

*Exploring Old Maps
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Knowledge Organisation with Maps as Nodes

First steps to integrate information content and information context of thematic maps in library services

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Abstract— Thematic maps are an ideal medium for storing and visualising data on social or economic relations as well as for visually represented arguments. Using different layers and signatures they are able to create a synopsis of geodata with temporal, statistical or factual data. In traditional map cataloguing this informational dimension of multimodality in many cases is not included. The library of [the Institute for East and Southeast European Studies \(IOS\)](#) is searching within the project [GeoPortOst](#)¹ for ways how to extract the different information layers encoded in maps to get better access to complex spatiotemporal relationships.

Keywords— map retrieval; thematic maps; metadata; georeferencing; linked data; authority files; [GeoPortOst](#)

Libraries own extensive collections of maps. And maps are an important source of information in nearly all scientific disciplines including – of course – the area studies with its spatial based approaches of research.

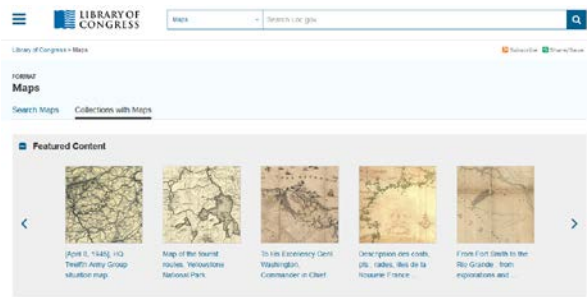
With the progressing digitization of library collections, also maps become more easily available. But digital items made available in the Web can be more than just mere bitmap images consumed on the screen at home.

Digital documents generally are tagged with additional metadata. So, it is no longer only the document itself (or rather its digital manifestation) that carries all the information. Information is stored as well in the metadata describing the document and linking it to external information.

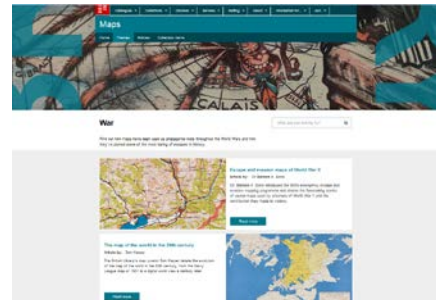
By this means the concept of a monolithic document, understood as container of information, changes into a more complex digital information object compounding content and context [\[1\]](#).

In consequence, objects in the digital world can be represented, and, in addition, their structure and order can be shaped [\[2\]](#).

¹ <http://geoportost.ios-regensburg.de/en/>



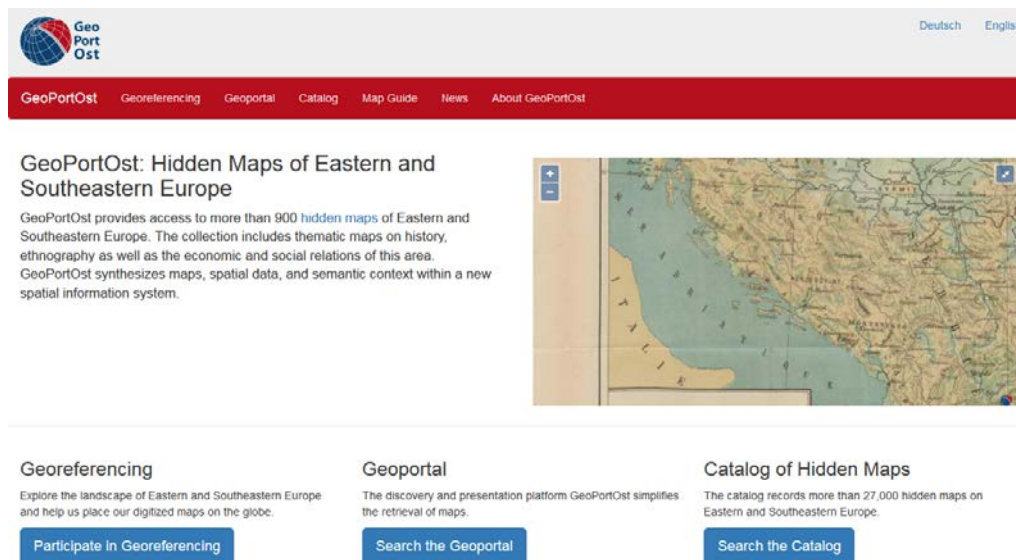
[Screenshot: Library of Congress, Maps Division]



[Screenshot: British Library, Map Collections]

The traditional functions of libraries are well defined and developed: collecting, preserving, arranging, and providing of information. Due to the digital turn they are faced with a new role in linking and contextualizing digital documents. In this talk I would like to discuss ways, how libraries can generate useful content and context descriptions of digital documents and how they can open up these data for public reuse.

To illustrate these aims I'll focus on the map project GeoPortOst [3]. GeoPortOst is realized at the library of the Institute for East- and Southeast European Studies in Regensburg, Germany.



[Screenshot: GeoPortOst]

(1) Maps as Records.

At first, let me introduce the project GeoPortOst as an example for providing access to its maps.

(2) Maps as Narrative.

As you will notice, the collection organized within GeoPortOst consists primarily of a special type of maps: thematic maps predominate. I will try to characterize this category of cartographic production.

(3) Librarian Map Mining.

This part of the presentation is dealing with the question how we can model and arrange the digital maps of our collection.

(4) The Library a Map?

Finally a few concluding remarks on lightweight steps to improve the accessibility of maps and map data.

Maps as Records.

Before using maps one has to find them. And of course not just any map, but the adequate one.

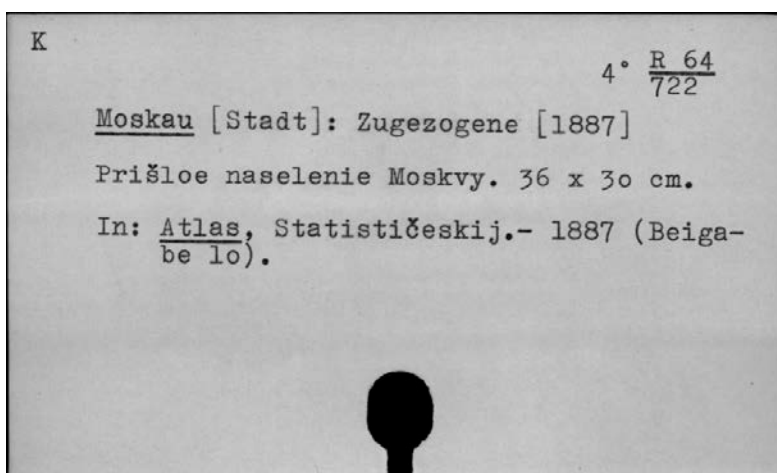
Therefore the Institute for East- and Southeast European Studies Regensburg (IOS) provides a specialized and deep digging tool for retrieving a category of maps often unseen and neglected: so called Hidden Maps.

The term “Hidden Maps” denotes dependent cartographic material printed in books or periodicals. This material is not recorded by any traditional reference system.

Since the foundation of the IOS predecessor institutions,² the library indexes even the contents of books and journals. Therefore, over time several specific catalogues for articles in book series or journals, for figures, as well as for maps have grown.

Particularly maps, printed within books or periodicals, were recorded in the Hidden Maps catalogue. Thus, a unique instrument was created with about 27.000 cartographic items, described on 16.000 catalogue cards.

The standard indexing of the maps included the traditional bibliographic classes like author, title, subject headings, reference to the source, but also place names and a physical description of the map. The catalogue of hidden maps is the base for the project GeoPortOst, funded by the [German Research Foundation](#).³



[Card from the Hidden Maps-catalogue]

At a glance, GeoPortOst’s concern was to transfer information physically stored in the catalogue records and in the maps themselves into free and reusable data.

To approach this objective we started in 2015 with the retro-conversion of the card catalogue. 16.000 cards were digitized, converted into structured text, and imported into an integrated library system. Now, the catalogue is part of the data infrastructure of the Bavarian Library Network and worldwide searchable in the Bavarian online gateway.

Then, we selected the public domain maps and digitized them together with the works they are part of. This core collection is consisting of 912 maps up to now representing all regions of Eastern and Southeastern Europe. Made searchable in the Geoport, ⁴ it constitutes the foundation for our work on organizing the digital maps into an information network of references.

Finally, the heart of GeoPortOst’s features has been the implementation of a web-application to crowdsource the georeferencing of our digitized maps [4]. For this task we chose the proprietary web tool Georeferencer, developed by KlokanTechnologies [5].

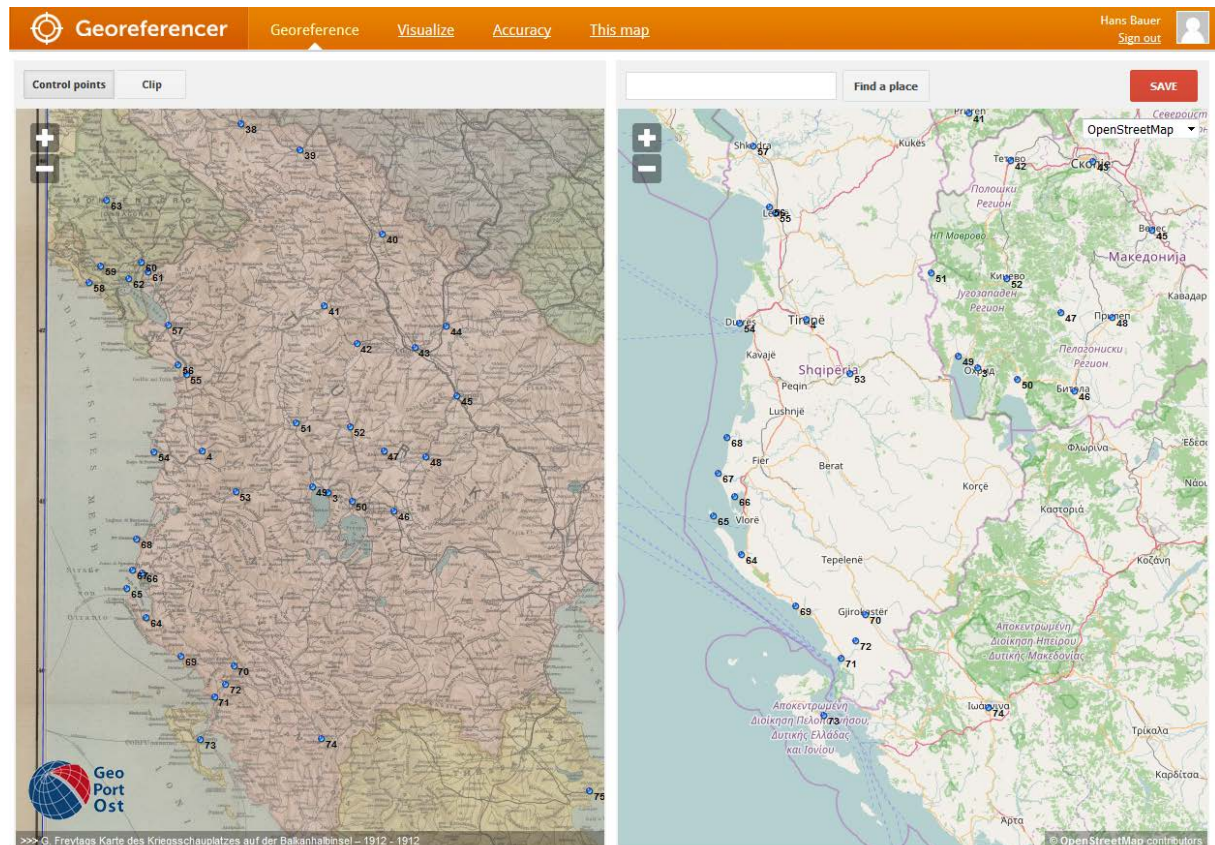
² The Institute for Southeast European Studies, founded in 1930, and the Institute for East European Studies, founded in 1952, merged in 2012 to the IOS.

³ Project details given under: <http://gepris.dfg.de/gepris/projekt/252088190?language=en>

⁴ <http://geoportost.ios-regensburg.de/en/geoport/>

Georeferencing has become an imperative standard for digital map collections [6]. It is a rather simple, but effective process to assign geodetic information to images of old maps so that they align with real world geography. The essential process typically consists of adding control points to an old map that have a real-world location; once there are sufficient control points, the map can be transformed so that it correctly aligns with geographic reality [7].

After signing in via google, facebook, twitter, or other channels the Georeferencer offers convenient features for contributing for all interested volunteers. On the left side of the screen you see the original map image, on the right hand a modern base map. The contributor chooses a place on the old map and identifies it by clicking on the base map. The result can be seen immediately, which also creates a competitive setting for further engagement of the volunteers.



[Screenshot: GeoPortOst-Georeferencer]

Only four weeks after the launch of the GeoPortOst-georeferencer (October 12th) the success is overwhelming: 900 maps are located. Reviewing the quality of the georeferencing we find indeed a large variety in assigning control points. Some maps are fixed only by three, the 'best' one in contrast by 327 control points.

Anyway: the benefits of the volunteer participation are given. Most maps of our collection are linked up to real-world coordinates. They can be overlaid and compared with other maps, the geodata can be exported freely as kml and ESRI world files, and the library gets spatial metadata in MARC 21 format appropriate to populating the catalogue [8].

Maps as Narrative.

Let's have a look on what material we have got georeferenced in GeoPortOst. Hidden Maps always are specifically designed as an integral part of the source, they are published in. In contrast to the general or topographic map the accurate representation of geographical space must not necessarily be their primary objective. Mostly they serve as a vehicle for the figurative expression of thematic (abstract, historical, ethnographic etc.) concepts [9]. In consequence the genre of thematic maps is central for

our collection. In numbers: we counted 374 maps showing historical events, 120 statistical maps, and 89 infrastructure maps on Eastern and Southeastern Europe, and even non-maps, but only 88 topographical maps.



[Content diversity: geographic subjects, thematic subjects]

Thematic maps are an integral part of humanities research. They assign data and information to concrete measurable spatial entities by linking temporal, geographic and factual issues. As media with highly concentrated information content, thematic maps visually synthesise quantitative and qualitative assertions [10]. So they often play not only an illustrating but also predicative role [11]. Especially in historical research, maps printed in publications can become a case for the discourse and can function as rhetoric device, as J.B. Harley points it out in his programmatic text ‘Deconstructing the Map’. They are able to overlay the metric space of geography with meaningful arguments and to mark specific semantics. By using text, signatures, colour and raster codes these maps develop complex representations of spatial concepts. They can become a mechanism for spatializing and defining social relationships, sustaining social rules, and strengthening social values [12].

What is unfamiliar especially to historians, is that thematic maps (and maps in general) visualize subjects without revealing their sources. The decision for using this and not another signature, a color and not another is made in the so called ‘black box of the cartographer’ [12].

Insofar, Hidden Maps have the advantage that they are embedded in context referring to the map. And – maybe – the context will allow some conclusions to be drawn about map production. Whereas tools like the Georeferencer can help us to understand the topological and geometrical relation of the old map, we now need to produce a new component for its thematic layer: a contextualizer, which is able to interlink geographical with semantic reference systems [13].

Librarian Map Mining.

I’ll try to explicate from the perspective of a small library with only little IT resources, which are the steps necessary to approach this aim. So, I won’t introduce a new, tricky research environment, but suggestions how libraries can shape their core business – organizing and describing collections by creating metadata – in a way that impact will be effecting not only the performance of the catalogue but also outside the catalogue.

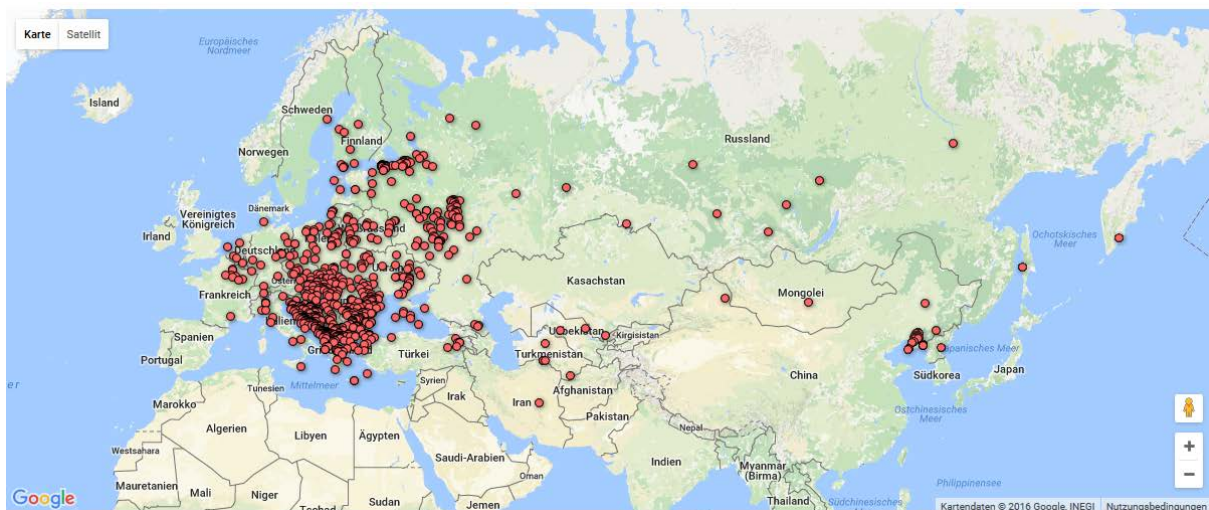
1 Mark Up your Map Collection with Coordinates

Library catalogues are well-designed for searching by author, by title, and by topic, but not for searching by place. One can search for placenames in titles or in subject headings, but the geographical headings and the geographical subdivisions of librarian classification tend to be political jurisdictions— primarily countries, states, and cities. The names, the boundaries, and the political structures of these entities tend to be unstable over time – especially in our area, where placenames often changed or vanished at all. This situation provides limited help for scientific, historical, and narrowly local searches

when the interest is in a geographical region rather than in a geopolitical unit [14]. Another problem exists, because maps always contain more places than given for example on the title of a single sheet.

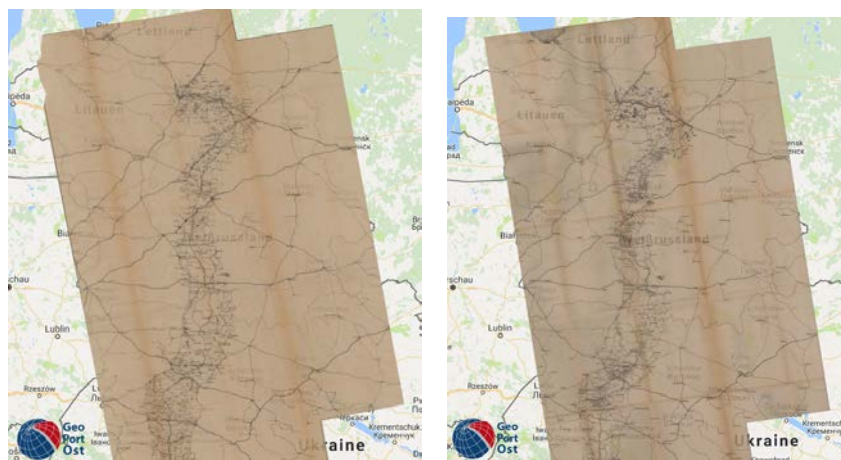
Including geographic coordinates in bibliographic records stands to be one of the most important decisions a map cataloguer can make in an effort to increase the accessibility of map and geographic data collections – within and outside of the catalogue. One of the most useful applications of geographic coordinates in library catalog records is the ability to pull those coordinates into a geographic search interface that exists outside the online library catalog. With the geographic search interface, a user can search for an item according to its location on a map rather than by less-accurate textual means [15].

A look on the georeferenced GeoPortOst-maps proves these advantages immediately on a simple google map.



[GeoPortOst-collection located on a google-map]

At the moment we are working on enriching our library catalogue with boundary coordinates in the MARC 21 subfield 034 for coded cartographic mathematical data [16]. This field will enable us to include our maps in federated search engines with geo-enabled search methods such as OldMapsOnline [17]. Thus the materials will be searchable term independent. And users will get an increase of matches for example while searching for maps showing the same territory for comparison.



[Two maps⁵ showing the Eastern Polish border before and after the negotiations in Riga 1920/1921 – it is also possible to integrate the maps in GIS for drawing new comparative maps by exporting the kml-files]

⁵ Dziennik ustaw Rzeczypospolitej Polskiej, 1921, p. 346 (URL: <http://geoportost.io-regensburg.de/map/BV042517611>), p. 847. (URL: <http://geoportost.io-regensburg.de/map/BV042517611>)

2 Mark Up your Map Collection with Authority Files

Whilst coordinates play the role of identifiers for the geographical base layer of a thematic map [18], we still need an analogue for the thematic information visualized on the base map.

This is where the librarian's effort yields a great return. In our Hidden Maps-catalogue all items are deeply indexed by subjects. By connecting these subjects with authority files we get a kind of semantic identifier for the topics of our maps.

Authority control is a task of national libraries providing a standardized heading for subjects like books, persons, places, and events. It combines differing name variants, biographical information, and short definitions for any subject into a controlled vocabulary [19]. Each subject gets a particular unique identifier or heading term denoted by an URI which is then used consistently, uniquely, and unambiguously for all references to that same subject [20]. The potential of authority files unfolds in matching different language versions in an international authority service, called VIAF [21]. The VIAF links for example the German Common Authority Files (GND) with the Library of Congress Subject Headings and the French Rameau and offers a global concordance for subjects.

Adding authority files to our map metadata identifies the semantic statement shown on the geographical layer. For example, a map of the battle of Borodino illustrates an event of the Napoleonic Wars.



[Plan srazheniya pri Borodine, in: Istorija russkoj armii i flota/3, 1911, p. 160, URL: <http://geoportost.ios-regensburg.de/en/map/BV042513748>]


Indexing the map with the subject “Napoleonische Kriege”⁶ connects the place with a certain event associated to a certain time period and to individual people [22]. For the user it becomes clear that this map is not a street map of the Moscow oblast', that this map is not showing the battlefield at Borodino in 1941, and that for example a person named Kutuzov was involved. The authority ID links it also with its English counterpart “Napoleonic Wars, 1800-1915”⁷ and its French equivalent “Guerres napoléoniennes (1800-1815)”⁸, enabling cross references.

⁶ <http://d-nb.info/gnd/4041216-7>

⁷ <https://lccn.loc.gov/sh85089767>

⁸ http://data.bnf.fr/12035694/guerres_napoleoniennes_1800-1815/

Link zu diesem Datensatz	http://d-nb.info/gnd/4041211-7
Sachbegriff	Napoleonische Kriege
Quelle	Kompakt 8, gegen M, SWL
Erläuterungen	Definition: Zeitliche Überschiebung mit Koalitionskriege für den Zeitraum 1803-1807
Zeit	1803-1815
Land	Europa (XX)
Geografischer Bezug	Europa betreffe: Frankreich
Beziehungen zu Personem	betreffe: Napoleon I., Friedriech, Kaiser
Thematischer Bezug	Verwandter Begriff: Koalitionskriege
DDC-Notation	940.27
Systematik	8.4 Militär
Typ	Historisches Einzelereignis (sh)
Andere Normdaten	LC91: Napoleonic Wars, 1800-1815 KARMA: Guerres napoléoniennes (1800-1815)
Untergeordnet	17 Datensätze 1. Taro <Russ> / Schlacht Teil von: Napoleonische Kriege 2. Befreiungskriege <1813-1815> Teil von: Napoleonische Kriege 3. ...
Thema in	210 Publikationen 1. Die Feldzüge Napoleons in Europa und Nordafrika Recht-Herr, Claudia. - [Wien] : [AV + Astora Druckzentrum], [2016], Klein Maßstab angegeben 2. Krieg und Frieden Tobias, Lew. - München : der Hörverlag, 2016, neue Ausgabe 3. ...



View this record in: [MARCXML](#), [IMADS](#) | [LC Authorities & Vocabularies](#)

Napoleonic Wars, 1800-1815

LC control no.	sh 85089767
Topical heading	Napoleonic Wars, 1800-1815 Browse this term in LC Authorities or the LC Online Catalog
Variant(s)	Napoleonic Wars, 1800-1814
See also	Europe--History--1789-1915 Browse this term in LC Authorities France--History--Consulate and First Empire, 1799-1815 Browse this term in LC Authorities
Found in	Work cat. Forbescue, J. The campaign of Waterloo, 1807 Britannica Macro - under French Revolutionary and Napoleonic wars: the French Revolutionary wars include the campaigns waged by Revolutionary France between 1792 and 1802, the first major battles of the Napoleonic Wars (1803-15) took place after France again went to war with Great Britain Random House (Napoleonic Wars, the intermittent wars (1796-1815) waged by France principally against England, Prussia, Austria, and Russia) Encyc. mit. (Napoleonic Wars, waged 1803-15 against Napoleonic France by Great Britain and its Continental allies to restore the European balance of power) Acad. An. encyc. (were those waged between France under Napoleon I and various combinations of European nations from 1803 to 1815. They were a direct continuation of the French Revolutionary Wars (1792-1802)) Dupuy, R.E. The encyc. of military hist., c1970, p. 743 (the Napoleonic Wars, 1800-1815, Napoleon Bonaparte's accession to power as First Consul is taken as the dividing point between the Wars of the French Revolution and the Napoleonic Wars)

[GND: Napoleonische Kriege ; LOC: Napoleonic Wars]

By aggregating geographic and semantic layers into compound information objects our maps become information nodes. Because all of the components of these objects can be identified by a unique, web enabled, and machine readable URI it is possible to build up connections to services outside of library infrastructures. For example to Wikipedia. By publishing a so-called BEACON-file (a simple txt-document containing all GND-URIs, indexed in GeoPortOst) we show: the following topics are to be found in the portal [\[23\]](#). Now, this signal can be decoded by Wikipedia or other resources, where our items could be linked with the relevant articles. And vice versa we are able to integrate resources from the WWW to our collection.

3 Mark Up your Maps with Context

As mentioned earlier, Hidden Maps are surrounded by context. There are textual references in the books, or tables, or lists.

This context can help us elucidate the story behind the map, so it could be worth pointing explicitly to the relation between map and source [\[24\]](#).

In GeoPortOst we already realized a first, rather rough connection of the single map to its source – both denoted by stable URIs. You can find the digitized source linked in the Geoportal and the OPAC. The relation between map and source is marked machine readable by the Dublin Core-property isPartOf, and the relation between map and subjects is marked by dcterms:subject as already realized in the Linked Open Data Service of the B3Kat [\[25\]](#).

St. Petersburg at lod.b3kat.de
<http://lod.b3kat.de/title/BV023237199>

Property	Value
isbd:p1006	• Drawn from a plan published at the Etat Major, from a Trigonometrical Survey, 1827 / Intended to illustrate Dr. Granville's Work on St. Petersburg.
isbd:p1003	• 3 RS. Lithographie 27 x 27 cm, gefaltet Indication of the Churches, Canals, Bridges, and Principal Streets in the new plan of St. Petersburg. (2 Bl.)
dcterms:alternative	• Saint Petersburg
dcterms: bibliographicCitation	• [Kartenbeilage zu], page 537 m. Bl. auf p. 537-539
dcterms:contributor	• http://d-nb.info/gnd/103734067 • http://d-nb.info/gnd/103739146
geonames:countryCode	• GB
islat:islat	• 471
islat:docType	• 29024
dcterms:descripton	• Ohne Kartennetz, ohne Maßstabangabe - Mit Straßen- u Gebäudefeverz auf d Bildrand • Bild mit Text
islat:islat	• http://lod.b3kat.de/title/BV023237199 • http://lod.b3kat.de/title/BV023237199
dcterms:ispartof	• 3 RS. Lithographie 27 x 27 cm, gefaltet Indication of the Churches, Canals, Bridges, and Principal Streets in the new plan of St. Petersburg. (2 Bl.)
dcterms:ispartof	• http://d-nb.info/gnd/103734067
dcterms:issued	• 1829 (xsd:int)
dcterms:language	• http://d-nb.info/gnd/103734067 • http://d-nb.info/gnd/103739146
islat:islat	• http://d-nb.info/gnd/103734067 • http://d-nb.info/gnd/103739146
islat:islat	• Drawn from a plan published at the Etat Major, from a Trigonometrical Survey, 1827 / Intended to illustrate Dr. Granville's Work on St. Petersburg
islat:islat	• London
islat:islat	• http://d-nb.info/gnd/103734067 • http://d-nb.info/gnd/103739146
islat:islat	• London's Henry Colburn 1829
dcterms:publisher	• Henry Colburn
islat:islat	• http://lod.b3kat.de/title/BV05419246 / http://lod.b3kat.de/title/BV05419246 / http://lod.b3kat.de/title/BV05419246
dcterms:ispartof	• http://lod.b3kat.de/title/BV05419246 / http://lod.b3kat.de/title/BV05419246 / http://lod.b3kat.de/title/BV05419246
dcterms:ispartof	• http://d-nb.info/gnd/103734067 • http://d-nb.info/gnd/103739146 • http://d-nb.info/gnd/103734067 • http://d-nb.info/gnd/103739146
dcterms:ispartof	• 907.2 (dcterms:DDC) • Altkarte (G6) • Petersburg: Stadtplan (um 1829) • Saint Petersburg (G6) • Stadtplan (G6)
dcterms:ispartof	• St. Petersburg
dcterms:ispartof	• http://d-nb.info/gnd/103734067 • http://d-nb.info/gnd/103739146 • http://d-nb.info/gnd/103734067 • http://d-nb.info/gnd/103739146

Diese Seite zeigt Informationen aus dem SPARQL endpoint <http://lod.b3kat.de/sparql>, betrieben mit dem Triplestore Blazegraph.
 As Turtle | As RDF/XML | Browse in Datas

[Example from GeoPortOst: <https://lod.b3kat.de/page/title/BV023237199>]

But context enrichment doesn't have to stop on this level. Context enrichment may be applied at far finer levels of granulation, enriching with increasingly smaller parts of documents: sections, paragraphs, tables, diagrams, even the appearance of individual concepts or entities [26].

For this purpose we are planning to integrate an annotation tool, where an image area on the map could be marked up and linked to a marked up area in the digital texts. Finally the annotations should be exported as research data into GeoPortOst represented by a specific identifier and a semantic property.

The outcome seems to be attractive: imagine that it could be possible to identify the position of a single unit on a battle map by place and link it to the relevant explication given in the source.

Other scenarios could realize links between structured data – like census data from statistical atlases – and a georeferenced map, or between maps printed in address books with person data. [Example: market places in St. Petersburg as shown on maps in Ves' Peterburg and person data of foreigners in St. Petersburg published in the Amburger-database [27] – possible query: are there places preferred by foreign businessmen?].

The Library a Map?

Summary:

First, we disaggregated different information layers of maps into single metadata strings. Then, we defined these metadata as meaningful data. We denoted spatial-geographical and content information with separate identifiers. The identifiers serve each as a pivot for connections with other information resources such as other map catalogues, gazetteers, online encyclopedias etc.

It is worth remembering that in doing so we always acted only as a library. We didn't do anything else than digging out already given information layers from the map and from the source. It could not be our aim to analyze or review the documents. That's the researcher's duty.

But in this way we liberated our digital maps from closed information silos such as the OPAC, and settled them into a more open, but yet controlled / standardized space able to represent their heterogeneity [28].

Metaphorically, we left the vertical hierarchy of librarian cataloguing rules and classification systems and established a flat, sometimes maybe fuzzy map where the digital map object is a node within a network of links.

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