Dashboards for Davis

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ABSTRACT

This paper presents two interactive dashboard prototypes designed for the Davis visualization environment at TU Wien Library, targeting casual information visualization for academic communities. The prototypes address the challenge of making institutional scientometric data accessible and engaging to non-expert users, including students, researchers, and individuals with personal connections to academic activities. The first prototype visualizes international research collaborations through an interactive world map interface, leveraging OpenAlex bibliographic data to display co-authorship patterns and institutional partnerships. The second prototype visualizes a bi-partite network of student theses and their topics, mapping thematic clusters within and cross-domain relationships between the university's eight faculties. Both prototypes employ established information visualization principles, including geographic context for navigation, progressive disclosure of information, and cognitive load management through multi-scale data aggregation. This work demonstrates how casual information visualization can transform institutional datasets into meaningful, accessible experiences that bridge the gap between expert analytical tools and public engagement with academic research and teaching activities.

1 INTRODUCTION

Visualization plays an important role in scientometric analysis. Many different visualization approaches have been applied to its broad variety of applications, ranging from straight-forward statistical data charts for individual or institutional performance evaluation to sophisticated visualization pipelines for knowledge-domain mapping [3]. Such visualizations are usually targeted at a specific audience, consisting of university administrators and hiring committees, research funding agencies and science policymakers [1], with the explicit aim to enhance insight and support decision making. Some visualizations of scientometric information, however, can potentially also be of interest to non-expert user groups. Subsumed in [4] under the umbrella term "casual information visualization", such approaches would especially be designed to also include novice and non-professional users that don't necessarily have specific domain knowledge and analytical needs. Members of such user groups, however, are instead expected to have more personal ties to the presented data. In the context of scientometric visualization, this would include students, researchers and other persons with strong connections to their own academic work and the teaching and research activities at their respective institution. Davis[1] is a visualization environment located at the library of TU Wien, offering visualization infrastructure for teaching and science communication. It provides a 4.6m x 2.6m 4K 3D LED wall for stereoscopic VR visualization and a 4.1m x 1.2m LCD IR-touch wall for interactive presentations. The latter is supposed to host an openly accessible digital exhibit that should offer casual users a data-driven "shopwindow" to the activities of the university, capturing their attention with personally meaningful information they can identify themselves with. This work gives a brief overview on available data sources and presents two prototypes for the touch wall, designed with this user-group in mind.

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[1] https://www.tuwien.at/en/library/digital-scholarship/data-visualisation-space-davis, retrieved June 19th 2025

2 PROTOTYPES

Two complementary prototypes have been designed, focusing on research and on teaching activities respectively. The first prototype focuses on international collaborations of TU Wien researchers with peers from worldwide partner institutions based on co-authorship in scientific publications. The second prototype focuses on the topics of final student theses (Master and PhD level) and how they are clustered and interrelated across the eight faculties of the university.

2.1 Bibliographic Data sources

Scientometric analysis requires access to bibliographic data about publications and related entities such as persons and institutions. Sources for such data are institutional databases and externally aggregated offerings. As far as the latter are concerned, [3] provides an overview on common providers which are of commercial or community-based, open-source nature. An important consideration is the accessibility of the data, which should ideally be retrievable in bulk via data dumps or API access. The first prototype uses freely available data from OpenAlex[2], described in [5], while the second prototype uses bibliographic information about student theses from the university library's own library information system.[3]

2.2 International Collaborations

The "International collaborations" data visualization constitutes an interactive multi-user application for the Davis environment. The project employs a dual-component architecture capable of handling substantial data volumes while providing intuitive, real-time visual analytics capabilities. The backend datastore manages relational data encompassing institutions, researchers, publications, and geographic distributions. Optimized spatial data structures enable rapid rendering of institution locations and affiliation densities across the global map. Pre-computed statistics for publication counts, author collaborations, and temporal trends reduce query response times during interactive exploration. The frontend framework adheres to Shneiderman's Mantra: "overview first, zoom and filter, then details-on-demand" [6]. The design system partly builds on the visualization concept of Project Ukko [2], and incorporates four core principles that bridge cartographic tradition with contemporary data visualization theory.

2.2.1 Geographic Context as Primary Navigation

The world map serves as the primary navigation interface, leveraging users' inherent spatial cognition to explore landscapes. Proportional circles indicate institutional presence, while color coding differentiates institution types (universities, research centers, government labs, hospitals, etc.) as shown in Fig. 1. This approach allows users to immediately identify research clusters and geographic patterns in academic collaboration.

[2] https://openalex.org, retrieved June 19th 2025

[3] https://catalogplus.tuwien.at, retrieved June 19th 2025

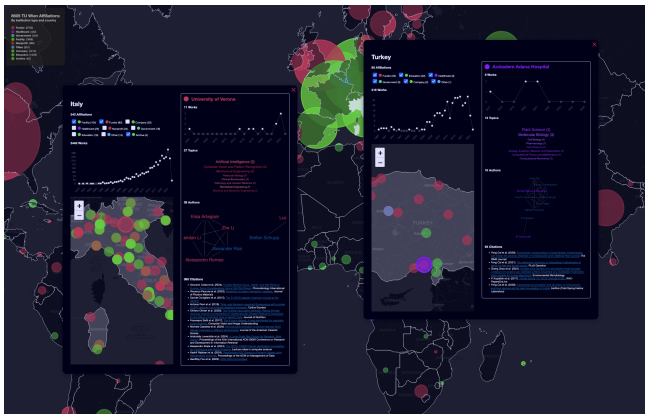

Figure 1: World map navigation of “International collaborations” dashboard with two opened country popups and a selected institution

2.2.2 Contextual Information Architecture

Interactive selection reveals multi-layered detail panels that avoid overwhelming users with information. Each institution panel displays hierarchical information from broad (country, total affiliations) to specific (individual researchers, recent publications), allowing natural drill-down exploration. Integrated temporal charts provide historical context for institutional research trajectories, supporting both current state assessment and longitudinal analysis.

2.2.3 Visual Encoding Strategy

The system employs consistent visual vocabulary across views: circle size represents magnitude (publication count, collaboration frequency), color indicates categorical distinctions (institution type, research domain), and spatial position conveys either geographic location or abstract similarity relationships in secondary plots.

2.2.4 Cognitive Load Management

Rather than presenting all data points simultaneously, the interface strategically aggregates information at appropriate scales. Country-level overview aggregation prevents visual clutter while maintaining the ability to zoom into institutional and individual researcher details. Filter controls in the left panel enable users to progressively refine their focus without losing spatial context. This multi-scale approach acknowledges human perceptual limitations while preserving analytical flexibility, enabling both exploratory browsing and targeted investigation within a unified interface framework.

2.3 Common Topics in Student Theses

Focusing on teaching aspects and student theses in particular, the second prototype seeks to spark interest in teaching and research topics of the university’s faculties as they become eminent in the keywords assigned to thesis metadata upon submission. The underlying assumption is that theses and keywords constitute the nodes of a bi-partite network with thesis-keywords edges, resulting in a map of topics which are on the one hand expected to be clustered by scientific domain but also to feature cross-domain relationships either via common keywords representing general concepts (e.g. “simulation”) or via application scenarios where a particular technology or process is applied to another domain.

2.3.1 Visual Encoding Strategy

The node-edge nature of the data is directly translated into a visualization of the network’s topology featuring 10,000 theses and an approximately equal amount of keywords, shown in Fig. 2. The layout has been created using the Force-Atlas-2 algorithm from Gephi[4]. Keyword-nodes are uniformly shown in grey, while thesis-nodes are categorically colored by faculty. In order to prevent visual occlusion, labels are shown only for the most popular keywords. When a thesis-node is touched by the user, all its connected keyword labels are activated and a tooltip shows the title of the work. Double-touching a thesis-node enables users to read the thesis via a pop-up PDF-reader.

2.3.2 Preliminary user feedback

The prototype has been presented to potential users in informal settings such as guided Davis tours. Anecdotal feedback suggests that the visual display of student theses and their topics has a strong identification potential among students but requires solid and intuitive interaction paradigms for the intended unsupervised casual use.

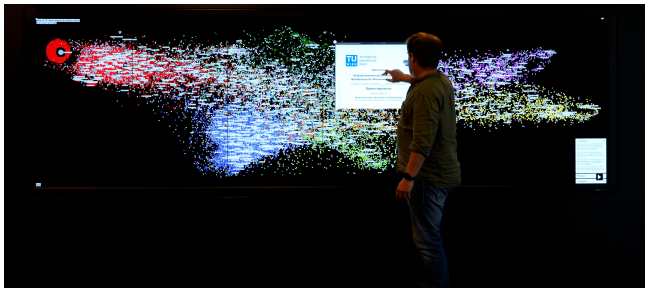

Figure 2: Network of student theses and topics

3 Conclusion

The two dashboard prototypes for the Davis visualization environment demonstrate the potential of creating compelling casual information visualizations for academic communities. Being at an early design stage, initial refinements and additional features have been implemented based on internal feedback and spontaneous, informal user tests. Future development will therefore focus on broader usability and accessibility optimization, bug fixing and iterative functional expansion. These developments strive to position the Davis dashboards as exemplars of how interactive visualization can transform bibliographic datasets into meaningful, accessible, and inspiring experiences.

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