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# Digital Humanities and the “Deutsche Biographie” as historical biographical information system

Matthias Reinert // Dirk Scholz<sup>1</sup>

## Abstract

The German biography portal “Deutsche Biographie” is a joint effort of the Historical Commission at the Bavarian Academy of Sciences and Humanities and the Bavarian State Library and supported by cultural heritage institutions to develop a historical and biographical information system for the German-speaking world. It includes digital full texts of more than 48.000 articles about persons and families of two biographical dictionaries and indices from associated institutions. We will describe our objectives in adopting state-of-the-art methods in Digital Humanities (DH): metadata modeling, text-encoding, identifying individuals and places in authority files and aggregating further biographical information from freely available, persistent, scientific and source-based websites and databases. The portal offers an entry point for historical biographical research by providing programmable web services to foster current approaches in DH like linked open data/semantic web, historical network research, computational linguistics. The potential of it lies in its coordinated biographical data management and integration. The common database is gradually enlarged in a collaborative and modular manner together with partners in Germany and Europe. We will discuss on how the collection information can be curated in order to serve and facilitate future research trends.

**Keywords:** biographies, biographical dictionaries, digitization, information extraction, authority files, biographical metadata aggregation, semantic web

The partners received funding by the DFG 1999-2001, 2007-9, 2011, 2012-2016.

## 1. Overview

Biographical dictionaries constitute a unique source of historical knowledge. The articles not only inform about its subject, but they also give insight into the authors, their questions, methods, intentions, biases, and the zeitgeist. The factual knowledge expressed can be regarded as metadata. And, as we will show in this article, it can be successively derived from text, expressed using semantic web ontologies and reasoned upon. We achieved this result by interlinking recognized entities (names, places) with authority files. And we will try to pursue this approach further (works and similar subjects). Our efforts relate closely to similar digitization and interlinking projects of prosopographic research.<sup>2</sup>

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<sup>1</sup> The authors represent the Team Deutsche Biographie. It is led by Professor Dr. Malte Rehbein, head of the department at the Historical Commission. Matthias Reinert, Sophia Stotz, Valentina Stuß, Ingo Frank, Sebastian Gassner, Maximilian Schrott worked as research staff between 2012-2016. For the Bavarian State Library Dirk Scholz, Thomas Busch, Alexandra Gobrecht, Sebastian Lutze, Marwin Bartels, Christian Kaufhold & GND – Team at the Munich Digitization Center led by Klaus Kempf contributed substantially to the projects results.

<sup>2</sup> The biographical portal of the Netherlands successfully merged and enhanced several digitized historical biographical dictionaries as well as current online resources. (<http://www.biografischportaal.nl/about>) An API

In addition our research fits equally into the field of Digital Humanities. Without deciding if DH is a discipline still defining itself as a science in terms of methods, objects and habits of discourse<sup>3</sup> we observe that our project shares main aspects with what is regarded as DH in teaching<sup>4</sup>, namely digitization (1999ff), modeling biographies by metadata (2001ff), XML/ TEI encoding, interacting with authority files (2007ff), linguistic and network analysis (2012ff), programmable interfaces (2015). Hence we understand DH as an approach to transfer methodologies and techniques from other fields to the humanities under supervised conditions and by reflecting upon these methodologies.<sup>5</sup> In this sense DH is an experimental science too. And we will show how we did experiments with authority file alignment and -linking; by offering web-services to access our data hub; with computational linguistics in order to deepen the understanding of our texts and finally with network visualizations to understand the connections between lives better.

Finally our inter-disciplinary endeavor incorporates leading (experts of) libraries, biographical research as well as computational linguistics, semantics in an agile, project-like style. The agile approach helps us to react and adapt to the latest developments in methodologies and research programs of DH.

## 2. Biographical dictionaries in Print: ADB 1875-1912 & NDB 1953- (Vocke)

The precursor of the “Neue Deutsche Biographie” (NDB) originates in the 19th century. The “Allgemeine Deutsche Biographie” (ADB) was compiled and printed in 55 vol., between 1875 and 1912. This dictionary was embedded into a program to shape the national identity on the basis of a German culture and language. The concept was to reinforce a kind of federated cultural nation on the basis of protestant liberal middle-class milieus including opponent and minority positions (Hockerts 2008, 238).

The NDB was outlined towards the end of World War II in order to renew the former dictionary ADB and in the preface dedicated to the German people as a whole (“das dem ganzen deutschen Volke gehören soll” Vorwort, NDB I, 1953, p. VI). It was conceived to cover distinguished

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(<http://www.biografischportaal.nl/about/bioport-api-documentation>) allows automated request of database entries. The Oxford University Press (OUP) set up an index combining individuals from the Oxford Dictionary of Biography with the National Portrait Gallery and National Archives content (images), as well as indexes of several monographs and dictionaries they published. Available online is a search gateway “Oxford Index” based on identified names linking to 16 selected resources (<http://oxfordindex.oup.com/>). There are no known projects outside OUP which reuse these identifiers apart from Wikipedia/Wikidata. <https://www.wikidata.org/wiki/Property:P1415?uselang=de>. Digital projects are pursued by the Australian Dictionary of Biography (<http://adb.anu.edu.au>), cf. Arthur (2015) and the born-digital Historical Dictionary of Switzerland, s. Jorio (1990) and Jorio (2000), is linking consequently to the authority file Gemeinsame Normdatei (GND) and the Virtual International Authority File (VIAF). Finally the tripartite complex Wikipedia, DBpedia and Wikidata must be mentioned. The DBpedia arose out the Wikipedia-dictionary as a means to conceptualize facts and assertions in a structured way. In addition the practical requirements to manage obvious facts scattered in different language versions gave birth to the Wikidata effort. Wikidata manages merely simple assertions on articles and struggle with the problem that facts and ontological structures are not always translatable. (s. Mark Grahams early remarks in <http://www.theatlantic.com/technology/archive/2012/04/the-problem-with-wikidata/255564/>) 3 Thaller (2017), 16 and Jannidis (2017), 106f stress the importance of „modeling“ as crucial to DH as a scientific discipline. We follow the conservative approach allowing both understandings of DH as a discipline and a set of shared methodologies as outlined by Hirsch (2012) 3.

4 For an overview on DH requirements in teaching in Germany see Sahle (2013), 18f.

5 Schreibman et al. (2004) introduced DH as a set of shared methodologies across different humanities.

individuals of German language and culture and was not confined by national borders. The culturally grounded concept included members of the German *Volk* (in Austria and shortly before detached territories) and foreigners with cultural influence in Germany (Vorwort, NDB I, 1953, p.VII f., in detail Hockerts 2008, 244-254).

As of 2017 26 volumes in alphabetical order up to “Vocke” have been published. Two volumes („Vocke – Zyrll“) are planned to be released until 2020.

The NDB gives concise, thoroughly prepared biographies of deceased persons who have had a significant impact on developments in scholarship, literature, arts, politics, economics, social life, and technology (Hockerts 2008). The NDB is regarded as an authoritative biographical dictionary for all regions in which German is spoken (“deutscher Sprachraum”) and German culture is prevalent (Hockerts 2008, Kraus 2010).

The NDB covers the period from the early middle ages down to the present and is arranged alphabetically. The 26 published volumes, contain about 23.000 articles, roughly 19.000 are biographies on individual persons and 3.000 cover families. The articles include detailed information on genealogy (cf. Ebneith 2012), selective lists of works as well as secondary literature, and references to portraits. In total about 8.000 different authors, often distinguished experts in their field, have contributed articles.

Each volume is prepared by an editorial staff of five historians each of whom is responsible for a particular subject area. The staff selects the people to be included in the NDB, appoints qualified authors, and edits the articles for printing. The preparation process builds upon an internal database which is continuously extended by systematic examination of online resources, monographs, periodicals, newspapers, obituaries, bibliographies, editions and exhibitions.

Each volume covers a selection of 8.000 names in the internal database, the editor responsible for a specific field (humanities, sciences, literature, arts, politics, business, medicine) creates a preselection which is discussed with selected relevant experts. The author is chosen by the editor and the article undergoes an informal peer review process in the editorial office and a revision in order to fit the criteria of style, content and completeness.

A strict structure is imposed on all articles (cf. Redaktion der NDB 2009):

1. Full name, occupation, date and place of birth, date and place of death, tomb, religious denomination
2. Family (genealogy)
3. Career, achievements, critical evaluation
4. List of selected works
5. List of sources and secondary literature
6. References to portraits (but no illustrations)
7. Name of the author.

### 3. digitization as a first step

One of the earliest projects of the Munich Digitization Center (MDZ) at the Bavarian State Library (BSB) had been the Image-Scan of all 56 volumes of the ADB. They were published online in 1999. By adding the index of persons mentioned in the biographical dictionaries the first web application appeared in 2001. An early MS-Access database had been transformed to a PHP/MySQL search interface for personal and family names, professions, confessions, years of birth and death, gender, nobility status, and authors.

Some years later the partner gathered further funding and digitized the NDB volumes as well as could offer a fulltext version of both dictionaries in structured XML in 2010. The dictionaries had been transcribed by third party and reworked inhouse according to principles of the Text Encoding Initiative. All articles were aligned to the index databases by internal identifiers in a semi-automated process.

The decision to apply the formerly called „Personennamendatei“ (PND, now part of GND) to the complete set of individual names originated in early concepts of the MDZ/ Bayerische Landesbibliothek Online from 2003<sup>6</sup>. Until 2010 more than 80.000 index entries had been aligned to the PND, tens of thousand entries had been added to the authority file.

The next step were the merger with entries of the editors workbench (so called „Hauptkartei“) in 2011. All 150.000 reference cards had been digitized, key values transcribed and aligned to the PND which led to an increase by 40.000 in total numbers after de-duplication.

### 4. Extending the knowledge base

The latest activities since 2012 comprised in bilateral efforts to bring further partners into the GND and the Deutsche Biographie alike. The latest project to establish a „historical and biographical information system“ run from 2012 to 2016 and was funded by the DFG (Hockerts 2012; Jordan 2012; Hagn/Schrott 2015; Ebneht 2015). In two funding rounds the database has been enlarged by incorporating selected cultural heritage partners.

In a further step the Deutsche Biographie aggregated data from 15 selected renowned partners in Germany who provide content related to individuals of importance. In a first stage (2012-14) we worked with Deutsches Literaturarchiv Marbach, Bundesarchiv Koblenz/Berlin, Germanisches Nationalmuseum Nürnberg, Foto Marburg, Deutsches Rundfunkarchiv Frankfurt/Main and Deutsches Museum, München to get their individual records in selected databases linkable.<sup>7</sup>

The MDZ/BSB offered the redaction of GND records to certain websites of the partners mentioned. In total more than 35.000 new records had been added to the GND. The partners on the other hand were able to use the GND-identifier to link to the Authority file that comes with up-to-date bibliographic information. Some were linking back to the Deutsche Biographie, others used a web-service to aggregate further web-links by adopting a simple protocol (Beacon).

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<sup>6</sup> Search for persons in the BLO according to Seep (2007) 4.

<sup>7</sup> List of Partners cf. <http://www.deutsche-biographie.de/partner>.

The second stage in 2015 includes Staatsbibliothek zu Berlin as coordinating body of “Kalliope”, Deutsche Fotothek Dresden, Deutsches Filminstitut Frankfurt/Main, Landesarchiv Baden-Württemberg (Landeskundliches Informationssystem Baden-Württemberg LEO-BW<sup>8</sup>), as well as selected projects of four academies of sciences and humanities (Berlin-Brandenburg, North Rhine-Westphalia, Mayence and Bavaria).

Most partners in the second stage usually offered to align their biographical information with an authority file (GND) on their own and agreed that their names should be integrated into the Deutsche Biographie. Again more than 20.000 entries had been added to the GND.

## 5. The knowledge base today

Initial starting point had been the corpus of full text digitized biographical dictionaries (27.000 biographies from the ADB and 23.000 of the NDB, 3 volumes remain still to be added to the online version). Roughly 6.000 were presented in both series. Each biography is structured in XML according to the printed volumes: by a headline (surname, forenames, titles, professions, date and place of birth, death and burial, confessions), a genealogical abstract, the main biographical account, followed by technical paragraphs covering achievement and awards, works, secondary literature and reference to pictures and finally a line of the signing author(s).

The second source of personal and family entries to the database was the index of mentioned names. That source is subsequently growing with each volume appearing in print. It consists of 98.000 entries (2017). Together with 50.000 entries from the day-by-day running workbase the total of 150.000 biographical entries is the contribution of the Historical Commission to the Deutsche Biographie as information system.

The partner campaign 2012-16 let the Deutsche Biographie grow by 600.000 additional records. The biographical data of these records originates in the GND. Even several thousands interpersonal links between GND records are taken into account and presented in the search results.

As of late 2016 the Deutsche Biographie offers more than 730.000 records on personalities with further biographical information and individual linking to more than 230 web resources.

### 1 Webservices

#### 1 Aligning with authority files

Instead of creating an own authority file the NDB sought the cooperation with the MDZ at the Bavarian State Library in order to supply each individual in the NDB/ADB with an identifier in the bibliographical authority file GND (Busch/Jordan 2011, Ebneht/Busch 2012).<sup>9</sup> For technical reasons an internal identifier is still necessary to refer to entries without GND-record.

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<sup>8</sup> <http://www.leo-bw.de/web/guest/about>.

<sup>9</sup> The GND is curated by the German National Library and widely used by german, austrian, and swiss libraries to collect and identify personal and organizational names, geographic entities and subject headings. <http://www.dnb.de/gnd>.

Besides the overall alignment of all records to the PND/GND there are further reference like resources in our information system:

The first database online (2001) already offered selections along groups of profession. An early classification with a two level hierarchy of occupations distinguishes between humanities, sciences, arts, administration & church, and business & technology. It is still in use and could in the future support grouping queries and information extraction alike.

By using GND the Deutsche Digitale Bibliothek (DDB<sup>10</sup>) and the Consortium of European Research Libraries (CERL<sup>11</sup>) Thesaurus, regional information systems (LEO-BW), library catalogs, and digital/digitized editions are frequently linking back to Deutsche Biographie.

Recent efforts in this direction had been the locating of birth and death places of the NDB in geographical databases, namely OpenStreetMap (OSM) and Geonames, as well as in the GND. The headlines of articles regularly state the place of birth and of death. These placenames were extracted from the headlines and linked with geographic databases. The API provided by Nominatim, a joint service of Mapquest and OSM was used.<sup>12</sup> One third of the 12.000 different place names could be automatically matched and provided with coordinates. Unfortunately Nominatim and OSM did not provide persistent identifiers. To some extent our model and the OSM approach mismatched, because we do not differentiate yet between geographical entities like OSM did. In difference to the GND we also treated every place as a timeless point where the GND differentiates places as historical corporate bodies. But at least the coordinates persist and we use them to offer search results on a map.

## 2 Beacon – a link exchange format

To ease access to all relevant scientific sources it is required to improve and systematize linking. The NDB besides others adopted and promoted the use of authority files and identifiers in historiographical research projects, cf. Akademiunion (2009).

Following prominent proponents like BSB and Wikipedia the NDB promoted a simple protocol (Beacon<sup>13</sup>) to offer and share lists of identifiers and concordances.<sup>14</sup> With Beacon everyone can aggregate lists of links on an individual basis automatically.<sup>15</sup>

IN addition to promote our resource through a Beacon protocol, we cooperate with some institutions to provide a Beacon for their special interest websites. A link aggregator based on the GND-Beacon protocols not only feeds the records of our information system but is available for free.<sup>16</sup>

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10 <https://www.deutsche-digitale-bibliothek.de>.

11 <http://thesaurus.cerl.org>.

12 <http://nominatim.openstreetmap.org>.

13 <https://de.wikipedia.org/wiki/Wikipedia:BEACON>.

14 <http://www.historische-kommission-muenchen-editionen.de/pnd.html>.

15 [http://www.deutsche-biographie.de/vernetzte\\_angebote](http://www.deutsche-biographie.de/vernetzte_angebote), see also <http://beacon.findbuch.de/seealso/pnd-aks>, equally possible for institutions <http://beacon.findbuch.de/seemore/gnd-aks>.

16 Access to the productive version will be published on <http://data.deutsche-biographie.de/about>.

### 3 Advanced Webservice

The link structure emerging out of such a simple but effective Beacon protocol is helpful but does guide the users away from our resources. But we wanted to ease the exploration of our biographical data even further and extract as much information as possible from the text.

#### I. Information extraction on biographical articles

Cross linking articles by recognizing and identifying persons mentioned in the index files was a first approach to a more general extraction of information. It started with regular expressions and outstanding features like names and dates in headlines as well as page numbers. With the 152.000 references in the printed index as a basis, nearly all article headings (48.000) were identified automatically and about 55.000 occurrences of names could be located in the corpus with heuristics on names and candidate disambiguation (cf. Reinert 2010).

After that our efforts went to extracting information in interpersonal relationships as found in the articles of the NDB. The prospect was content enhancement and better search functions by adding context to search results.

Although the research started with very limited resources we could rely on advice and help from experts at the Centrum für Informations- und Sprachverarbeitung (CIS, LMU München), namely Franz Guenther and Michaela Geierhos (now University of Paderborn, cf. Geierhos 2010). The concept of Local Grammar (Maurice Gross) was adopted and grammars drafted to be applied with Unitex<sup>17</sup>, a versatile open source corpus processor. Through cooperation we were allowed to use the CISLEX dictionaries for German (Guenther & Maier 1994; Langer et al. 1996).

Due to limited resources we started with scientific teachers and students, and slightly extended linguistic work to cover friends and circles. The focus lay on the most frequently recurring phenomena (Stotz/Reinert 2013; Stotz/Stuß 2014).

#### II. Sparql - querying the metadata expressed as RDF

In late 2011 the Historical Commission applied successful for consulting in an EU-funded project Linked Open Data (LOD2, Riechert 2011).<sup>18</sup> Together with experts from the Leipzig AKSW<sup>19</sup> the metadata were translated into a semantic web ontology expressed in RDF-XML (Brümmer 2011). This prototype<sup>20</sup> was based upon the ontology-schemata developed for the authority file GND and comprised roughly 2.7 million statements.

The concept of linked open data is nourished by prospects of machine reasoning and automated knowledge management. Interlinking of in-homogeneous web content by use of identifiers, decidable ontology-schemata and expression of facts in simple structured phrases (RDF) seems to allow the cross-checking of information, the recomposition of knowledge and distillation of new

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<sup>17</sup> <http://www-igm.univ-mlv.fr/~unitex>.

<sup>18</sup> <http://lod2.eu>; <http://blog.aksw.org/german-biographies-as-part-of-the-linked-open-data-cloud>.

<sup>19</sup> <http://aksw.org>.

<sup>20</sup> <http://data.deutsche-biographie.de:8888/bigdata/>. Access to the productive version will be published on <http://data.deutsche-biographie.de/about>.

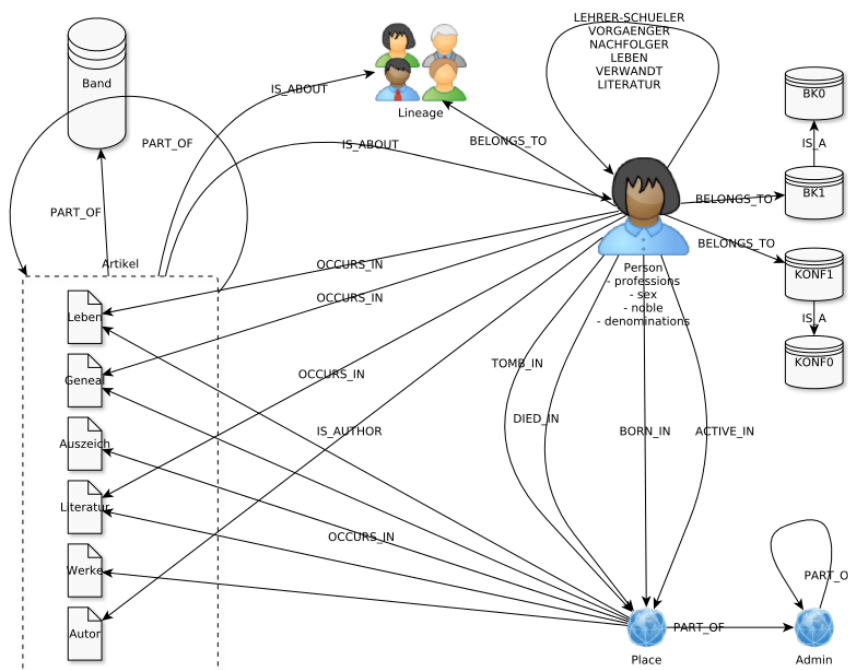


knowledge. In respect of the DBpedia/Wikidata-approach on biographical data we estimated that it is too laborious to check each difference in factual assertions, especially as often a severe scientific controversy lies behind a seemingly simple difference.

In order to interoperate on linked open data and infer statements a significant amount of ontology-mapping and value-combing is necessary. The GND contained a small number of errors, e.g. impossible dates. Our own linked data set contains normalized values and in some cases information is lost. For example, the year of birth “um 1225”<sup>21</sup> or place of birth “wohl in Aquitanien”<sup>22</sup> would require more specific vocabulary which would make inference more complicated.

### III. The database as a graph

With the emergence of Neo4J<sup>23</sup> as free and open source software (version 1.0 in 2010) we tried to



adopt graph based data stores in order to easier access certain properties of our data. The initial concept map covers books, articles, and parts of; lineages and persons, places and administrative divisions and finally a low level profession and confession classification.

The entity detection and our efforts in identifying persons and places and specific interpersonal relations (scholarly relations, friendship, predecessors and successors) amounted to roughly

140.000 persons with relations, 9500 places with 5600 administrative entities and 104.000 relations between individuals based on the text. In total the graph contains 310.000 nodes and 937.000 edges.<sup>24</sup>

### IV. Open search engine

After request from interested researchers we allow the access to the Solr-search-engine. Every interested individual can formulate queries in a special query language and query the database of 736.000 entries.<sup>25</sup> The API suppresses writing and updating records and a future version will provide keys to potential users in order to manage their requests.

21 <http://data.deutsche-biographie.de/rest/sfz17523.rdf>.

22 <http://data.deutsche-biographie.de/rest/sfz70566.rdf>.

23 Version 3.2.2 of the community edition is employed. cf. <https://neo4j.com>.

24 Access to the productive version will be published on <http://data.deutsche-biographie.de/about>.

25 Access <http://data.deutsche-biographie.de/beta/solr-open/>.

## 6. Open source technology stack

Experiments must be set up on a way they can be falsified or verified. Hence it is crucial to not rely upon commercial products. The Open Source community and several consortia (W3C, TEI) offer a with range of common standards and tools we were able to adopt.

The website is driven by Open Source technologies like Apache Tomcat, Apache Solr and plain XML files. Webservices rely on Blazegraph<sup>26</sup>, Virtuoso<sup>27</sup> and the Neo4J community edition. The web presentation is implemented in Java using Thymeleaf-templating. Interaction is managed by well-known Javascript libraries, namely Leaflet, Bootstrap and D3js. Finally no map search and presentation would be possible without the map data provided by OpenStreetMap and the tile-server operated by the Heidelberg GIScience Group<sup>28</sup>.

In the backend where the data of heterogeneous resources is processed, open source software is applied throughout: The data process is twofold. On the one side the TEI-XML data of our dictionaries still in volume-level format is merged with two index databases in XML format originating from a proprietary closed source application with limited extendability.<sup>29</sup> These files are aligned together by a common, internal identifier by scripts (XSLT, Perl) governed by Apache Ant.

On the other side the GND resource will be updated in a local copy. All partners communicate their GND identifier via Beacon. The protocol is harvested, the entries are merged and corresponding data will be aggregated and enhanced with biographical information from the GND and a tiny local metadata store serving categories per resource.

## 7. Vision of a biographical research lab – online

After having the print biographies digitized and the personal entries aligned with authority files, relations between them analyzed and places located a remainder consists in the limited interaction with the audience of the website.

Researchers are free to download metadata (CC-Zero licensed) or the XML tagged full text of the biographies (CC-BY-NC-SA resp. CC-BY-NC-ND licensed). But they are bound to the faceted search option we provide for everyone.

For a prospective research laboratory we differentiate the casual visitor searching a biographical information from the more able and informed digital humanities student as well as the expert in digital humanities. Together with institutions all of them need specific search forms; filter, query and download options. There is a demand for more flexibility in accounting on result sets, more and diverse visualizations and even citeability of temporary result sets and their visualizations as networks or on maps. The lab should provide these features with user and group accounts, commentary functions and sophisticated versioning of the information system.

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26 Blazegraph, formerly bigdata, <https://github.com/blazegraph/database/>.

27 Virtuoso Open Source edition 7.2.4, <http://vos.openlinksw.com/owiki/wiki/VOS>.

28 GIScience/ Geoinformatics research group at the university of Heidelberg, <http://giscience.uni-hd.de>.

29 The index entries and daily working base are held in a retrieval system called Faust 7, cf. <http://www.land-software.de/webinfo.fau?sid=EBD7BFBC1&nr=00000170&art=1>. For further data preparation all entries are exported to XML. There is no round trip facility built into Faust only a limited „insert with update“ procedure.

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