain degree more transparent to the observer and thus opens up opportunities to link the cartographers' work to a variety of contemporary discourses, e. g. about 'scientific' map-making standards.[7] The context might reveal the origin of certain pieces of information on a map, how this information is processed and which decisions were taken by the cartographer. Furthermore, aspects of design (graphical representation of the terrain) and printing (method applied and implications on material and visual properties of the map) are also discussed by the context materials.

As the context information is only available for the maps produced by Perthes (but not for the reference maps[8]), the Perthes Map Laboratory is centered around these maps in order to benefit from the entire set of diverse materials assembled in the Perthes Collection. For instance, the combination of maps and text documents constitutes a rich base for analyzing map genealogies, which involves the complex task of reconstructing the origins of the geoinformation contained in a certain map by identifying 'ancestors' of that map and by qualifying the 'kinship' relation between them.

Perthes Maps on the Web: The Design of the Map Laboratory

The presentation of digitized maps on the web has already moved far beyond the stage of library catalog text search interfaces and plain thumbnail galleries (cf. Journal of Map & Geography Libraries 2013, special issue 1-2), so the Perthes Map Laboratory can conceptually build on a broad base of ongoing work carried out by various international institutions holding map collections. However, the multitude of choices at hand for the online presentation of digitized maps has to be evaluated from the point of view of the collection, in order to be able to determine the crucial features to be implemented by the Perthes Map Laboratory.

As it is neither desirable nor possible here to anticipate all the research questions related to the Perthes map collection that will be addressed in the future (and to determine which tools for working with the material would best serve these research projects), it seemed reasonable to design the GML according to basic scholarly operations on source materials that apply to most, if not all, research questions. Unsworth (2000) identifies six such operations and called them "scholarly primitives": discovering, annotating, comparing, referring, sampling, illustrating, and representing. The following outline of the GML features uses Unsworth's scholarly primitives as a guideline.

Discovering

When it comes to browsing and searching in map collections, *faceted browsing* of image galleries is a widely used interface to map collections (e. g. *LOC, DRHMC*). Despite the visual aspect of the map

[7] The quotes refer to Harley's (1989: 10–11) consideration that the label "scientific" must also be regarded as a metaphor to justify an ultimately contingent set of culturally and socially determined assumptions, practices and authorities guiding the cartographers' work.

[8] However, for some reference maps that were taken out of books in the company library, the corresponding book, of course, provides valuable context.

thumbnails being displayed, the search is in principle still based on textual metadata such as author, publication date and so on that serve as facets to gradually restrict the result set.

A more intuitive approach is *geographic search*, because it supports the user's wish to search for maps covering a certain geographic area instead of bearing a certain title (cf. Witschas 2006: 3, Southall 2013: 2). We identified three different variants of geographic search, all of which are based on the bounding boxes[9] of the maps: 1. by displaying the bounding boxes of maps as rectangles on a reference map that can be panned and zoomed to the region of interest (*OMO, MapScholar*), 2. by choosing a point on the map and subsequently retrieving a list of maps covering that location from a DB (*NOAA*) and 3. by using a place name that is converted into spatial coordinates using a gazetteer (*Old Maps Online*, *MapHub*, *NOAA*). Probably the most sophisticated geographic search interface is MapRank Search (cf. Oehrli et al. 2011, implemented in *DRHMC, Old Maps Online*), and which provide options to refine the result set by scale, time of publication and keyword/author. Another variety of spatial browsing through map collections implemented on the *NLS* site uses graphical indexes for a preconfigured choice of map series.[10] This approach is especially well-suited for ordnance survey maps and other large-scale multi-sheet maps.

The MapRank Search interface[11] seems to be a sensible approach for the Perthes map collection. However, as two dimensions of special interest in the Perthes map collection derived from the key properties outlined above comprise the intermediary stages of map construction/production and subsequent revisions of a given map sheet, a possible extension to the interface would involve specific features to indicate the existence of draft maps or to show revisions within a customizable time frame. From the point of view of Unsworth's primitives, the process of discovering would thus be meaningfully combined with some gathering of context.

Viewing and Comparing

Especially the American map collector David Rumsey has spent a lot of effort in experimenting with different ways of visualizing old maps made accessible via his collection's website, even in 3D environments (Google Earth, Second Life) (*DRHMC*, cf. Rumsey & Williams 2002).[12]

The most common map viewing features on the web comprise zoomable high resolution image display, views overlaying recent geospatial data or another old map with the map of interest (*VUG*), and side-by-side views of two or more juxtaposed map panes for comparative analysis (*VUG*, *Retromap, DRHMC*). The latter can usually be carried out by using synchronized map panes, each following the pan and zoom actions executed on any of them by the user. The synchronized variant

[9] The bounding box of a map is a rectangle derived from the geocoordinates of the map corners, roughly indicating the geographic coverage of a map. It is the most basic kind of georeferencing maps and "the root spatial geometry needed to create an index representation of a map" (Knutzen 2013: 12, cf. Westington & Bridge 2013). For a detailed discussion of different transformation types for georeferencing old maps, see Boutoura & Livieratos (2006), and for an analytical application of georectification, see Perthus & Faehndrich (2013).

[10] A digital and interactive version of traditional index maps similar to the one depicted in Schelhaas (2009: 232, Fig. 1), showing an index map of Africa from an 1865 PGM register volume.

[11] Developed by Klokan Technologies GmbH.

[12] *MapScholar* also provides a 3D view via Google Earth enabling rotated and tilted perspectives, for the most remarkable reason to "break the traditional view that puts north at the top and pictures space from a strictly bird's-eye view" (Edelson & Ferster 2013).

requires an alignment of the maps, which is usually effected by georectification (cf. *Retromap*[13], *VUG*, *DRHMC*[14]). A rectangular grid overlaid on all panes can facilitate comparative eyeballing of both maps (*Retromap*).

A special method to view maps that comprise multiple sheets is to generate composite images by digitally stitching together the images representing the separate sheets in order to create a single object. As the necessary image manipulation idisrupts the integrity of the individual map sheets, we will not further discuss this method here.[15]

For the presentation of the Perthes map collection, the comparison of different map design stages or revisions can be counted among the essential functionalities. Overlays enable the users to quickly skim through a virtual stack of related sheets. In other cases, juxtaposition might be more practical. By leaving the map panes unsynchronized, several details of the same map can be compared, or two clippings representing the same location on different maps can be manually aligned without previous georectification.

Referencing Map Views

A map viewer that generates permanent links containing all the relevant parameters of a customized view (including overlays and juxtapositions) is a highly useful tool for detailed analysis of maps: authors can easily reference even tiny details in large format maps in their papers, and readers in turn can exactly return to the exact original view while retracing the author's line of thought relating to the detail, especially when using an electronic publication. Therefore, the availability of digital versions has also the potential to alleviate difficulties of referencing cartographic material within print publications. Especially the process of illustrating multiple references to map details using colored clippings is often either not affordable, or the images cannot be reproduced in adequate quality.

Bearing this in mind, the visionary statement of Edelson & Ferster (2013) could also be read as describing the potential gain from a GML with referencing features: "When scholars know they can show readers their maps in detail, in comparison, and in context without limit, this freedom will open the range of their questions and allow them to move beyond a map-by-map approach to map history." (85)

The GML will contain case studies featuring different parts of the Perthes map collection and illustrating the added value of referencing map examples as clippings or more complex views.

[13] As the site does not provide an English language version yet, here is a link to access an example for the dual view: http://retromap.ru/mapster.php#left=051968&right=051952&zoom=15&lat=55.710649&lng=37.53994 (the structure of the link is also a good example for readable permanent links, as it makes explicit the IDs of the maps juxtaposed, the zoom level and the coordinates of the visible section of both maps).

[14] Views of juxtaposed maps can be accessed from the landing site via the option *2D GIS Browser.*

[15] A composite of a 1850 *Stieler* map of Germany can be found here: http://www.davidrumsey.com/luna/servlet/s/154usi

Annotating and Linking Maps

Given the diversity of genetic and other relations connecting maps to other maps together with a diversity of other context objects within the Perthes Collection, it can be safely concluded that the linking of objects can be safely regarded as an essential feature of the GML.

Recently a number of promising interface solutions supporting the task of annotating maps and linking them to other related objects has been developed, thus bringing forward a strong desideratum on the part of the scholarly community. A static – nonetheless very instructive – example is *Ebskart*, an interactive annotated version of the medieval Ebstorf world map generated by the Leuphana University of Lüneburg. *Neatline*, developed by the University of Virginia as a plugin for the CMS *Omeka*, is an authoring tool for map annotation, and other environments also providing web-based user editing of given datasets are the *DM Project* (cf. Bradshaw & Foys 2011),[16] and *Maphub* (cf. Haslhofer et al. 2013a, 2013b). Another project for annotating images online, *Annotorious*, is about to develop a plugin that will extend its scope to map annotation.

Annotation (e. g. attaching a note or textual reference to an object) and linking objects (storing the information that object A is related to object B) are in a technical sense very similar operations. The *Open Annotation Data Model* (Sanderson et al. 2013), which is well on the way to becoming a web standard for annotating web resources, proposes a general data structure that is equally suitable to account for annotating as well as for linking objects, a fact that highly qualifies the model to be used in the GML. In combination with the permanent link referencing feature discussed above, even specific *map views* (as discussed above) could theoretically be annotated, which would add one level of complexity to the presentation. The *DM Project* provides a unified interface for annotating and linking text and image objects, which allows for precise referencing (e. g. relating a text paragraph to a distinct feature on an image or a map).

Putting the 'Primitives' together: Modular Structure

The GML will be set up in the form of three modules entitled *Enquiry*, *Presentation* and *Workshop*. The first module, *Enquiry*, will provide structured access to the repository of digitized maps and objects, containing the functionalities for discovering, viewing and referencing as outlined above.

The *Presentation* module will consist of case studies illustrating the key properties of the collection and also, of the web interface. At the present moment, three case studies were scheduled: one featuring revisions of maps of Africa published in subsequent editions of the Perthes flagship product; the second giving an impression of the rich context material available to trace the map-making process by using the example of a Wilhelm Junker's expedition to the Báraka Valley in North East Africa. The third case study will feature pedagogical cartographic materials produced by the Perthes publishing house, presented as an interactive map reading course. The *Presentation* module will be connected to the *Enquiry* module by the referencing functionality, thus providing the reader with an extraordinarily precise reference to the details of the high resolution source material the reasoning in the text is based on (via a permanent link).

[16] A preview of the intended functionality is available in the form of several example videos on the website (see references).

The third module, *Workshop*, will provide users with tools for augmenting the data by annotating and linking both maps and context materials – either private or public. Public links and annotations will support other users' structured exploration of the material. Additional functionality such as crowd-sourced manuscript transcription or georectification of maps allows for possible future extension of the *Workshop* module.

Implementation of the Perthes Map Laboratory

The Perthes Map Laboratory is a long-term endeavor accompanying the ongoing scientific exploration of the Perthes Collection. Due to constant rapid change in the domain of information technology and an ever-growing plurality of technological choices with an uncertain future, sustainability is an important issue for any digital humanities project (just as for any project involving information technology). The use of widely accepted and used data formats and standards as well as open source, modular software architectures rather than closed environments is essential to prevent premature obsolescence of web interfaces and project data ending locked up in isolated "silos" (cf. Edelson & Ferster 2013: 84). Therefore, the GlobMapLab will put special emphasis on utmost interoperability when it comes to structuring the data it is using (digital images of maps) and generating (links and annotations). A future goal, for example, would be to represent objects, relations and annotations as linked open data based on an ontology for old maps yet to be developed, by embedding the data of the GML into the wider context of the semantic web and thus creating new opportunities to relate the data to various other datasets on the web. For many research questions, source materials from a variety of institutions (archives, libraries) in different places have to be taken into account. The ability to carry out comparative analysis of digitized maps from the Perthes Collection with items kept far away (e. g. maps and documents from the Bartholomew Archive in Edinburgh[17]) via a web interface such as the GlobMapLab would be a tremendous improvement for historians involved in research related to 19th century cartography history.

The first development phase (until 2015) of the GML will begin with the setting up of the *Enquiry* module. At the same time, the maps and objects for the test data repository are chosen and digitized by the Gotha Research Library. After that, the case studies of the *Presentation* module will be added, and references to related views of the digital objects will be established. As the last step, the annotation and linking features of the *Workshop* will be implemented and researchers will be invited to collaborate with the project.

Conclusion

The GlobMapLab prototype as outlined here will be set up as a threefold modular structure (*Enquiry, Presentation, Workshop*) around a sample of about 1,000 maps of the Perthes map collection. It will

[17] The Bartholomew Archive (*BA*) is the extensive legacy of the Scottish map engraving, printing and publishing company *John Bartholomew & Son Ltd.*, a contemporary competitor and partner of the Perthes publishing house. One example for cooperation of the two companies is the English edition of the *Berghaus Physical Atlas* (one of the Perthes flagship products), printed and published by Bartholomew, which uses the original copper printing plates acquired from Gotha. For a more detailed account of the relations between both publishing houses, see Güttler (2014: Ch. 5).

serve as an experimental platform to enhance the visibility of and facilitate access to the Perthes Collection as a whole, by using the maps as an entry point. With analytical tools adapted to the key characteristics of the collection as well as features to augment the database with user contributions, it has the potential to raise awareness and interest of both an expert audience and a broader public.
As Knutzen points out, a project comprising the development and maintenance of software as well as georectification and transcription is "far too much for a single or even small group of institutions to bear" (2013: 22/23). Therefore, one of the most important future goals for the Perthes Map Laboratory will be to establish a network of collaborating institutions sharing an interest in the technologies that are being developed within the project.

Acknowledgments

The research reported was funded by the Ministry of Science, Education and Culture of the Free State of Thuringia (TMBWK), Germany and is part of the three-year project "Globalization and Local Knowledge. Collections-based Research into Justus Perthes Publishers" (2012–2015). It is *inter alia* a follow-up project to previous projects conducted by Susanne Rau at the University of Erfurt in 2010–2012 and funded by the German Research Council. These projects established collaborations with the French geographers Jacques Lévy (EPFL, Lausanne, Switzerland) and Jean-Marc Besse (CNRS, Paris, France) and resulted in the University of Erfurt becoming a member of the Eidolon Open Network for Cartography[18] and the international ACSAM research group on atlases in modern and contemporary culture.

References

Boutoura, C. and E. Livieratos (2006). Some fundamentals for the study of the geometry of early maps by comparative methods. *e-Perimetron 1 (1)*, 60–70. In digital form. http://www.e-perimetron.org/Vol_1_1/Boutoura_Livieratos/1_1_Boutoura_Livieratos.pdf [accessed Sep 10, 2013]

Bradshaw, S. and M. Foys (2011). Developing Digital Mappaemundi: An Agile Mode for Annotating Medieval Maps. *Digital Medievalist* 7. In digital form. http://www.digitalmedievalist.org/journal/7/foys [accessed Aug 20, 2013]

Brogiato, K.-H. (2008). Gotha als Wissens-Raum. In Lenz & Ormeling 2008, 15–29

Crampton, J. W. and J. Krygier (2006). An Introduction to Critical Cartography. *ACME 4 (1)*, 11–33

Demhardt, I. J. (2006). *Der Erde ein Gesicht geben : Petermanns geographische Mitteilungen und die nge der modernen Geographie in Deutschland. ts- und Forschungsbibliothek Erfurt/Gotha im Spiegelsaal auf Schloß Friedenstein in Gotha, 23. Juni bis 9. Oktober 2005*. Erfurt: Universitätsverlag

Edelson, S. M. and B. Ferster (2013). MapScholar: A Web for Publishing Interactive Cartographic Collections. *Journal of Map & Geography Libraries 9 (1–2)*, 81–107

[18] See http://www.eidolon.ch/

Espenhorst, J. (2008). *Petermann's Planet. A Guide to German Handatlases and their Siblings throughout the World. Volume I: The Great Handatlases*. Ed. and transl. from the German Text by George R. Crossmann. Schwerte

Güttler, N. (2014). *Das Kosmoskop. Karten und ihre Benutzer in der Pflanzengeographie des 19. Jahrhunderts*. Göttingen: Wallstein

Harley, J. B. (1989). Deconstructing the map. *Cartographica 26 (2)*, 1–20

Haslhofer, B.; Robitza, W.; Lagoze, C. and F. Guimbretiere. (2013a). Semantic Tagging on Historical Maps. *arXiv preprint arXiv:1304.1636.* In digital form. http://arxiv.org/pdf/1304.1636v1 [accessed Aug 14, 2013]

Haslhofer, B.; Newman, K.; Stefanik, A.; Robitza, W. and C. Lagoze (2013b). Old Maps and Open Data Networks. *iConference 2013 Proceedings*, 819-822. In digital form. http://hdl.handle.net/2142/42105 [accessed Sep 3, 2013]

Journal of Map & Geography Libraries: Advances in Geospatial Information, Collections & Archives. Special Issue: Working Digitally with Historical Maps. Volume 9, Issue 1–2

Kitchin, R., Gleeson, J. and M. Dodge (2013). Unfolding mapping practices: a new epistemology for cartography. *Transactions of the Institute of British Geographers 38 (3)*, 480–496

Knutzen, M. A. (2013). Unbinding the Atlas: Moving the NYPL Map Collection Beyond Digitization. *Journal of Map & Geography Libraries 9 (1–2)*, 8–24

Lenz, S. and F. Ormeling (2008). *Die Verräumlichung des Welt-Bildes: Petermanns geographische Mitteilungen zwischen "explorativer Geographie" und der "Vermessenheit" europäischer Raumphantasien; Beiträge der Internationalen Konferenz auf Schloss Friedenstein Gotha, 9. - 11. Oktober 2005*. Stuttgart: Steiner

Oehrli, M.; Přidal, P.; Zollinger, S. and R. Siber (2011). MapRank: Geographical Search for Cartographic Materials in Libraries. *D-Lib Magazine 17 (9/10).* In digital form. http://www.dlib.org [accessed Oct 19, 2012]

Perthes, S. (2012). Justus Perthes. Kurzer Abriss der Verlagsgeschichte 1785 bis 2012. In digital form. http://www.perthes.de/geschichte_justus_perthes/ [accessed Aug 26, 2013]

Perthus, S. and J. Faehndrich (2013). Visualizing the map-making process: Studying 19th century Holy Land cartography with MapAnalyst. *E-Perimetron 8 (2)*, 60–84. In digital form. http://www.e-perimetron.org/Vol_8_2/Perthus_Faehndrich.pdf [accessed Sep 1, 2013]

Rau, S. (2013). *Räume. Konzepte, Wahrnehumgen, Nutzungen*. Frankfurt/New York: Campus

Rösler-Goy, M. (2013). Eine Landkarte ist eine Datenbank! Zu aktuellen Landgerichtsurteilen zum Datenbankschutz. *Kartographische Nachrichten 1/2013*, 33–36

Rumsey, D. and M. Williams (2002). Historical Maps in GIS. In Knowles, A. K. (ed.). *Past Time, Past Place: GIS for History.* Redlands, California: ESRI Press

Sanderson, R.; Ciccarese, P. and H. Van de Sompel (eds.)(2013). Open Annotation Data Model. W3C Community Draft, 8 February 2013. In digital form. http://www.openannotation.org/spec/core/20130208/index.html [accessed Sep 10, 2013]

Schelhaas, B. and U. Wardenga (2007). "Die Hauptresultate der Reisen vor die Augen zu bringen" - oder: Wie man Welt mittels Karten sichtbar macht. In Bernd, C. and R. Pütz. *Kulturelle Geographien*

: zur Beschäftigung mit Raum und Ort nach dem Cultural Turn : [ausgewählte Beiträge der vierten Kulturgeographietagung in Frankfurt am Main] - Kultur und soziale Praxis. Bielefeld: Transcript

Schelhaas, B. (2009). Das "Wiederkehren des Fragezeichens in der Karte". Gothaer Kartenproduktion im 19. Jahrhundert. *Geographische Zeitschrift 97 (4)*, 227–242

Schelhaas, B. and U. Wardenga (2011). "Inzwischen spricht die Karte für sich selbst". Transformation von Wissen im Prozess der Kartenproduktion. In Siegel & Weigel 2011, 89–107

Schneider, U. (2004). *Die Macht der Karten. Eine Geschichte der Kartographie vom Mittelalter bis heute*. Darmstadt: Wiss. Buchgesellschaft

Schunka, A. (2011). Das Rohe, das Gekochte – und das Kochrezept. Kartenkommentare des 19. Jahrhunderts als historische Quellen. In Siegel & Weigel 2011, 143–160

Siegel, S. and P. Weigel (2008). Der Rotstift des Kartographen. Grenzverschiebungen in Stieler's Hand-Atlas. *Grenzbilder. Bildwelten des Wissens. Kunsthistorisches Jahrbuch für Bildkritik 6 (2)*, 58–65

Siegel, S. and P. Weigel (eds.)(2011). *Die Werkstatt des Kartographen. Materialien und Praktiken visueller Welterzeugung*. München: Laboratori

Simon, R.; Sadilek, C.; Korb, J.; Baldauf, M. and B. Haslhofer (2010). Tag clouds and old maps: Annotations as linked spatiotemporal data in the cultural heritage domain. *Proceedings of the Linked Spatiotemporal Data Workshop (LSTD 2010)*, 12–23

Southall, H. (2013). Guest Editorial: Working Digitally with Historical Maps. *Journal of Map & Geography Libraries 9 (1–2)*, 1–7

Unsworth, J. (2000). Scholarly Primitives: what methods do humanities researchers have in common, and how might our tools reflect this? *Part of a symposium on "Humanities Computing: formal methods, experimental practice" sponsored by King's College, London, May 13, 2000*. In digital form. http://people.lis.illinois.edu/~unsworth/Kings.5-00/primitives.html [accessed Apr 12, 2013]

Weigel, P. (2011). *Die Sammlung Perthes Gotha, Forschungsbibliothek Gotha*. Patrimonia 254. Berlin: Kulturstiftung der Länder [u.a.]

Westington, M. A. and K. Bridge (2013). The Value of a Bounding Box: Moving Historical Charts beyond the Image Browser. *Journal of Map & Geography Libraries 9 (1–2)*, 108–127

Witschas, S. (2006). *Exploration historischer Karten – leicht gemacht?* In digital form. http://www2.ioer.de/recherche/pdf/2006_witschas_khc_exploration_hist_karten.pdf.

Websites

Last access on all following websites: Sep 13, 2013

Annotorious. Image Annotation on the Web. http://annotorious.github.io

BA. National Library of Scotland: The Bartholomew Archive. http://digital.nls.uk/bartholomew

CWM. Library of Congress: Civil War Maps. http://www.loc.gov/collection/civil-war-maps/about-this-collection/#overwiew

DRHMC. David Rumsey Historical Map Collection. http://www.davidrumsey.com

DM Project. Tools for Digital Annotation and Linking. http://dm.drew.edu/dmproject

EbsKart. Annotated Facsimile of the Ebstorf World Map. http://www2.leuphana.de/ebskart

MapAnalyst. The map historian's tool for the analysis of old maps. http://mapanalyst.org

LOC. Library of Congress Maps. http://www.loc.gov/maps

Maphub. Historic Map Annotation Portal. http://maphub.github.io

MOS. National Library of Scotland: Maps of Scotland. http://maps.nls.uk/scotland/

NLS. National Library of Scotland: Map Images. http://maps.nls.uk

MapScholar. http://www.viseyes.org/mapscholar, http://mapscholar.org

Neatline. Plot Your Course in Space & Time. http://neatline.org

NOAA. National Oceanic and Atmospheric Administration Office of Coast Survey. Historical Map & Chart Collection. http://historicalcharts.noaa.gov

OMO. Old Maps Online. www.oldmapsonline.org

Omeka. http://omeka.org

Retromap. http://retromap.ru (Russian only)

Sammlung Perthes Gotha. http://www.uni-erfurt.de/sammlung-perthes (German) or http://www.uni-erfurt.de/index.php?id=8903&L=1 (English version)

VUG. National Library of Scotland: Visualising Urban Geographies. Dual Map View. http://urbhist.nls.uk/extmap/dualmapview.htm