
Mapping Semantic Constructs in Historical Domains to Visual Structures as Basis for Resource Discovery Using the Example of Historical Financial Records

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Abstract

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Keywords: web of data; semantic web; ontology; information visualization; financial records; historical information; digital history

The (digital) visualization of information is neither theoretically nor methodologically well elaborated in digital history. However, the presentation or synopsis of historical sources and historical information has been used for a long time and is an important method to work with historical data. And so there are projects that deal with this, such as histograph. The idea behind this tool is to make any relation between actors, who are mentioned in documents, visible in a network. This kind of representation enables a user to get to know more about a dataset and a domain connected to it. When it comes to heuristic and the specific requirements of historians, the information need is more likely to follow the paradigm "I don't know what I'm looking for, I'll know it when I find it" and not really the principles of classic information look-up.

Especially the fundamental categories of historical research - time, actors and space - seem to be important dimensions to implement information visualization. Therefore, well established visualisation principles and methods based on spatial and temporal encoding exist. The principles include on the spatial side geographic maps and diagrams to represent networks, sets or other types. On the temporal side timelines, animation and superimposition are common forms. These methods cover the following functions of a visualization: comparison, proportion, hierarchy or distribution of data. An application aiming to enable resource discovery enables a heuristic view to a domain. One core of this is information visualization, embedded into an infrastructure and connected to functionalities for sorting, filtering and organizing information to be discovered.

Usually approaches to information visualization can be derived from a research question, the data, its semantic structure and the information about it. Formalized, this can be called a knowledge domain, which may also include directly or indirectly the knowledge of how to represent information in a meaningful way.

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In my presentation I want to discuss potential ways of using formalized knowledge in ontologies to develop generic or at least semi-generic and guided workflows to set up information visualization for historical information. These thoughts will be illustrated using the example of historical financial records.

Let us consider historical account books whose semantic structure is formally described in the Bookkeeping Ontology. This ontology defines a transaction of monetary values or economic goods from one agent or account to another. When working with data like that, use cases can be generalized. The ways of information representation are determined by the semantic structure of transactions of money or economic goods and, thus, can lead to a set of standard representations for financial records. This includes, temporal development in relation to quantifiable dimensions, the relations between participating actors or the distribution and proportions of transferred goods, to name some essentials. Examples are the payment of a levy or the income of money as they occur in historic city accounts. They describe the flow of a monetary value from an agent to the city for a specific category and vice versa. This scenario can be formally described in RDFS/OWL. Such logical expressions contain all the necessary dimensions for visualization: the date and the amount of money and its currency. The idea is to map such a semantic construction to a visual structure in which, for example, the date is placed as a dimension on the x-axis and the amount of money and currency on the negative y-axis. For another semantic construction, an income, the mapping must be described slightly differently: the amount of money must be placed on the positive y-axis.

POLOWINSK developed a top-level ontology for describing visual structures and views (VISO), a declarative RDF-based language to define mappings of RDFS/OWL- constructs in ontologies to visual or graphic objects (RVL). VISO together with RVL offers a formal way to describe the information visualization and provides the basis to implement interaction with it in a definable graphical environment. One example using this is SILKNOWViz, an open tool for visualizing selecting and filtering in a graphical interface. Entities of the ontology are put in relation with spatiotemporal data and the instances related to them.

To sum up, I would like to discuss in my presentation how use cases for visualization of historical information in financial records can look like and how formally described constructs in the Bookkeeping Ontology can be mapped onto visual structures. This provides the basis to set up (semi)automatic workflows to implement information visualization functionalities, based on a formally described historical domain. These methods will be compared to other ways to achieve such a goal. The first solution to be compared is the knowledge graph infrastructures metaphactory, which allows to visualize, navigate and explore data in the form of interactive graphs and diagrams based on underlying data sources, queried by SPARQL. This would include the considerations in the topic in the ResearchSpace project. The paper will in the end suggest a first generalised hypothesis how ontologies in the Web of Data can formally describe domain knowledge in a way that it can be used for the implementation of discovery strategies of research data and consolidate possible synergies.

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