Navigational Interaction Techniques in the Search Results Space

Workshop on Innovation and Evaluation in Information Exploration Interfaces

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Themes

User interface design for information exploration, and
Empirical evaluation of information exploration interfaces

Keywords

Interaction Design, Tasks, Visualization, Adaptability.

MOTIVATION: AVAILABILITY VERSUS ACCESSIBILITY

One of the new design challenges for Human Computer Interaction (HCI) and Information Retrieval (IR) is to process large quantities of structured and accessible information which is available to a variety of users having different information needs. Here we underline the seminal role that Human Computer Interaction (HCI) plays in Information Retrieval Systems (IRS). While most IRS rely on the power of indexing and search mechanisms, we focus on the user interface of such systems: We mainly work on the design of visualization techniques of the search results space and more generally on the design of navigational interaction techniques in the search results space because they can play a central role in accessing the retrieved information.

DESIGN APPROACH

Our goal is not to define yet another visualization technique of the search results space but to gain understanding of its design. Our design method is based on a conceptual study

of the user, her/his information needs and tasks while handling a huge quantity of information. The results of this conceptual study are used to identify ergonomic criteria that should be verified by the user interface. We then develop design rules that the designer can use for constructing a user interface that verifies the ergonomic criteria. Having designed the user interface, the software design is performed before the coding phase. We also show how the ergonomic criteria can be verified or at least assessed within the software design using our PAC-Amodeus model [8]. This is the first step towards a predictive evaluation of the user interface. Finally the developed user interface can be evaluated using the ergonomic criteria. In [9] we develop this method further and present our results at each step of the design. Based on the three workshop themes, we present here our results on task analysis. After presenting one of our ergonomic criteria, we briefly present one design rule. We finally present our past and present projects.

INFORMATION NEEDS AND TASKS

When handling a huge quantity of information, the needs and tasks of the user are numerous. The user's information needs characterize the tasks. It is consequently important to study the information needs in order to better understand the task and identify the relevant information to be made perceivable. In [3, 7] we present a taxonomy of users' information needs: We define axes that group various intrinsic properties of an information need. For example the "users' need characteristics" axis identifies two properties: the definition of the need (values from well-defined to fuzzily-defined) and the stability of the need. We adopt here a user's point of view. Nevertheless it is important to notice that a well-defined information need from the user's point of view can correspond to a very vague query from a system point of view and vice-versa.

In order to study the various tasks, we apply a classical hierarchical task analysis. Figure 1 illustrates this analysis: This avenue allows us to organize previous approaches with ours within a unified framework.

Figure 1. Hierarchical analysis of information exploration tasks.

At a higher level of task analysis, tasks are clearly domain-dependent. Without considering a particular system dedicated to a given domain, identifying all the tasks of the user is difficult. For example in the TTT taxonomy [10], at a higher level of abstraction, task-domain information actions are required.

At a finer grained level of analysis, we identify general sub-tasks that are domain-independent. As shown in Figure 1, such sub-tasks define the domain-dependent tasks. The literature is abundant with domain-independent tasks a user is faced with in dealing with a huge quantity of information: For example one such study started at a FADIVA workshop [5] pinpoints the difficulties of the enterprise. Examples of sub-tasks that have been identified are: searching for a particular piece of information, grouping, comparing, analyzing, creating new information. Another list of tasks can be found in the CHI'97 tutorial notes on Information visualization [4]. Likewise, in the TTT taxonomy [10], seven tasks are defined: overview, zoom, filter, details-on-demand, relate, history and extract. At this level of analysis, it becomes difficult to identify an exhaustive list of sub-tasks.

The finer grained level of analysis is at the interaction level. In our work we adopt an interaction-based approach and we study the elementary tasks the user will perform, namely querying and browsing. In order to define the two tasks, we employ the Information Exploration Model [11]: We consider two relevant dimensions (out of three dimensions in the original space), presented in Figure 2: "Target orientation" and "Structural responsibility".

* The "Target orientation" dimension identifies two tasks, querying and browsing. "Browsing is distinguished from querying by the absence of a definite target in the mind of the user." [11]. In [6], querying and browsing are respectively designated as "searching and browsing" (Figure 2), whereas in [2] they are respectively named "identifying objects and exploration", showing that the terminology is not well established.

* Structural responsibility refers to the responsibility for performing the task either by the user or the system. Along this dimension, two values are defined: mediated (task performed by the system) and navigational (task performed by the user). This dimension corresponds to the criterion "Task migrability" in our design space [1]. It refers to the transfer of control for execution of tasks between user and system. In [6], mediated and navigational responsibility are referred to as "querying and navigating".

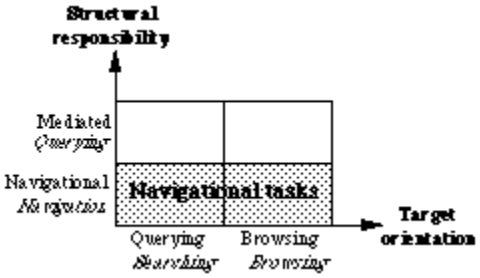

Figure 2. Navigational tasks in the Information Exploration Model [11]. (The dimensions presented during the CHI'97 workshop on Navigation [6] are presented in italics.)

We focus on the design of navigational techniques that support the two tasks "Querying

and Browsing" (Figure 2).

CRITERIA AND DESIGN RULES

Based on our framework for characterizing navigation [9] we identify criteria that should be verified by the navigational techniques. One of the criteria is representation multiplicity. It involves flexibility or adaptability of search results space rendering in order to face the diversity of user's characteristics and tasks. Representation multiplicity is a case of output multimodality. One design rule based on this criterion is:

* Temporal continuity must be guaranteed while changing the representational systems in order to provide visual continuity. The user should not be lost in the search results space because she/he switched from one representational system to another one.

PAST AND CURRENT PROJECTS

We have developed three systems (TIAPRI, IRIS-M and VITESSE) that are complementary because they implement different information exploration means. As shown in Appendix 1, our first project IRIS-M [3] displays a representation of the corpus by clustering documents.
IRIS-M presents each document cluster as a cone, each cone belonging to a plane (levels of abstraction). The second project is TIAPRI [7]: As shown in Appendix 2, query and results are displayed in a starfield. The starfield is decomposed into slices, each slice corresponding to a query term. A retrieved document is represented by a star.

Our current project is VITESSE, running on the web. We applied our criteria and design rules for the design of the user interface [9]. The VITESSE user starts by specifying a query sent to a selected web engine and then navigates in the search results space. VITESSE is independent of the search engine. As shown in Appendix 3, VITESSE displays the overall graph structure of the results: Each retrieved page (node) and their links are displayed. VITESSE allows six representational systems of the space (representation multiplicity and adaptability criteria): birdeye view, polar and cartesian fisheyes. We carried out an experimental evaluation of VITESSE based on various scenarios. The goal of the experiment was to evaluate the usability of the representational systems and the navigational tools provided by VITESSE. To do so our scenarios include the two navigational tasks of Figure 2: querying and browsing. Some of the evaluation results confirm that our criteria/design rules are valid: In particular, many of the participants use different representational systems based on their tasks. Nevertheless more usability testing must be carried out, with more participants. In addition we now would like to undertake a comparison test. For example, since the program uses the search results from the AltaVista search engine, it would be logical to test the efficiency of finding information using VITESSE with that of AltaVista.

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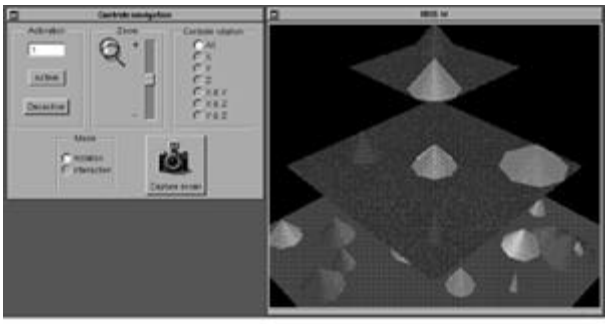
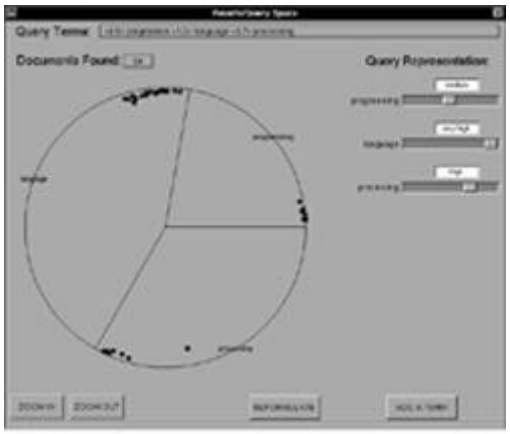
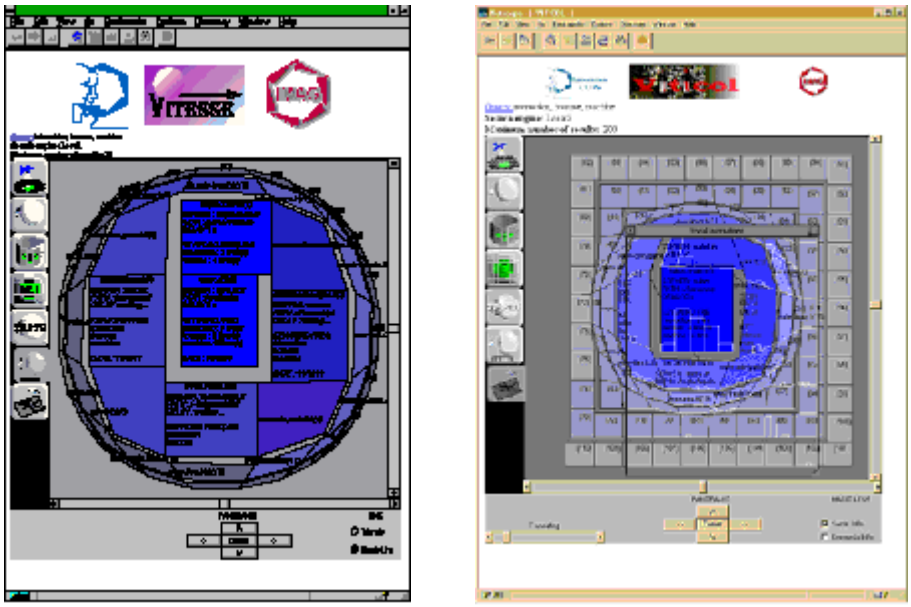


Appendix 1. The IRIS-M system,
representation of the corpus by clustering the documents.



Appendix 2. The TIAPRI system,
the results window.



(a) (b)

Appendix 3. The VITESSE system. (a) Truncated spherical view of the search results space. (b) Combining social and system relevance: Opinions of others are superimposed (magic lens displaying bar charts) on the search results space ("Hill" view of the search results space). http://iihm.imag.fr/demos/VitesseDemos.html

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