Applying Design Strategies in
Publication Networks – A Case Study

Bram Vandeputte
Dept. Computerwetenschappen, Univeristy of Leuven
Celestijnenlaan 200A
3000 Leuven, Belgium
bram.vandeputte@cs.kuleuven.be

Erik Duval
Dept. Computerwetenschappen, Univeristy of Leuven
Celestijnenlaan 200A
3000 Leuven, Belgium
erik.duval@cs.kuleuven.be

Joris Klerkx
Dept. Computerwetenschappen, Univeristy of Leuven
Celestijnenlaan 200A
3000 Leuven, Belgium
joris.klerkx@cs.kuleuven.be

Abstract
This case study shows how following two different designs strategies (Overview first, zoom and filter, then details on demand [8] and Start from what you know, then grow [5]) influences the sensemaking behavior [6] of users in the context of science2.0 [9]. To this end, we have designed, developed and evaluated two multi touch applications that provide interactive visualizations of authorship networks. Overview first steers people towards structural insight and overview sensemaking, while Start from what you know invites users to use topical information to explore the data.

Keywords
Sensemaking; multi touch; information visualization

ACM Classification Keywords
H.5.2 [Information Interfaces and Presentation]: User Interfaces - Evaluation/methodology.

Introduction
In 1945, the perfect desk of a researcher was described as having all knowledge of the world available for exploration and retrieval [4]. When researchers are not looking for factual data, but want to learn and investigate, exploratory search plays an important role [7]. Our work leverages state-of-the-art exploratory
search techniques to enable sensemaking in networks of scientific publications. It goes hand in hand with an upcoming trend of trying to renew the ways in which people do research, Science2.0 [9]. Obviously, there is too much material being published nowadays to go over all the publications manually to select the most relevant ones. Our goal is to assist researchers in performing sensemaking tasks through interactive visualizations of scientific publications. To this end, we have developed and evaluated two multi touch tabletop applications. A first small-scale study confirms the usefulness of these applications [10]. While research on tabletop interaction is very active, our study focuses on a different aspect, namely the effects of two different design strategies: (i) Overview first, zoom and filter, then details-on-demand (Overview) [8] and a more egocentric approach (ii) Start from what you know, then grow (Expand) [5]. As far as we know, this is the first study that explicitly tries to compare user behavior in the two settings. Following section introduces both strategies. Then, the evaluation setup and the analysis of the result are presented and finally, we summarize the conclusions.

Overview first vs. start with what you know
Both OverviewTable and ExpandTable show a node-link network. The nodes are authors and papers, and the edges represent an authorship relation. Overview dictates that a visual design should allow the user first to gain an overview of the entire information space [8]. The user should have tools to control zoom and focus. By filtering out unwanted items or including more relevant ones, users can quickly focus on their interests and select an item to see detailed information. This approach is adopted in OverviewTable. Starting with a view on the complete network, we enable users to search, pan, zoom, filter and favorite, in order to explore the network. Filtering is supported on publication year and number of publications. Expand argues that showing an overview of the complete network can carry too much perceptual and computational burden for users [5]. Starting from a more egocentric perspective guarantees the presence of readily identifiable landmarks to orient the user. Users can selectively expand the network to explore the larger community. ExpandTable starts with just a search button. Users decide how they start exploring the network by searching on either names of authors or titles of publications. From this initial set of nodes, users gradually explore the network by expanding nodes and exposing direct neighbors or by adding additional search results to the table. A visual clue on the number of neighbors is added to each node.

Evaluation
Both applications were evaluated in a real life setting, namely during the Hypertext 2011 conference [1]. A tabletop was installed in the main hall. During coffee breaks, people were asked to volunteer for the evaluation. First, they received a short introduction about the applications. The dataset contained all publications of all 23 Hypertext conferences. 934 papers and 1601 authors were gathered, making up 2440 authorship relations. Test volunteers were given one open ended task: to explore the network using the basic search and navigation facilities given by the tool, and to favorite every interesting paper or author. We adopted this approach in order to not constrain users in one specific way of exploring publications. We described “interesting” as: “want to know more details, want to read, want to get to know his/her work, etc.”. The volunteers could first test each application for
about one minute. After this initial trial run, they were asked to use both applications for five minutes. In order to assess basic usability, participants filled in a SUS questionnaire [2]. Both applications scored an equal 73% on the System Usability Scale. This is good [2] and confirms that our findings below are not artifacts due to usability issues. The next paragraphs elaborate on the most significant differences in the exploratory search process between the applications.

Categorizing the searches in topic related and author related reveals that participants performed 63% topic and 37% author searches in ExpandTable. In OverviewTable, only 39% were topic related and 61% author related. Both findings indicate that the participants were taking different approaches in their sensemaking process. OverviewTable was used more for getting acquainted with the overall structure of the network, and thus users were looking for known or prolific authors to start the exploration. In ExpandTable, users were more interested in getting to know who was working on a particular topic.

**Filter** - Although we clearly mentioned the filter feature when explaining OverviewTable, only seven out of the seventeen participants used this functionality. Four of them used it more than once. This low use may indicate that there is no need for explicit filtering, as users can pan and zoom around to “filter” on things they find interesting. No filtering is offered in ExpandTable, as users manually add or remove information, which makes filtering less relevant.

**Search** - Figure 1 shows the number of logged entries. OverviewTable has on average significantly less searches per session (2.6 vs. 5.9, T-test p=0.0047).

**Tap, Pan & Zoom** - As indicated in Figure 1, there are significantly more taps in OverviewTable (23.1 vs. 14.1, p=0.0041). Users of OverviewTable regularly moved nodes around to get insight in how authors were connected to each other. Figure 2 plots the zoom level of each participant with relation to time. OverviewTable starts at zero, which is the most zoomed out state. ExpandTable starts at the default zoom level, one. The zoom functionalities were used more intensively in OverviewTable than in ExpandTable, where only five participants actually zoomed out. Both seem to indicate that users replaced some of their searches in ExpandTable by tap, pan & zoom in OverviewTable.
**Favorite** - On average, participants take significantly more time to favorite their first item in *ExpandTable* (79 vs. 58 seconds, \( p=0.09 \)). We noticed that people using *ExpandTable* keep everything they find relevant on the screen, and only favorite from these items afterwards. This indicates they first do a “local” optimization of their results. In *OverviewTable*, however, users mark favorites “as they go”, which might be caused by the higher perceptual burden to find something back.

**Conclusions and future work**

As far as we know, there are no studies that directly compare influence on the user behavior of the design strategies *Overview* and *Expand*. This initial study confirms that interface design has significant impact on how users explore the information to find relevant work. *Overview* steers people towards structural insight and overview sensemaking. In these tasks, the pan and zoom capabilities render the search functionality less crucial. *Expand* engages users in topical exploration. This results in a two-stage selection process, where all initially relevant search results are grouped on the screen, and then a final selection is made. This might indicate that structural oriented tasks benefit from *Overview*, while topical oriented tasks might benefit from *Expand*. Further studies are needed to validate these assumptions.

To live up to Vannevar Bush’s vision, we need to connect to all available knowledge. To get one step closer to this, we are working on connecting with DBLP through linked open data [3]. DBLP currently contains 1.7 million computer science related bibliographic references. This will pose new challenges in terms of scalability, performance, and interface design such as clustering of nodes, extra filtering mechanisms, etc. Finally, similar needs for exploring a rich body of available information exist in many other domains than science2.0, like for instance the need of professionals like doctors, lawyers, etc. to stay up to date with developments in their field. It would be very interesting to evaluate the usefulness of our approach in such contexts as well.

**Acknowledgements**

We gratefully acknowledge the financial support of the European Commission through the STELLAR project (grant agreement no. 231913).

**References**