BiblioMaps - A Software to Create Web-Based Interactive Maps of Science: The Case of UX Map

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ABSTRACT

Maps of science, allowing the exploration of large-scale bibliographical datasets, are meeting an increasing interest across a broad range of audiences: students, educators, researchers, policy makers, technology developers, etc. This paper presents BiblioMaps, a freely available software that can be used to create web-based interactive maps of science. Our toolkit uses a mixture of statistical techniques and similarity measures on bibliographic metadata extracted either from the Web of Science or Scopus. After processing, the data is used in web-based interactive visualizations. The main visualization is a map of topical clusters - gathering publications based on shared references - whose characteristics can be easily explored in detail. As an example, we discuss some insights gained by exploring maps based on a corpus of about 10,000 "User Experience Design" research publications.

KEYWORDS

Map of science; Interactive tool; Web interface; Information visualization; Bibliometry; UX design.

INTRODUCTION

In recent years, the number of scientific publications being published has been constantly increasing, reaching just about 3 million publications in 2016 according to the Web of Science and Scopus. And while the scientific knowledge continues to grow in size and complexity, the different communities willing to access it - researchers, students, policy makers or citizen - are lacking accessible tools to explore it and make sense of it.

INTERACTIVE MAPS OF SCIENCE

We present BiblioMaps[1], a web-based interactive map of science, allowing the exploration of large-scale bibliographical datasets. This tool was developed to propose a maximum of relevant information that can be intuitively explored and used by a large audience. Bibliomaps also offers a freely available toolkit that allows anyone with minimal developing skills to process the metadata of the corpus of publications of their choice and produce interactive maps of science from any corpus of bibliographic data extracted from either Scopus or the Web of Science.[2]

Here are BiblioMaps Interface's main feature:

- Interact spatially with the map
- Explore the nature of each topic and subtopic
- Access a selection of representative and highly cited papers using Google Scholars
- Perform searches in topics
- Modify layout parameters
- Export the produced visualizations
- UX Map

As an example, we have built a scientific map of the User Experience Design field (UX Map). To allow users to interact with the data and analyses we produce, we developed two visualization interfaces created using D3.js. These interfaces can be explored online (http://sebastian-grauwin.com/UXMAP). The first interface proposes a description of the items found in the publications of the studied corpus (their authors, keywords, references, countries in the affiliations, etc.), via sorted lists and a series of customized graphics (word clouds, networks, pie chart, bar graph or world map) that were chosen to fit common, intuitive metaphoric representations. The second interface (cf Figure 1) allows the exploration of the two-levels hierarchical thematic map built out of clusters obtained in the Bibliographic Coupling analyses. It was built to answer potential needs of various users.

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[1] BiblioMaps is the extension of BiblioTools (Grauwin & Jensen 2011) a toolkit that already allowed to draw static representations of topical fields but necessitated the production of lengthy companion documents to make the link between paper-level and topic-level information.

[2] A few maps of sciences can be found online, see for example (Börner & al., 2012; Claveau & Gingras, 2016; Cobo & al., 2011; George & Knedjens, 2013; Kang & al., 2006; Leydesdorff & Rafols, 2009). However, these maps often require strong information visualization knowledge to be able to navigate and to understand the data presented. A few software toolkits allowing researchers to create standard bibliographic maps (co-authors, co-citation, bibliographic coupling networks, etc.) also exists, see e.g. Van Eck & Waltman (2010). However, most of them produce visualizations that are not primarily built for the web and require installing specific interface to be explored and are therefore less easily accessible to a large public. They also often require programming knowledge.
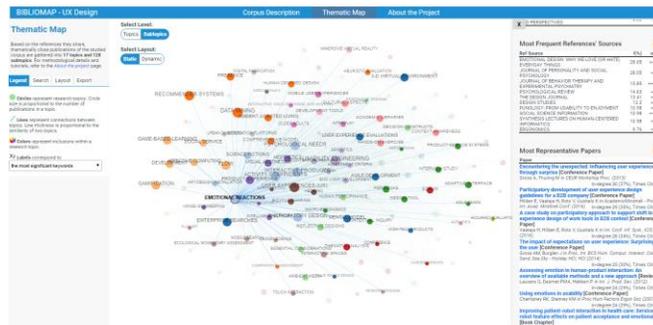
Figure 1. Screenshot of the "Thematic Map" interface.

Methods

Bibliographical data can be retrieved from either Scopus or the Web of Science, and processed by the BiblioMaps software as described in Grauwin & al. (2012). Here, we selected a corpus representative of the research perform in UX Design by using the query *TITLE-ABS-KEY (UX AND design*) OR TITLE-ABS-KEY ("user experience*" AND design*)* in Scopus. This combination of keywords query allows to gather publications related to UX. Combining the terms User Experience and Design ensured that all the selected papers have a minimal focus on both UX and design, while using a query based only on e.g. "User experience" only yield too many results outside of our focus of interest. In total, the selected UX-Design corpus contains 12,220 publication records. Publications are then grouped in relevant topical clusters, by performing a standard Bibliographic Coupling (BC) analysis (see Grauwin & al. (2012)). Since it takes into account all publications - even not yet cited ones - BC is a relevant technique to represent research front and emerging topics such as UX Design in a meaningful way.

CONCLUSION AND FUTURE WORK

BiblioMaps visualizations can be of interest to the general public as well as to experts across diverse disciplines for educational, scientific, and practical purposes. More generally, it can help students, educators or researchers new to a field to rapidly get an overview of a discipline's topics of research, and relevant publications or authors. Researchers already aware of a field can also use BiblioMaps to look for new collaborators, to identify gaps in the research and to discover unforeseen links between different research topics. Policy makers can use it as an opportunity to build maps of their own institutions, thus fostering ongoing dialogue and praxis in their own institution. As for the UX Map example, it can become a valuable tool in this young field, strongly led by practitioners (Sperano, 2017), to address research issues and to build a stronger research agenda.

We plan to develop the tool further. For example, we are currently working on a functionality that would focus on the evolving nature of research fields (their appearance, disappearance, merging, splitting, etc.) and the detection and visualization of trends (e.g. in keywords or references usage).

REFERENCES

Börner, K., Klavans, R., Patek, M., Zoss, A.M., Biberstine, J.R., Light, R.P. (2012). Design and Update of a Classification System: The UCSD Map of Science. *PLoS ONE* 7(7): e39464.

Claveau, F. & Gingras, Y. (2016). Macrodynamics of Economics: A Bibliometric History. *History of Political Economy* 48, 4: 551-592.

Cobo, M.J., Lopez-Herrera, A.G., Herrera-Viedma, E. & Herrera, F. (2011). Science mapping software tools: Review, analysis, and cooperative study among tools. *Journal of the American Society for Information Science Technology*, 62, 1382-1402.

George, D. & Knedjens, R. (2013). Paperscape, an interactive map of the arXiv. Accessed Sept. 2017. http://paperscape.org/

Grauwin, S. & Jensen, P. (2011). Mapping scientific institutions. *Scientometrics* 89:943-954.

Grauwin, S., Beslon, G., Fleury, E., Franceschelli, S., Robardet, C., Rouquier, J-B. & Jensen, P. (2012). Complex systems science: dreams of universality, interdisciplinarity reality. *J Am Soc Inf Sci Technol* 63(7):1327-1338.

Kang, H. et al. (2006). NetLens: Iterative exploration of Content-Actor Network Data. *Proceeding of IEEE Symposium on Visual Analytics Science and Technology 2006 (VAST2006)*, 91-98.

Leydesdorff, L. & Rafols, I. (2009). A global map of science based on the ISI subject categories. *Journal of the American Society for Information Science Technology*, 60(2), 348-362.

Sperano, I. (2017). Content Audit for the Assessment of Information Space: Definitions and Exploratory Typology. *SIGDOC 2017*, Halifax.

Van Eck, N.J. & Waltman, L. (2010). Software survey: VOSviewer, a computer program for bibliometric mapping. *Scientometrics* 84, 2:523-538.