From Searching to Using: Making Sense of Digital Cultural Heritage Collections

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ABSTRACT

The rise of digital cultural heritage has seen the creation of a vast number of collections, which provide access to large amounts of data. While initially access to this data was provided only via keyword-based search interfaces, there has been increased interest in exploratory interfaces to support open-ended search tasks. However, finding information that interests the user is only the first step and the next step must be to provide interfaces that allow the user to actually make use of the information they have found. Towards this goal a novel sense-making workbench is presented in this paper, which enables the user to aggregate information from multiple collections, arrange them into a sense-making structure, and export them for their final use.

Keywords

search, exploratory search, sense-making

1. INTRODUCTION

Digital cultural heritage collections have grown massively over the recent years, creating a vast range of collections that often hold millions of items [10]. Access to these collections is primarily provided via keyword-driven search interfaces, which work well when the user has good knowledge of the domain, the collection, and a focused information need [22]. However, for non-expert users and those with an open-ended information need, they represent a significant hurdle [25, 4, 7]. To overcome this hurdle, exploration interfaces have been proposed to support the user new to the collection and open-ended information needs.

The ability to freely explore and search the collection is, however, usually not the user's final task goal when they use a digital cultural heritage collection. The user might be a researcher investigating a given topic with the goal of writing a book or article [14]. They might be a hobby genealogist wanting to trace their ancestry [3]. They might be an antiques collector trying to find context information on an object they recently acquired [20]. While their goals are very different, in all three cases finding data is just one step of the process. Current systems tend to present two major obstacles to the sense-making processes. First, few systems provide any kind of support outside the core search functionality. Second, where additional functionality is available, it usually only provides access to that one collection's data.

This paper proposes a novel sense-making workbench that combines exploration and search interactions across multiple collections with a workspace that enables the user to actually work with data from the collections in order to solve their goal. The remainder of the paper is structured as follows: Section 2 reviews existing models and interfaces for the search and exploration process, section 3 introduces the proposed sense-making workbench, and section 4 concludes the paper and provides ideas for future work.

2. BACKGROUND

The proposed workbench design is driven by research into sense-making, search, and exploration interfaces.

2.1 Sense-making

The process of turning a set of data into a cohesive structure that solves or at least addresses the user's goal is often referred to as sense-making. A large number of models have been created to describe the process, primarily driven by empirical observation of groups of users.

Bates "berry-picking" model [1] was derived from academics' interactions with a search system, while Khulthau's and Vakkari's models [14, 24] were both based on observations of university students. In contrast to these relatively linear models, Klein et al. and Russell et al. present iterative models [12, 18] in which the users' sense-making structures and the data they use are iteratively updated based on their influences on each other. Pirolli and Card [17] describe a mixed model based on the observation of intelligence analysts' work, which combines both bottom-up, data-driven and top-down, theory-driven processes with multiple loop structures.

While these models exhibit much variation, they all share the core idea that the user needs to be able to collect data and arrange it into a structure, a process that currently only has limited tool support [17].

Figure 1: Standard keyword-driven search interface. Example taken from Europeana, the European cultural heritage meta-data aggregator.

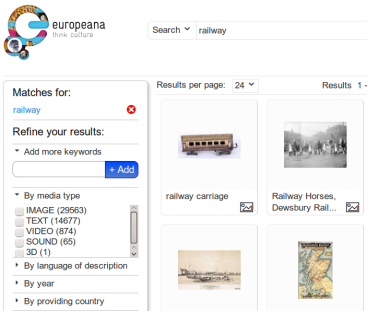

Figure 2: Faceted search interface taken from Europeana. By selecting facets from the list on the left, the user can narrow down their search results.

2.2 Interfaces

While these models are not new, there have been no significant attempts at integrating them into existing systems. Traditional search interfaces (Fig. 1, source `http://europeana.eu`) focus on *information lookup*, enabling the user to find the specific items in the collection that provide the information the user needs. The problem is that in cultural heritage collections, users frequently have more complex information needs that are not well supported by these interfaces [22]. They are also a significant hurdle for novice users unfamiliar with the collection or the subject domain. A log-study on Europeana[1] shows that approximately one third of users execute a single query, view one or two items, and never return [7]. While this might mean that they immediately find what they are looking for, the fact that they do not return makes it more likely that their searches are unsuccessful.

Due to this there has been a push towards exploratory search interfaces [15, 16]. The standard exploratory search interface uses faceted search (Fig. 2), where in addition to the search box, users are presented with a set of facets and facet values, which are derived from the collection items' meta-data. By selecting facet values the user can narrow down their search or use them to explore the collection. As they are automatically derived from the items' meta-data, they also provide an overview over the most common content in the collection [9]. The issue with these interfaces is that cultural heritage collections are usually very heterogeneous, with the result that a single facet will frequently contain many values that occur with similar frequency. The interface, however, allows for only a small sample, usually 10 to 20, to be shown. This limits both the overviewing and exploratory strengths of the faceted interface.

Other visual exploration interfaces have focused on 3D visualisation that allow the user to replicate the experience of going to a museum or gallery [23, 21, 11]. However, these visualisations require that the items are manually curated, as in a physical museum or gallery, which means that they cannot be applied to modern digital archives that contain millions of items.

[1]The European Digital Library – `http://europeana.eu`

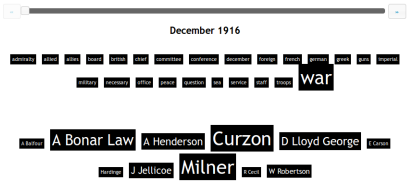

Figure 3: Time-line-based exploration interface provided by the United Kingdom National Archives.

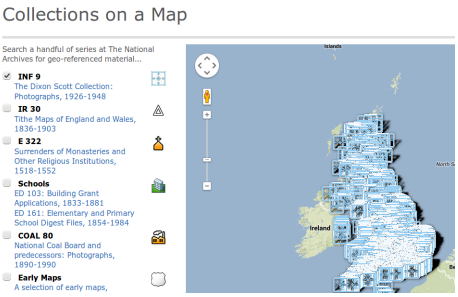

Figure 4: Map-based exploration interface provided by the United Kingdom National Archives.

To be able to explore larger digital archives, interfaces turned to providing users with time-lines (Fig. 3, source `http://labs.nationalarchives.gov.uk/cabinetpaperskeywords/`) [13] and maps (Fig. 4, source `http://labs.nationalarchives.gov.uk/wordpress/index.php/2012/04/collections-on-a-map/`)[19] These are well-suited for cultural heritage collections, as location and time of an item are usually important pieces of meta-data. They also both enable the generation of higher-level overviews, showing the user how many items are available for an area or time period, which the user can zoom in and out of. The limitations of these interfaces are that they require the necessary spatial or temporal meta-data, which is often missing or incomplete, and that they require the user's interest to be spatially or temporally framed.

Finally there has been a push towards exploratory interfaces that focus on supporting the exploration of the semantic space. These include interfaces that use Wikipedia as an intermediary [7], semantic map-based interfaces [6], and browsing interfaces aiming to partially re-create the archive experience [5]. While these support open-ended exploration, they do not provide any support for the sense-making process. The PATHS project [8] included a workspace that users could use to collect and arrange items, but it only allowed for very simple sense-making structures.

3. A SENSE-MAKING WORKBENCH

Although there are existing tools that support parts of the sense-making process, bringing them together into a single interface reduces the users' cognitive load, as they do not have to constantly mentally integrate the information stored across systems. To ensure the workbench achieves its goals,

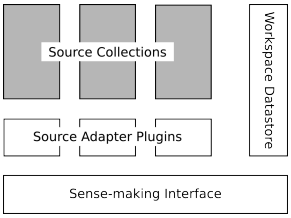

Figure 5: The sense-making workbench architecture consists of the main *Sense-making interface* that the user interacts with, the *Workspace Datastore* that stores the items the user has added to their workspace and their layout, and the *Source Adapter Plugins* that mediate between the workbench and the *Source Collections*.

the following requirements have been identified:

1. *Integrating* access to multiple collections;
2. *Overviewing* the collection to give the user an initial idea of the kind of information available [9];
3. *Exploring* the collection to let the user develop a deeper understanding of the collection;
4. *Searching* the collection for specific items;
5. *Collecting* items from the collection;
6. *Arranging* the items into a sense-making structure;
7. *Annotating* the items and the structure itself;
8. *Exporting* the sense-making structure to complete the larger task.

To support these requirements, the workbench architecture in Figure 5 is proposed. The core approach is to use a set of pluggable adapters that enable the integration of different source collections (requirement #1) and that inform the main system which functionalities the individual source collections provide. With this structure the user can seamlessly switch between collections and combine items from multiple collections into their final sense-making structure. To support the integration of data from different sources, which will usually have different meta-data structures, the *Workspace Datastore* uses Resource Description Framework (RDF) graphs to support storing arbitrary data-structures.

The workbench interface itself is shown in Figure 6 and consists of two main parts, the interface for interacting with the collections and the workspace interface that enables the sense-making process. Ideally the main collection interface will provide all three search interactions (requirements #2, #3, #4, and #5), but where the necessary functionality is not supported by the *Source Collection*, only the supported functions are available to the user. The workspace on the right provides the sense-making functionality (requirements #6, #7, and #8), initially displaying a list of those items the user collected[2].

[2]Item sources: `http://europeana.eu/portal/record/2022608/OMU_OB_Y1405.html`, `http://europeana.eu/portal/record/2022608/OMU_OB_Y1408.html`, `http://europeana.eu/portal/record/2022608/OMU_OB_OT013.html`, `http://europeana.eu/portal/record/2022608/OMU_OB_OT181.html`, `http://europeana.eu/portal/record/2022608/OMU_OB_OT470.html`, `http://europeana.eu/portal/record/2022608/OMU_OB_Z05819.html`

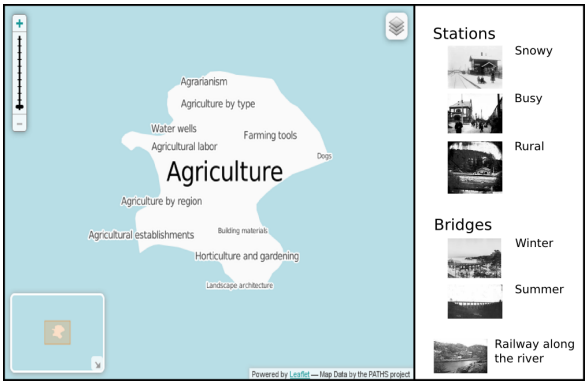

Figure 6: The sense-making workbench in its initial view, which is focused on the acquisition of items. The demo interface shows a map-based visualisation that the user can explore. By dragging items into the workspace on the right the user has collected a number of items, which have been grouped together. The user can expand the workspace to switch to the two-dimensional view in Figure 7.

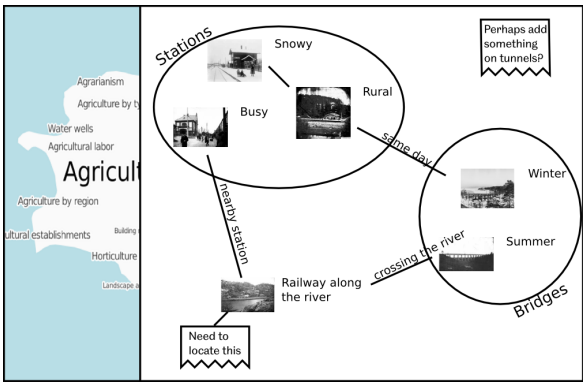

Figure 7: The sense-making workbench in the workspace-focused view. The user has arranged the items into groups and added relationships and annotations to support their sense-making process.

The user can expand the amount of space the workspace covers and in the expanded display, the workspace switches from the initial list view to the flexible, two-dimensional space in Figure 7. Here the user can drag items into a spatial arrangement that represents their current view and understanding of how the items relate to each other (#6). They can also add relationships between items or groups of items and add annotations to the items, groups of items, or the structure itself (#7). This kind of functionality has been shown to work well for organising archival collections [2].

The final step is to export the sense-making structure (#8). The primary export functionality will be through an RDF graph of the workspace, which allows the integration into other software packages, such as the graph visualisation tool Gephi[3]. The second export functionality lets the user specify which relationships are central to them and then uses those to automatically create a narrative from the sense-making structure and the annotations the user has provided.

4. CONCLUSION

Large digital cultural heritage collections require interfaces that go beyond search and enable overviewing and exploration of the data. However, to truly work with the collections, users need to be able to collect and structure the items they have found in order to satisfy their information need. In this paper a novel sense-making workbench is proposed that enables the user to integrate data from multiple sources, supports the complete sense-making process, and allows them to finally develop their own narrative out of the data. Future work will focus on the implementation and user-testing of the proposed system.

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