

## Search and the *Subjective* Web

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### ABSTRACT

This paper describes a research project on people's subjective models of the World Wide Web, and the strategies they commonly use to retrieve Web information. Initial results suggest that Web use may be far more flexible and adaptive than most HCI workers realize. These findings directly inform Web navigation and search tool design.

### Keywords

Internet, World Wide Web, search, information retrieval

### INTRODUCTION

The World Wide Web promises easy access to--and navigation within--a vast distributed information space. However, the results of many usability studies suggest rampant disorientation on the Internet, with even regular users often experiencing great difficulty in retrieving desired information from the Web [2,4]. While a great deal of research has been done on the *objective* structure of the Web and its implications for search engine effectiveness [1], users' *subjective* representations (or "mental models") of the Internet remain largely terra incognita. Yet mental models are primary determinants of navigation and search strategies in both real and virtual spaces [3]. Most studies done on users' search strategies have tended to look only at performance on decontextualized and highly constrained tasks, typically requiring standard use of a single search engine [2,4]. Users have many more options than this, especially now with the proliferation of "portals" (gateway sites promoting easy entry to a large variety of other sites, often with customizable homepages). Little is known about the strategies people actually use to retrieve information from the Web in their everyday lives, and how these strategies may differ and change with experience.

This paper describes initial findings from a large research

project exploring users' subjective experiences of the Internet, including mental models of Web structure and "everyday" information retrieval strategies. We're also investigating individual differences in search strategies, and how such strategies may change with experience. We believe that understanding users' perspective(s) is a basic HCI design requirement, essential for fulfilling the Web's promise of easy navigability and universal access.

### Method

#### *Participants*

21 men and women (aged 25-50), were recruited without screener by a local company. All took the Internet Usage survey; selection for one of the additional tasks (10 for observation/interview, 8 for mental modeling) was random.

#### *Materials*

The *Internet Usage survey* consisted of a printed set of 8 questions. The initial questions were largely open-ended and concerned how often, how & why the participant used the Internet, as well as use of some specific Web-searching strategies. Familiarity rankings were then obtained for a long list of sites, including most major search engines and portals. The other tasks required no special materials.

#### *Procedure*

All participants completed the survey (given independently to prevent task bias); most also did an additional task.

In the *observation/interview* task, individual participants were asked to come to our lab, log onto the Web as they usually do, and perform any tasks they needed or wanted to do that day (while thinking aloud). (Resource limitations prevented home visits; we used a quiet office w/ a computer set up to mimic their Internet facilities as much as possible.) They were then asked to enact other kinds of tasks they typically perform on the Internet (also while thinking aloud). Observation was followed by in-depth, contextualized interviewing about what the participants were doing (or trying to do), and about more general Internet use habits and search strategies. Qualitative research techniques promoting internal and external validity were employed.

The *mental modeling* task consisted of two classic sub-tasks from psychological research on mental representations, *free recall* and *mental map* drawing [3]. For *free recall*, participants were asked to try to recall all of the Internet sites they could think of, writing in sequence on paper for as long as needed. For this initial, unconstrained *mental map* drawing task, participants were given pen & paper and were asked to simply draw their own, personal "mental map" of the Internet as they knew it.

## Results and Discussion

*Mental modeling:* In the *free recall* task, participants recalled a mean of 36.4 sites. Large "horizontal" portals and search engines (most notably Yahoo) were most often mentioned first, suggesting high salience. Analyses of category clustering (i.e., proximal multiple responses from a given category) show that on average, 8 clusters of 3 items each were used; most content clusters included "vertical" portals (i.e., content-domain specific; e.g., cnet.com, cnn.com & nytimes.com for headline news). Analyses in progress include: frequency & position of mention of individual sites and cluster categories, commonalities across participants, and correlations with gender and with Web experience. Two robust effects are apparent without analysis: First, more experienced users recalled more sites, with larger clusters, a classic expertise effect [4]. Secondly, hi-tech company websites comprised a prominent cluster category for men, but were rarely mentioned by women. Preliminary examination of the unconstrained *map drawing* task show that two kinds of maps were drawn: 1) grounded in concrete objects (e.g., map of the world, metaphorical office) and 2) purely abstract (dot-and-line diagrams). Interestingly, men drew more concrete maps than women. In general, the maps were less detailed than we had hoped; further research will incorporate a more constrained map task.

*Observation/interview:* A great deal of rich information was obtained. Preliminary analyses suggest that:

--Most people find the information they need, often using a variety of search strategies and tools.

--The simplest form of keyword search is vastly preferred to any form of advanced or constrained search.

--Only the first few search results are typically looked at; most (especially on additional pages) are ignored. Users tend to return to a search engine's home page to initiate a further search.

--Directed search is much more frequent than true browsing (this may be age- or style- related). If a search target is not found, one hybrid strategy is to click on a result that seems close to the goal and browse from there.

--Loosely formed initial queries tend to be associated with low success rates, and are more often accompanied by

follow-up browsing. True browsing may be more common for media (image, audio, video) than text searches

--Typing known or imagined urls into the http address box functions as a search strategy, especially for novices.

--Using the same keyword search on multiple search engines, rather than refining the query within a given search engine, is fairly common.

--Rather than using one search engine or large horizontal portal in an integrated way, people often use vertical portals or bookmarked entry sites for specific familiar content domains.

--New search tools (e.g., search engines, portals) tend to be learned through: 1) friends' recommendations, 2) links suggested by other sites, and 3) media ads.

--Experienced users differ from novices less in how they form queries than in the variety and number of search tools they use, especially vertical portals and other useful entry and pivot sites.

*Internet Usage survey:* Preliminary results converge well with the findings discussed above, and to save space will not be repeated here. Additional results thus far include:

--Internet usage is estimated as 1 to 3 hours per day.

--Participants reported using the Internet primarily to obtain specific information or products/services, especially: maps/directions, weather information, shopping and research.

--Most had registered on at least one Web site, esp. a large portal; customization of portal sites is not very common.

--Yahoo, AltaVista & Excite were the only search engines/portals rated as fairly familiar by most participants. Yahoo was most often cited as "favorite search engine"; this was attributed to simplicity and familiarity.

This research project is only beginning, but the initial findings are intriguing and informative. People's common use of the Web is far more flexible and adaptive than most researchers--and designers--may realize. A better understanding of search of the *subjective* Web will have direct implications for improving Web navigation and search tool design.

## REFERENCES

1. Broder, A. et al (1999) Graph structure in the Web. <http://www.www9.org/w9cdrom/160/160.htm>.
2. Nielsen, J. (1997). Search and you *may* find. <http://www.useit.com/alertbox/9707b.html>.
3. Schiano, D.J. (1997). Convergent methodologies in Cyber-Psychology: A case study. *Behavior Research Methods, Instruments & Computers*, 29 (2), 270-273.
4. Shneiderman, B., Nyrd, D. & Croft, B. (1997, Jan.). Clarifying search: A user interface framework for text searches. *Dlib Magazine*.



