

Unveiling the Dispersal of Historical Books from Religious Orders

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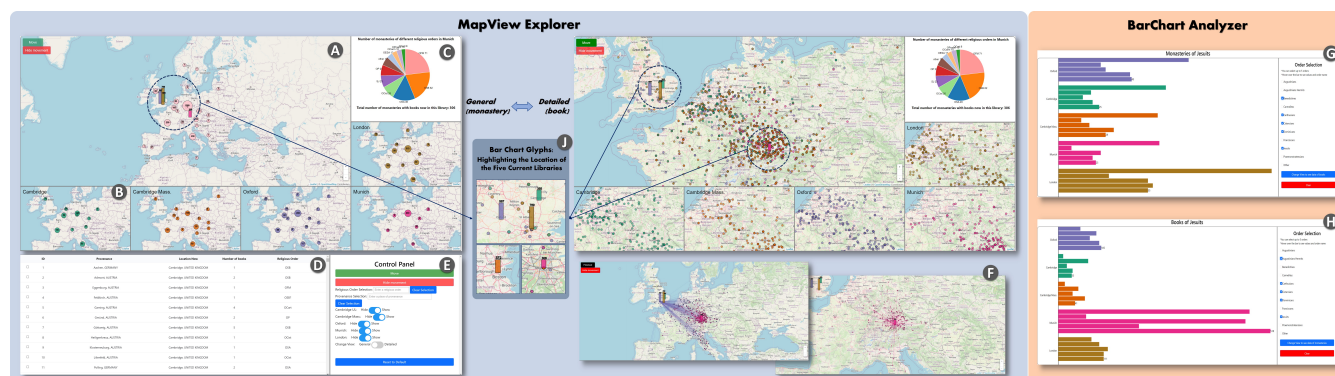


Figure 1: Two interfaces are designed to visualize the dispersal of books using map-based layouts augmented with descriptive statistics. The *MapView Explorer* offers a two-tier view of the monastery or book distribution on the main map (A) and five synchronized mini-maps (B), with bar chart glyphs (J) highlighting the current libraries. Pie Chart (C) shows the proportions of books by the religious order. Table (D) lists book records with interactive features. Control Panel (E) manages the map components and the book movement animation (F). The *BarChart Analyzer* presents monastery or book counts of various religious orders in current libraries using customizable bar charts.

Abstract

In this paper, we introduce a visualization prototype designed to assist historians in exploring the dispersal of books from religious orders throughout Europe during the sixteenth century and beyond. The prototype is the result of a collaboration between visualization researchers and a historical book researcher, aiming to apply visualization techniques to address real-world domain challenges. Over two months, we engaged in an intensive collaboration with the domain expert to analyze domain issues and requirements and subsequently developed a prototype featuring two interfaces. Weekly discussions with the domain expert guided design and ongoing prototype evaluation. In its infancy, the prototype shows promise for enhancement and scalability. Future efforts will target systematic usability and practicality evaluations.

1. Introduction

The secularization of religious houses in Europe, driven by significant political events such as the reigns of Henry VIII, Joseph II, and Napoleon, as well as the Spanish *desamortización* (Spanish land and property expropriation) and the formation of the Italian State, led to the dispersal and partial destruction of vast quantities of early printed books. These events have shaped the landscape of libraries across Europe, with many books from secularized institutions forming the core of national and municipal libraries, while others found their way into the international antiquarian book market and became part of other countries' early printed heritage collections. To address historical interest in mapping the dispersal of thousands of books, a collaborative project between a historian and visualization researchers resulted in the creation of an interactive visualization tool to quantify and analyze the extent of this phenomenon. We uncover hidden patterns and connections between the

original and current holding institutions by extracting information on the provenance of books from monastic institutions in major European collections. In light of thousands of book records, sourced from five libraries housing European collections tied to monastic institutions, a tool was developed that employs a multi-view approach, integrating map-based representations and linked panels for an intuitive exploration of the relationship between the provenance and destination of these books through the perspective of religious orders. This interdisciplinary project emphasizes the potential of visual analytics for further historical research.

2. Motivation, Domain Background, and Data

From the sixteenth century onward, vast quantities of early printed books have been displaced and partially destroyed because of the secularization of the religious houses of Europe. Historians have always tried to quantify the extent of the phenomenon and have man-

aged to extract useful information from the provenance data of historical books, as they frequently change ownership throughout their lives, disseminating knowledge, ideas, and information [Don13]. Since 2009, the collaborative database Material Evidence in Incunabula (MEI) [CER15] has collected data on the former ownership and usage of 15th-century books, enabling the tracking of their circulation in Europe and the USA. For this project, domain experts selected a dataset of 2,369 books currently held in five libraries (Oxford Bodleian Library, Cambridge University Library, London British Library, Munich Bayerische Staatsbibliothek, and Harvard University Houghton Library) from the MEI database, emphasizing the impact of secularization of religious houses on historical book distribution. The data is organized into a two-level hierarchy, consisting of books and monasteries. Each book is linked to an origin-destination location pair, while each monastery is connected to its respective religious order. The Origin-Destination (OD) features within the data [TC21], along with hierarchical visualization and decomposition techniques [BJGA98], have attracted the interest of visualization researchers. A wealth of existing literature on geospatial data visualization serves as a strong foundation for our work [SMKH22]. The research conducted by [FK23] shares a close connection with the theme of our work, but primarily emphasizes the distribution on the map over time, rather than the relationship between provenance and current holding institutions.

3. Requirement and Task Analysis

Based on the discussions with the domain expert, we identified the following requirements to achieve the objective of *mapping the dispersal of books from religious orders*:

- R1 *Display the locations of monasteries and libraries.*
- R2 *Illustrate the current book locations and movement paths.*
- R3 *Support for multi-faceted data exploration.*

Based on the requirements, we devised specific analysis tasks:

- T1 *Emphasize the provenance-destination pairing.*
- T2 *Facilitate comparisons among books or monasteries.*
- T3 *Visually differentiate the data by current holding institutions.*
- T4 *Enable extensive dataset exploration & manipulation via table.*
- T5 *Visualize the descriptive statistics of the data.*

4. Tool Description

The prototype features two interfaces, as shown in Figure 1, to address domain requirements. Multi-view design is applied as the decomposition technique to efficiently handle the two-level hierarchical data structure, allowing users to seamlessly switch between books or monasteries for comparison, exploration, explanation, or identification (R3, T2). A consistent color scheme is employed, encoding data with five distinct colors for different libraries to facilitate intuitive comparison and differentiation of book origins and distributions. The *MapView Explorer* features map-based visualizations (Figure 1 A, B, F) designed to showcase the location of holding institutions and the dispersal of books (R1, R2, T1). At the monastery level, bubble (proportional circle) maps depict the location and the number of books held in each monastery. When zooming in to the book level, each scatter point on the map represents an

individual book. The bar chart glyphs (J) on the map differentiate the five current libraries from other circle markers, indicating the number of books each library currently houses. For comprehensive data comparison, the use of small multiples [vdEvW13] enables the design of five synchronized mini-maps, each highlighting data specific to an individual library (T3). Supplementing the map-based views are connected panels (C, D, E), offering diverse perspectives, flexible options, and interactive data manipulation through a control panel, table, and interactive pie chart (T4). The *BarChart Analyzer* delivers an interactive bar chart visualization, concentrating on presenting and comparing statistics from the perspective of religious orders. It allows users to select up to five orders to compare the number of books (H) or monasteries (G) affiliated with the five libraries (R3, T5).

5. Usage Scenario

The domain expert delved into the dataset using the *MapView Explorer*. Interacting with features on the map, she was drawn to the linked pie chart revealing the proportion of books held in the Munich Bayerische Staatsbibliothek by religious orders with nearly a quarter of the books belonging to the Franciscans (OFM). This finding substantiated her historical knowledge and past conjectures. Focusing on this particular religious order, she manipulated the visualizations using the control panel to filter out all data related to OFM regardless of the current holding libraries. She found that the London British Library also held a significant number of OFM books. For more detailed statistics about the OFM, she opened the *BarChart Analyzer*. Upon comparing the results of the number of books and monasteries affiliated with OFM in each library, she was surprised to find that the London British Library holds the highest number of books, while the Munich Bayerische Staatsbibliothek ranked third, even behind the Oxford Bodleian Library. However, in terms of the number of monasteries, the Munich Bayerische Staatsbibliothek took a clear lead. This disparity led her to consider both quantity and location (that is, the associated monastery) as key factors in assessing book distribution and religious dissemination. Beyond supporting data exploration and understanding, she perceived the tool's potential for educational use, particularly its ability to animate the journey of numerous books from diverse monasteries to their current libraries, effectively emphasizing the significance and scope of this historical phenomenon.

6. Limitation and Future Direction

As this project advances, refining the prototype and scrutinizing scalability and performance becomes paramount. Emphasis will shift towards systematic evaluations of the tool's usability and effectiveness, alongside integrating advanced visualization methods for hierarchical OD data representation. It is noteworthy that the prototype has already demonstrated its practicality in a teaching session, highlighting visual analytics' potential in boosting historical research and teaching.

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