GIS-based cartography – A change of media or a change of paradigms for Historic Towns Atlases?

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In view of the continuous trend of urban research based on Geographic Information Systems (GIS) and as the Digital Humanities paradigm gathers momentum, the projects forming the European Historical Towns Atlas aim to employ GIS for their future work. This conglomerate of national and regional projects all over Europe has so far published Historical Towns Atlases (HTAs) as cartographic source editions based on common standards for over 520 towns.[1] Especially in light of the Spatial turn, they provide an empirical base for spatial research with regard to urban history. The inclusion of GIS however, entails the shift away from purely visual representations of historic town plans. By georeferencing, vectorising and georectifying historical maps[2], GIS combine historical map data with real-world coordinates and allow to relate them to all kinds of historical (geo) data drawn from various disciplines, while also providing sophisticated tools for analysis and thematic queries. At the same time, GIS serves the pressing need for easy online presentation and also renders data suitable for print publications.

To address methodology and technological issues arising due to this shift, the Institut für vergleichende Städtegeschichte (Institute for Comparative Urban History) in Münster invited researchers and editors of Historic Towns Atlases to a four-day spanning workshop. The programme was made up of a mix of papers, practical demonstrations of software operations, round-table and general discussions to share ideas and reflect upon the relationship between practical, methodology and theoretical concepts.

The workshop was introduced by DANIEL STRACKE (Münster) who analysed the production of Historic Towns Atlases and their recent digital output in context of the current media revolution. With CD-ROMs featuring HTA content in the years after 2000 and later the development of interactive html-based maps[3] on the internet, important advantages of the 'digital turn' – interactivity and an increased potential for dissemination – were exploited relatively early by several projects. Yet, these initial steps are overshadowed by the possibilities offered by using GIS, because the compatibility of HTA material with other data (for use in research, urban planning and heritage management) as well as analytical and visualisation tools would greatly enhance the scientific and societal impetus of the project work. However, to ensure comparability, there need to be common technical and conceptual standards. Therefore, Stracke proposed to aim for a common document outlining the principles for the future work of the HTA projects. This would strengthen commonalities and the consistency of the material so as to provide a better basis for understanding the history and morphology of European towns.

Focussing on historic towns cartography, SYMON PORTEOUS (Witney) demonstrated the advantages of interactive map publishing compared with printed atlases, as explored by his employer Lovell Johns.[4] Aside from the wider accessibility of an online publication and the possibility of sharing map data with others, it is much easier to correct mistakes online than in a printed edition. When working with the maps the user can zoom in and use multiple layers of data to filter the desired information. Moreover, the data can be attributed with time stamps to create a basic temporal GIS and, thus, show changes over time in a dynamic visualisation. Here Lovell

[1] For an overview of the towns covered so far, see http://www.uni-muenster.de/Staedtegeschichte/en/portal/staedteatlanten/karte.html (28th July 2017).

[2] Most projects use cadastral maps as base material due to their accuracy and availability.

[3] For examples of html-based thematic maps see http://www.uni-muenster.de/Staedtegeschichte/portal/Stadtkarten/index.html (24.07.2017).

[4] Lovell Johns is a British company providing cartographic services, with close ties to the Historic Towns Trust, which is responsible for the production of the British Historic Towns Atlas, http://www.lovelljohns.com/ (24.07.2017).

Johns uses a snapshot model of time – not single cartographic objects, but a whole map is indexed by a time stamp. Porteous pointed out that the workflow of production of interactive maps could be entirely unified with the production of printed Historic Towns Atlases.

SARAH GEARTY (Dublin) outlined the production and distribution of the Irish Historic Towns Atlas.[5] The core map with which the individual plots and buildings can be studied, as it is a standard of the European HTA project, is the Irish HTA's Map 2 (scale: 1:2.500). Next to thematic maps and reproduced historic maps each Irish atlas contains a text commentary and, unlike several other European projects, a gazetteer listing all topographical information available from the sources in a thematically organised way. Future publications are to be accompanied by a web GIS application as an additional product.[6] The Irish colleagues also provide a range of supplementary products to their HTAs (folded maps, textbooks) to satisfy the needs of the wide spectrum of user groups, from historians to tourists.

RACHEL MURPHY (Maynooth) then gave an account of how the Irish team uses ArcGIS to produce Map 2 through georeferencing, vectorising and georectifying historical maps from the Ordnance Survey of Ireland. Murphy pointed out, that a degree of interpretation is inherent to the vectorising process as decisions have to be made on how lines are traced according to our understanding of the historical cartographic record. Moreover she stressed that by georectifying the original maps, the source material is being distorted. To reduce this distortion, Murphy called for a discussion on the advantages and disadvantages of the different transformation methods.

The two following papers were dedicated to the Polish Historic Towns Atlas which is being created in regional teams. Presenting the example of Trzebnica RAFAŁ EYSSMONT and RADOSŁAW GLINSKI (both Wrocław) outlined their approaches to traditional atlas production and the newly started digital work, as well as the problems the project encounters due to the destruction of the town during the Second World War. Due to a lack of historical structures hardly any control points for georeferencing and connecting the individual cadastre maps could be found. The inclusion of written sources as well as archaeological data provided additional layers of information from which a variety of thematic maps could be created. A publication of these results as a web GIS and the integration of 3D data are considered the next steps.

The workflow of the atlas of Toruń was presented by AGNIESZKA PILARSKA (Toruń) who drew attention to the variation in source material across Europe by pointing out that in the east of Poland 19th century cadastres do not exist. The base map for the Toruń atlas was, hence, created from material dating to 1910. As in the case of Trzebnica, information from historical and iconographical sources was included to be able to create thematic maps. From a geomatical rather than a historiographic perspective she pointed out further technical challenges occurring during the stages of GIS-based atlas production. As one important problem, she highlighted the lack of compatibility between historical as well as contemporary cartographic reference systems.

Challenges occurring during the creation of the Historic Towns Atlas of Vyborg were presented by ANTTI HÄRKÖNEN (University of Eastern Finland). Lying close to the Swedish-Russian (later Finish-Russian) border, dominion over the Vyborg changed several times during the last 600 years, resulting in a variety of preserved historical maps. Härkönen further discussed the problems of uncertainty occurring during the georeferencing process: Some objects on the old maps are only vaguely defined, ambiguous or cannot be identified anymore. Potential errors made by the creators of historical maps also have to be considered. As a problem specific to Vyborg, there was a lack of control points (only five could be found) for the georeferencing process. In the live presentation of the final product, Härkönen showed how different layers of information (e.g. plots from different time slices, fortifications) in ArcGIS Online can be overlayed with the modern satellite image or Open Street Map data

[5] Irish Historic Towns Atlas, <https://www.ihta.ie> (24.07.2017).

[6] A prototype for the atlas of Derry can already be accessed here: https://www.ria.ie/digital-prototypes (24.07.2017).

of the town.[7]

KIMMO KATAJALA (University of Eastern Finland) concentrated on some aspects of the Digital Atlas of Vyborg from a historical research point of view and proposed how to use it to answer specific research questions.[8] The digital atlas was presented mainly as a descriptive tool visualising historical topographical information as well as the development and growth of the town. Aside from that the project not only features clear-cut, 'objective' topographical data, but also approaches the theme of 'mental maps' and social meaning: Inspired by post-modern theories of social spaces the web GIS shows the very different hotspots visited today by tourists of Finnish and Russian nationality for whom different localities serve as *lieu de memoire* of the town's Finnish and Russian past.

The presentation by KETI LELO (Rome) shifted the focus from this qualitative to a quantitative approach in GIS-based research. With the engineer, architect and cartographer Giovanni Battista Nolli's map of Rome (1738), she presented a highly accurate base-map. After georeferencing and vectorising it, the geo data could be correlated with a relational database including other historical source material, mainly cadastral registers from the early 19th century – including parcel number, owner, value and size of the property. Querying this data and mapping it onto the digitized base-map allowed to create thematic maps. These could answer a variety of questions about the social structure of Rome, like the population density in different parts of the town or the role of nobility in Rome's 19th century townscape and property market.

JUSTIN COLSON (Colchester) presented a paper on his experience in using digital mapping in research-based teaching at the University of Essex. As an essential part of a module 'Digital History', the intention of his course was to provide students with an understanding of how past events influence present urban structures and spaces, but also to develop basic skills wanted in the digital creative industries. Using the Story-Map feature of ArcGIS Online students were enabled to integrate multiple sources and source types with a thematic map vectorised and georeferenced by themselves. This project-based approach produced high-quality results as well as an active involvement by the students. Colson reported how the lack of technical experience and, hence, low sense of efficacy in this field kept the Humanities student in this field from fully embracing digital methods like GIS-based spatial analysis.

The following presentations explored the state of GIS-based research in the Low Countries, especially in the Netherlands where despite that lack of a current HTA project a long tradition in urban morphology and urban studies exists. BRAM VANNIEUWENHUYZE (Amsterdam) introduced a project utilizing the 220 town maps created 1550/70 by Jacob van Deventer. JAAP EVERT ABRAHAMSE (Amsterdam) presented the 'Atlas of the Dutch Urban Landscape'[9]. The first part of this volume is composed of 35 articles on the history of individual Dutch towns with a focus on spatial development featuring standardised maps. Based on these articles the editors engaged in comparative research in the second part of the atlas. The comparison was done on a hermeneutical level – GIS was used in the creation, but neither in the comparisons nor in the presentation of the results. Expanding the view on Dutch urban research further, MARCEL IJSSELSTIJN (Leiden) provided previews to a number of ongoing projects tackling urban comparative research questions including his current dissertation project on the connection between urban growth and the development of market places and ports. He stressed that while HTAs have to decide on either producing maps with very condensed information (e.g. German Historic Towns Atlas) or on series of maps (e.g. British Historic Towns Atlas), GIS leave the filtering of information layers to the user. MENNE KOSIAN (Amsterdam) then introduced a number

[7] The final product can be accessed here: https://www.arcgis.com/home/webmap/viewer.html?webmap=b8e3cf2350934bab9f83f78d4a9a7ee6 (24.07.2017).

[8] For a complete overview of the project see Kimmo Katajala (ed.), Meanings of an urban space. Understanding the historical layers of Vyborg, Wien / Zürich 2016.

[9] Reinout Rutte / Jaap Evert Abrahamse (Hrgs.), Atlas of the Dutch Urban Landscape. A Millennium of Spatial Development, Bussum 2016.

of different GIS-based projects.[10] For the most part, these can be understood as (interactive) editions of historical maps. Most of them relinquish the use of common standards in favour of capturing as much information from the historical source material as possible in a pragmatic way.

The development of a GIS-based methodology for research into the changes of a townscape during the expansion of the railway was the first topic of the final day of the workshop. At the example of Ravenna ROSA SMURRA and MARCO ORLANDI (both Bologna) showed how to use GIS for a better understanding of a rapidly changing urban environment. ROSA SMURRA gave an account of the history of Ravenna and MARCO ORLANDI continued with the presentation of the GIS-based workflow. As base maps a cadastral map from 1809 and a map created for a civil register in 1882 were used. This material was enriched with data from cadastral registers. Most polygons were then classified by preliminary defined object types (e.g. private building, church, or monastery). Where possible, the polygons were time indicated.[11] Orlandi then demonstrated how this data base could be used to visualize and explain changes in urban morphology. With the use of different layers, time indexes and a time-slider feature, changes over time could be made visible. Simultaneously, embedded source material, links and pictures help to promote dissemination of the research results to a wider audience.

The discussion sections in the workshop programme offered the participants the possibility to focus further on specific problems necessary for a European wide collaboration on the digital level. The topics ranged from methodical questions like the role of GIS as a cartographic source edition as well as technological challenges concerning the need for a consistent categorisation of cartographic objects, a common repository for geo data and a common data model. In this regard, a minimal and preliminary common standard, the use of three attributes for every polygon on a map was proposed: a unique identifier, the description of the polygon in the historical source and its provenance.

Aside from that the papers and discussion have shown how important GIS have already become for the work of the HTA projects. It has become clear that GIS offers the promise of considerable advances on the research level, in usefulness and reusability of the data the projects produce. While there is no discussion about abandoning the production of print atlases, GIS has turned the digital work into an enterprise with considerable value in its own right. As work in the digital sphere will continue to grow, the workshop succeeded in raising awareness for the need of more collaboration on the data. Assumptions, ideas, research traditions and theories built around the HTA projects need, at least in parts, to be re-assessed while other aspects, e.g. common data structure and ontologies, should be added. In this respect, to make use of the full GIS potential, a change of paradigms seems imminent.

Conference overview:

Setting the scene

Daniel Stracke (Münster): Introduction: The GIS shift for HTAs

General Discussion: Dreaming and dreading GIS - A vision for HTAs

Jan Erike (Münster): Present and future – Trends and perspectives in GIS

Symon Porteous (Witney): Publishing Historic Towns cartography in an interactive mapping environment

Digital HTAs in the Making

Sarah Gearty (Dublin): Becoming a digital town atlas: the Irish experience

Rachel Murphy (Dublin): Town atlas map-

[10] A selection of the projects discussed by Kosian is listed below: HisGIS, http://www.hisgis.nl/ (24.07.2017), Historisch Leiden in kaart, http://hlk.erfgoedleiden.nl/ (24.07.2017), GIStorical Antwerp, https://www.uantwerpen.be/en/projects/gistorical-antwerp/ (24.07.2017), Cartesius, https://www.cartesius.be/CartesiusPortal/ (24.07.2017).

[11] The resulting interactive map is available here https://www.arcgis.com/home/webmap/viewer.html?webmap=ff4a8634116346f9ab63763609a86a39 (24.07.2017).

ping: creating the core map in ArcGIS

Rachel Murphy (Dublin): Integrating maps and texts: plotting town atlas data in ArcGIS

Rafał Eyssmontt, Radosław Glinski, Martin Siehankiewicz (Wrocław): The hitherto and future practices of digital space data applied to the works on the Polish Historic Towns Atlas Śląsk. Development of the digital data based on historical cartographic sources

Agnieszka Pilarska (Toruń): Geomatic aspects of designing the 2nd volume of the atlas of Toruń

Antti Härkönen (University of Eastern Finland): Constructing the digital town atlas of Vyborg

General Discusion: Comparing workflows – georeferencing, vectorising etc.

Round Table: Editing historical sources and GIS

GIS-based Urban Research

Kimmo Katajala (University of Eastern Finland): Studying the formation of the town structure from the early modern town plans with GIS: Case of Vyborg

Keti Lelo (Rome): Quantitative spatial analysis for urban studies: a critical discussion

Justin Colson (Colchester): Teaching Urban History through Mapping: Research-led teaching with GIS Tools

General Discussion: Research – aims & needs

Bram Vannieuwenhuyze / Jaap Evert Abrahamse / Menne Kosian / Reinout Rutte (Amsterdam) / Marcel Ijsselstijn (Leiden): Historic Towns atlases, urbanization and GIS in the Low Countries

General Discussion: Online publication – aims & obstacles

Round Table: Comparative research perspectives based on digital HTAs

Looking ahead

Rosa Smurra / Marco Orlandi (Bologna): A GIS-based metholdology for HTAs. Ravenna on the eve of the Railway Age

Daniel Stracke / Philipp Schneider (Münster): Using the Historic Towns Atlas Forum

General Discussion: Present & Future Issues

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