

# Visually Exploring Books along their Subject Headings

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## Abstract

We present a visualization of subject headings that typically accompany books as flat textual metadata. The purpose of the visualization is twofold: first to expose the implicit structure in subject headings as an overview of a library collection and second to present a visual web of keywords to invite exploration of books. Taking a tag cloud as a starting point, the visualization extends it to a networked tag cloud that respects the hierarchy that is implicit in subject headings. By allowing an information seeker to successively build a subject filter, while seeing the results at each step, we hope to improve the searcher's orientation in a comprehensive book collection

**Keywords:** information visualization, tag clouds, information seeking, subject headings, library search

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## 1 Introduction

With many libraries digitizing their collections it is becoming a challenge to explore these information spaces. In a traditional brick-and-mortar library one may walk past many displays and magazine racks encountering many aspects of the book collection. The development towards digital library collections and high-density storage makes it more difficult to get that sense of a collection. However, many libraries have already put considerable effort into categorizing their collections with textual subject headings. These subject headings are typically ordered as lists of topics, which identify what subject matters are discussed in the book. For example, a subject string such as “Spain – History – 20th century” contains three topics. Topics that appear first are more general, while topics that appear later are more specific for a given book. A catalogueur would attach one or more subject headings to each book each having three to four topics.

Traditionally a library visitor would use a physical card catalog to search through subject headings in order to find a book on a given topic. Today, subject headings are used in keyword search as part of digital library interfaces. Either way this requires a searcher to have a relatively specific goal. The searcher cannot easily browse the collection by subject headings or get a sense how many books are about the respective topics. In a digital library, a reader enters a search query comprising one or several keywords leading to a list of search results. These results will be related to the search terms and rarely contain an unrelated book, which is great when the searcher's goal is specific. However, when the searcher has a more general interest, they typically only see subsets of the collection. There is no sense of the entire collection. In a physical library books are shelved according to a given system such as Dewey Decimals or simply by the author's last name. Books related to a given topic may not be placed next to each other. In a digital library books are often presented in decreasing order of relevance to a search term. This is very different to the physical library where books cannot be reordered based on each visitors preference.

We aim to bring a sense of the whole back while supporting the successive filtering and refinement of a collection. Towards that goal we present a visualization tool that uses textual subject headings in a

collection of books to aid exploration. Subject headings offer a rich under-utilized data source that can help provide a sense of context to a library collection in a digital interface.

## 2 Background

The initial aims behind this work were to expose interesting aspects of a library catalog, facilitate the casual filtering of books, and help the searcher to gain a better understanding of the collection. We have refined these goals in collaboration with a library professional whose work relates to the management of catalogs at our university library. In conversations with him we learned about the various fields of the typical database schema for library collections. Especially subject headings such as Library of Congress Subject Headings (LCSH) repeatedly popped up. On the one hand, subject headings are a form of metadata that are very useful in characterizing books, on the other hand they have not been fully utilized in catalog interfaces. We subsequently ran a sketching session with six researchers from our lab who were asked to sketch visual representations of 15 books and their subject headings to facilitate information exploration. Several sketches focused on the directionality of tags in subject headings, which our library expert responded positively about. While he acknowledged the variation among cataloguers, he viewed subject headings as a fruitful middle ground between highly structured classifications such as the Dewey Decimal System and less structured approaches like free-form tagging. Based on our initial goals and the subsequent discussions and explorations, we developed a visualization technique that exposes the ordered relationships among tags in subject headings.

Many visualizations systems have been developed that represent the tags or words in a collection or document. For unstructured text, several visualization techniques have been introduced that allow for the exploration of relationships among terms in textual documents and tags in collections. Word tree (Wattenberg & Viegas, 2008) presents a visual concordance that exposes the varying distributions of word-to-word sequences in a single text. Based on a selected word acting as the tree's root, any words that follow the selected word are branched off of it. Words which appear further away are connected to its respective predecessor. Phrase nets is a related technique that represents the latent network structure in a text where the words are connected by specific words, phrases, or patterns (van Ham, Wattenberg, & Viegas, 2009) providing a network approach to an unstructured text. Both techniques present unique perspectives on a single text, but are not designed to facilitate search across a collection of resources.

Tag clouds (Viégas & Wattenberg, 2008) are the most widely deployed text visualizations providing an overview of the frequency of words or terms either of a text or of a collection of photos or bookmarks. Tag clouds use font size to indicate the frequencies of terms in a data set. While it may not be ideal for a precise reading, a tag cloud provides a general sense of which terms are dominant in a given text or collection. However, tag clouds are not designed to work with sets of ordered tags such as subject headings and typically do not display connections between such tags. The tag cloud are also used in the VisGets (Dörk, Carpendale, Collins, & Williamson, 2008) interface supporting besides filtering a brushing mechanism that shows the correspondence between other facet values as well as the results.

## 3 Spidey Sense

For the purpose of designing a visualization of a book collection we used a subset of books from the Open Library<sup>1</sup>, an online project to create a universal book catalog. Besides typical metadata such as author, title, year, and blurb, the site also exposes LCSH terms as ordered tags. We focus here on the interplay between the visualization of the subject headings and the display of the books as the result space.

The Spidey Sense interface has two main parts: a subject visualization on the left and a result view on the right (see Figure 1). The results contain the books retrieved from the query that is formulated in

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<sup>1</sup> <http://openlibrary.org>



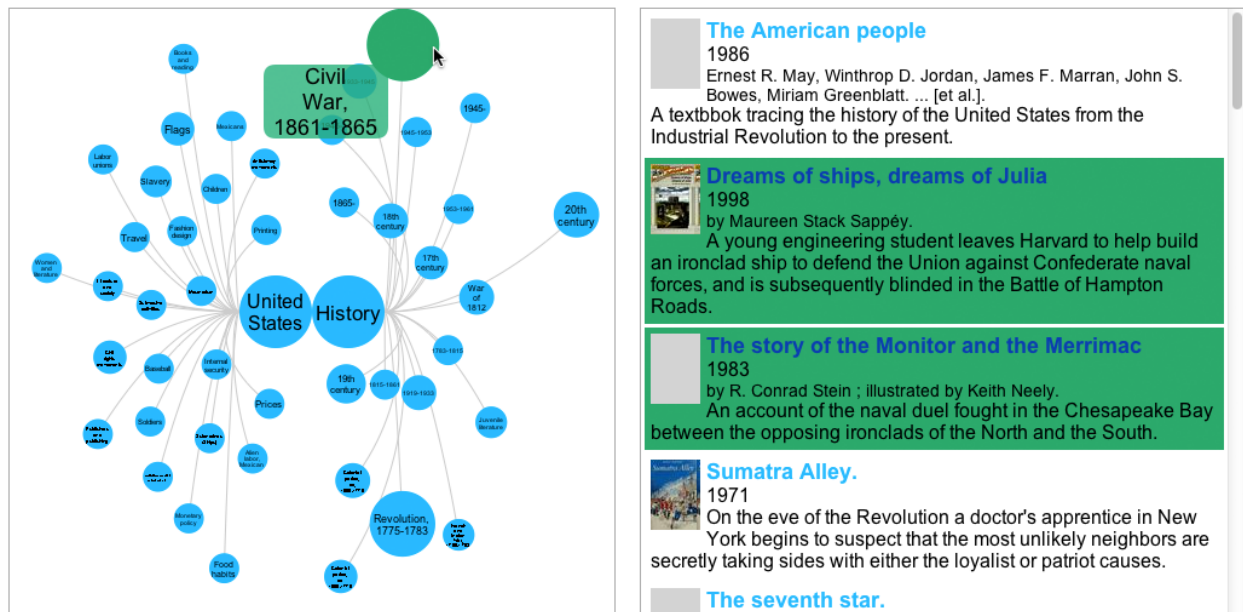


Figure 2: Brushing over a tag in the visualization highlights relevant books in the results view.

When a tag is clicked the visualization transitions to the filtered stage. The selected tag will move to the center. All tags that have a first-order relationship to the chosen tag remain visible and are linked to the chosen tag. Tags that appear immediately before the selected tag will move to the left and tags that appear immediately after will be moved to the right. All tags are visually connected by curved lines to the center tag or tags either to the left or right of it depending on their position in the subject headings. Considering that the tags at the beginning of a subject heading represents more general topics, the left side of the visualization contains more general tags. Similarly the tags on the right side in the visualization should be more specific. Clicking on a tag on either side (left or right) will add that tag to the selected nodes in the middle which results in a refinement of the result space. On the flip side, clicking on a tag in the middle will remove that tag from the selection, which broadens the query and expands the result space. If the last remaining middle tag is clicked, the system returns back to the initial stage.

The intention behind the design is to help making sense of the changing arrangement of tags as the searcher navigates between sets of books. The tags are gradually transitioned between display states to help the viewer make sense of the changes on the screen. After a query change is issued, tags which exist in both the before state and the after state are not removed but rather moved to their new location. This is done to try to keep a sense of fluidity.

The prototype queries a set of 1000 books from the Open Library database. Open Library is open for anyone to add bibliographic information about books. The project is implemented as a web-based system, written in JavaScript. Processing.js<sup>2</sup> is used to draw to the canvas element of HTML5 and the JavaScript library springy.js<sup>3</sup> is used to control the force directed layout. When the web page is loaded it retrieves a JSON file containing the metadata about the books. It immediately parses it and stores it in memory. Each query is then made on this data store.

<sup>2</sup> <http://processingjs.org/>

<sup>3</sup> <https://github.com/dhotson/springy>

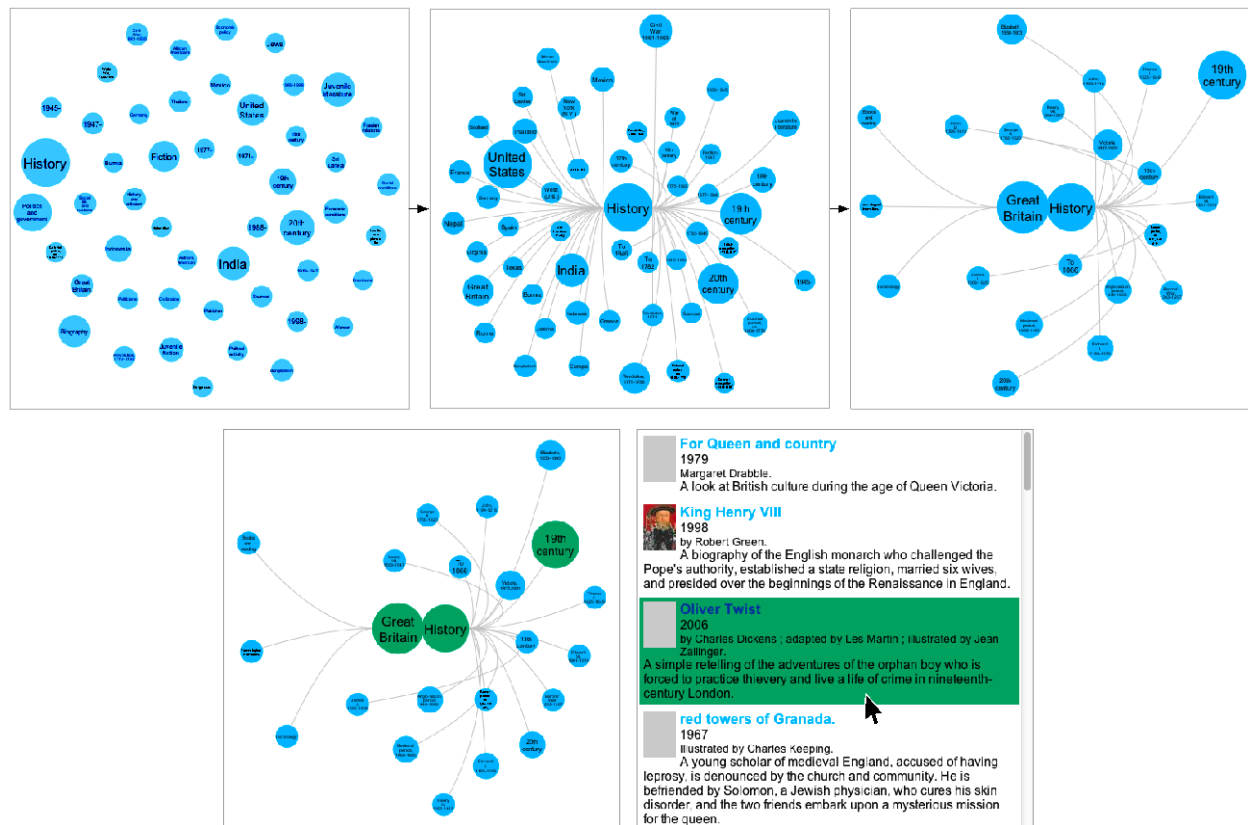


Figure 3: Example use case showing the initial state (top left), one selected tag (top middle), two selected tags (top right) and the brushing when hovered over a book (bottom)

#### 4 Use-Case Scenario

To demonstrate the potential of this project we provide a brief scenario. Suppose there is a searcher, named John, who is interested in finding a new book to read. He uses the Spidey Sense interface to find a book. In the initial view, he notices that “History” is fairly large compared to the other tags (see Figure 3, top left). This indicates there is a large amount of items in this collection about “History.”. Being generally interested in history, John clicks on the tag and the system updates the other tags. With “History” selected in the center he can see that the largest circles have the tags “United States”, “19th century” and “20th century” (top middle). This indicates these tags are the most common tags occurring in subject headings directly before or after a “History” tag. John clicks the tag marked “Great Britain.” Now the visualization indicates that most of the books in this subset are about the “19th century” because that tag is the largest (top right). After seeing *Oliver Twist* among the results (bottom right), John moves his mouse over the book and some tags in the visualization change color (bottom left). He can see that *Oliver Twist* has at least one subject heading containing the substring “Great Britain – History – 19th century.” John selects “19th century” and hovers over *Oliver Twist* again. Now the “Fiction” tag highlights. John decides he wants to read *Oliver Twist*. He selects the result and puts a hold on the book in his local library.

Alternatively John could have started with “Fiction”, then “19th century”, next “History” and finally “Great Britain.” He would be essentially navigating through the hierarchy from the bottom up. This also works if you start with “Great Britain” or “19th century.” John can form the same query by multiply paths.

This is contrary to the typical top down category structure often employed.

## 5 Conclusions

The Spidey Sense interface takes tag clouds as a visualization many people are familiar with as a starting point and introduces hierarchy to aid a more structured exploration of books. While the visualization allows an information seeker to use subject headings to explore books, it does not impose a certain order of navigating the collection. As digital libraries become more prevalent it is possible to explore new types of visual interfaces for navigating their contents. Considering that a lot of effort is invested in the creation and maintenance of a catalog, there is an opportunity to expose the rich relationships that collections contain. The visualization of the Spidey Sense interface adds a sense of order to an otherwise orderless tag cloud. By presenting this order to the searcher they can gain a different perspective on a library data set.

There are many ways this project can be taken further. First, it would be interesting to deploy the interface with an actual library catalog to investigate how searchers would make use of it. Second, it would be promising to investigate how such a subject visualization can be integrated with the search mechanisms of existing catalog interfaces. Third, we are interested in application areas beyond the library where the order of tags, for example, in the hierarchy of a shopping website, could be respected in order to provide a more exploratory experience. Often these hierarchies are loosely defined. For example if one is searching for paper this might be in the stationary department if the intent was writing paper or in the household department if the intent was a paper towel. Spidey Sense provides an elegant way of exposing this ambiguity.

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