Information Visualization as a Tool for Teaching Research Skills

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Background

Many people believe that the next generation of search engines will present their results not as a ranked list, but through visual depictions. Proponents of these visual presentations of information state that they help researchers understand the landscape of information on a topic more quickly and more accurately. They lead to a deeper understanding of the individual pieces of information, their contexts, and the relationships between them.[1] They are sometimes described as "amplifying cognition."[2]

Visual presentations of search results are currently used both with Web search engines and subscription databases. Common types of visual search engines include information maps[3] (which use cartographic techniques to map results from existing hierarchies), hybrid visualization systems[4] (often used for library catalogs), text clustering systems such as Vivisimo[5] (used with FirstGov), graphical systems such as Grokker[6] (used by the Ebsco databases and the Internet Public Library), and the tree structures created by hyperbolic browsers[7] (implemented by the Visual Thesaurus and xreferplus).[8]

Despite the potential that these information visualization systems may hold, there is widespread agreement that they are not yet sophisticated enough to replace traditional text-based search engines. Many information professionals say that visual search systems are at the threshold of true effectiveness, just waiting for the development of the "killer application" that will allow very sophisticated and user-friendly searching.[9]

The Idea

If information visualization systems are not yet ready to supplant traditional search tools, I wondered if they might nevertheless be useful for teaching research skills, and for promoting facility with those traditional tools. I hypothesized that by providing a clearer understanding of the landscape of information, including contexts and relationships, they might lead to greater skill at formulating search strategies while using more traditional text-based search engines.

Specifically, I wondered if:

- Examining visual search results while researching a specific topic would help an individual develop better traditional search strategies for that topic.
- Experience with visual search engines would lead to better traditional search skills generally, across all topics.
- Experience with visual search engines would lead to more creative thinking about the research process.

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• Experience with visual search engines would lead to more creative thinking generally.

Implementation

In thinking about these questions, it became clear that a rigorous experimental approach would not work. Any experimental design would involve too many uncontrolled variables, and would thus yield meaningless data. I therefore decided that for this initial stage of the inquiry, an exploratory, experiential approach was more appropriate.

For the first part of this project, I conducted individual interviews with several undergraduate students at Goucher College. These students were all workers in the Goucher College library, but they did not possess any research experience beyond that of the average undergraduate. This part of the investigation was somewhat cursory and superficial, but it did provide a useful starting point.

I asked each student to conduct a traditional search on a specific topic using an Ebsco database. I then asked the student to conduct a search on the same topic in the same database using the Grokker visual search function available through Ebsco. Finally, I asked the student to attempt a second traditional search on the topic after his or her experience with the visual search engine. I avoided giving any advice or making any comments beyond instructions for accessing the databases. For each student, I compared the search strategies across each of the three stages. At the end of the process, I also interviewed each student for his or her reactions.

For the second part of the project, I became a guest speaker in a class of first-year students. The instructors designed this class as an exploration of cutting-edge social and technological issues related to the information age, so it provided a natural forum for this topic.

In working with this class, I needed an approach that would involve the students in working with both a traditional and a visual search engine, allow them to compare the two, allow for some assessment of the effect of experience with the visual search engine on traditional search skills, and allow for some assessment of the effect of experience with the visual search engine on promoting creative thinking.

I did the following: I met with the class on two separate dates. At the first class session, I began with a brief lecture, demonstration, and discussion to introduce them to the concept of the visual presentation of results and its place in the research process. We then specifically addressed the topic of reality television (a topic I hoped would be interesting and generate some lively discussion). Using the database Communication and Mass Media Complete, which our library receives through Ebsco, we conducted a search on this topic using the Grokker visual search engine.

In an attempt to use the visual results as a catalyst for creative thinking, I had the class engage in a role-playing exercise. Because truly original thinking often involves placing ideas in a new context, or seeing previously unrecognized connections between pieces of information, the class and I used the categories and subcategories reflected in the visual results to suggest ways of ordering different aspects of this topic, and thinking about how they interrelate. To help students experience different perspectives, I assigned each student to a group defined by one of the categories in our results map, and to a specific role within that group. (I invented these individual roles myself.)

There were fifteen students in the class, with the instructor making sixteen. This allowed us to have four groups of four people each. The four general groups (identified by Grokker), and the four individual roles within each group (identified by me), were as follows:

- Television Viewers
  - Parent of young children
  - Parent of teenagers
  - Young, unmarried professional
  - Retired person
- Television Programs
  - Producer of Survivor
  - Producer of Fear Factor
  - Producer of American Idol
  - Producer of America's Most Wanted
- Fox Broadcasting
  - President of the network
  - Director of programming
  - Advertising sales representative
  - Owner of a local affiliate station
- The Media
  - Television critic for the New York Times
  - Professor of communication studies
  - Thinker and writer on cultural issues
  - Head of an advocacy group for parents and children

We began with the members of each group discussing among themselves the concerns of their group, its agenda, and how that group's positions could be represented to the larger community. We then moved to

an open debate, with the groups arguing their positions and countering each other's arguments.

At the end of the class period, I told the students that we would have the same type of discussion, with students reprising the same roles, in two weeks time. The students had had no warning or opportunity to prepare for this first exercise. Before the next session, I asked them to prepare for their roles by researching the topic of reality television using a visual search of Communication and Mass Media Complete (as we had briefly demonstrated in class), and also using a traditional, text-based search of the same database. As they researched, I asked them to reflect not only on their roles, but on how these two different types of searching compared, and how they informed each other.

During the second class meeting, students engaged in a similar debate, but with the advantage of the research they had done on their roles. We followed this with a class discussion that was essentially a debriefing, surveying students' reactions to this process, to visual searching, and to the ways in which experience with visual searching affects the process of traditional searching.

Results

1. Some students simply prefer visual search engines. When working with individual students, some resisted going back to the traditional search engine after experimenting with visual searching, saying, "Why would I want to go back after using this?" In the class, when the instructor reminded the students of their research assignment for the second class session, some students asked, "Do we have to use the traditional search methods at all? Can't we just work with the visual method?"

Of course, this may simply reflect that the skills of these students with traditional searching were not sophisticated enough to allow them to recognize the disadvantages of the visual methods. This interpretation is supported by the comments of at least one highly-skilled student in the class, who felt that visual methods provided a less effective way of searching.

On the other hand, perhaps visual searching is already more effective than we realize. We criticize it for only allowing simplistic searching, and not supporting complex Boolean expressions. But one of the advantages of a good visual search engine is that it does not require that a researcher start with a sophisticated search query. Rather, he or she can begin with a very broad search query, then use the visual display to refine the search further.

2. Visual searching can help some students develop better skills at traditional searching. The degree of benefit may vary from student to student. One student reported that the visual search engine helped her identify terms for traditional searching, but did not provide much help beyond that. Another student stated that she thought visual searching was very useful, but primarily at the beginning of a research project or when stuck, because it helped a person think more broadly about terms and ideas. Another felt that it provided a good deal of help in organizing thinking about concepts. Others stated that visual searching helped them think more in terms of concepts than in terms of unrelated bits of information, suggested ways of organizing concepts they would not have thought of otherwise, and provided a good overview of an area leading to better ideas for a more focused search. These statements were supported by my observations of the way in which students in the individual interviews modified their traditional search queries after working with the visual search engine.

On the other hand, one student stated that visual searching, "might help some people, but not me. I'd just keep putting in the same two words over and over. But then," he continued, "I'm just not very good at research." Of course, one goal of this process is to help students who are not good at research become better, but it may not be the most effective approach for everyone.

3. It remains unclear whether visual searching can lead to more creative thinking about the research process, or more creative thinking generally. Some of the students' remarks while playing their various roles suggest that they may have been led to consider new perspectives on the topic, or connect ideas in new ways. On the other hand, students sometimes had difficulty during the discussion remaining in the role they were assigned to play. They would slip back into simply giving their own opinion. It might have helped if students had been given specific research assignments consistent with their roles between the first and second class sessions, rather than simply being asked to research the topic generally. Clearly, more inquiry is needed in this area.

4. Visual searching can provide an effective introduction when teaching research skills, at least for some students. Some students described visual searching as "fun," "cool," or "neat." Another said that she thought it worked well for her because she was a visual learner. On the other hand, one student did not like the Grokker results screen because it often required "drilling down"

through several levels of bubbles to reach the actual articles. He preferred results presented as a simple list ranked by relevancy. These responses suggest that when teaching research skills, visual searching may provide an effective way to introduce the area for some, but not all, students, depending on an individual student's learning style.

Notes

1. Judith Gelernter, "Infoviz for Info Pros: Information Visualization Software Tools," *Searcher* 12, no. 9 (2004): 52–61.

2. "Information Visualization," *Library Technology Reports* 41, no. 1 (2005): 7.

3. See Antarctica Systems, "Antarctica," http://www.antarctica.net.

4. See Medialab, "AquaBrowser Library," http://www.medialab.nl.

5. See Vivisimo, "Clusty," http://www.clusty.com, and Office of Citizen Services and Communications, U.S. General Services Administration, "FirstGov," http://www.firstgov.gov.

6. See Groxis, Inc., "Grokker," http://www.grokker.com, and University of Michigan School of Information, "The Internet Public Library," http://www.ipl.org.

7. See Thinkmap, Inc., "The Visual Thesaurus," http://www.visualthesaurus.com.

8. For a general survey of all these approaches, see Judy Luther, Maureen Kelly, and Donald Beagle, "Visualize This," *Library Journal* 130, no. 4 (2005): 34–37.

9. "Information Visualization," *Library Technology Reports* 41:7.