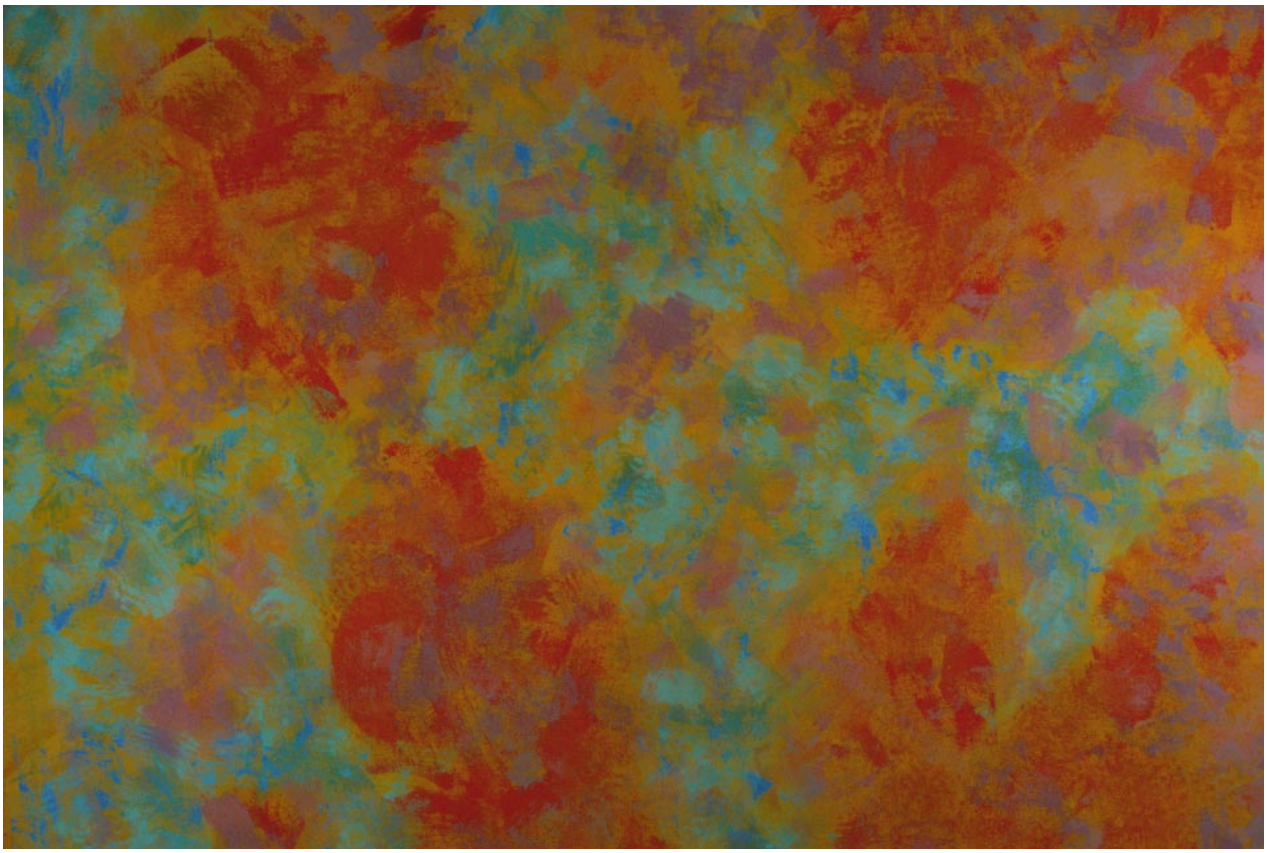

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Trends in Future Web Designs: What's Next for the HCI Professional?

Information Explosion

One thing is certain—the amount of information available on the Web continues to grow at a dizzying pace. For a Web site to add significant value to the user, it must provide an overview of accessible information to all users of varying Web expertise. This article attempts to outline many of the new interaction trends for information management that can now be observed on the World Wide Web. This overview was prepared with an eye toward attempting to ferret out research techniques and methods that might be most advantageous to a HCI (human–computer interaction) professional working on future Web designs.

For the sake of brevity, we focus on a subset of Web designs that we feel is indicative of what will catch on in the future. Our approach has been to collect, study, and analyze critically a large set of these new Web browsers, along a variety of interaction dimensions. The dimensions were generated from our research on both novel HCI techniques and technological breakthroughs (hardware and software). To leverage these new interaction and technology trends, it is critical that any new Web design be of high usability in order to garner the widest possible acceptance. To that end, once the important interaction dimensions of a new Web design are identified, it should be a less daunting task to put forth a research agenda evaluating its ease of use.

All of the new Web interaction techniques discussed in this article have one theme in common: They all try to present a very large set of information to the user in a format that allows the user to (automatically or preattentively) recognize patterns in the data easily. In other words, the new Web designs are an attempt to leverage the human's perceptual system in order to ease the burden of manually organizing or cognitively processing the displayed information. One implication of this commonality across the designs is that the HCI professional working on future browsers must be well versed in human perception and cognition. In addition, the professional needs to have a keen understanding of future technological breakthroughs or to have the luck of being on a multidisciplinary team that includes that expertise. The following sections identify the trends and techniques that could be increasingly prevalent over the next few years.

New Browsers and Information Visualization Techniques

Effectively shunting the burden of sensemaking during browsing Web documents from the cognitive to the perceptual system is a great design goal. If the user preattentively absorbs meaning from the structure of the presented information, then he or she can allocate more cognitive resources to the actual task at hand. However, identifying the user's task and designing for that task are also very important. Although many of the new browsers and visualization techniques we have reviewed were designed for specific tasks, we chose browsers that were specifically designed to help organize and make sense of large collections of Web pages, files, or documents. Target tasks for this analysis included finding the following:

- A Web document that you know exists and that you have visited before (*targeted revisitation*).
- A Web document you know exists but that you have never seen before (*targeted search*).
- A Web document and most of the pages related to it on a particular topic (*comprehensive browsing*).
- A Web document on a topic that is "close enough" to the subject at hand (*satisficing during browsing*).

The dimensions we are using for evaluation came from three different aspects of our research:

- Our ongoing usability analysis of Web browsers.
- Literature review of important browser usage characteristics [3].
- Cross-product comparison and historical tracking.

Targeted revisitation is the ability to go back to a page you have previously visited. The History feature in most Web browsers was designed for targeted revisitation. Our research shows that to date these History mechanisms have not been designed optimally in terms of supporting the user's search task. PadPrints [5] appears to do the best job of providing the user with an easy way to return to a previously visited page. PadPrints works by creating a visual tree of all of the Web pages that the user has previously visited. As the user moves around a Web site, the visualization keeps growing to show the overall structure of the site and, more importantly, the user's present location and navigation pattern within the site. At any time, the user can select and revisit any previous page on the tree. Empirical studies [5] have shown that using

PadPrints is a more efficient and satisfying way of navigating previously viewed Web pages than without it.

For *targeted search* tasks, getting great overview information and maintaining a global/local viewpoint are critical, as well as knowing what categories you have already examined during a search task. We chose to examine browsers such as Inxight's Hyperbolic Browser (http://www.inxight.com/products/hw/infoseek.htm) [7]. The hyperbolic browser, shown in Figure 1, is a wheel of information with browsing beginning at the center node. When a spoke of the wheel is selected from the first ring around the center node, the wheel's shape warps, leaving the first ring smaller but still visible, while allocating more screen space to subcategories and nearest neighbors of the selected item. In user studies [2], we compared the hyperbolic browser with a traditional hierarchical tree control user interface. Our studies demonstrated that the hyperbolic browser was effective for finding search targets during browsing primarily because of its effective use of overviews and related item expansions via animation. Users frequently found target items in local spaces that they may not have found if they were required to navigate physically up and down a tree. This type of browser does depend on a very careful layout of the physical space, and an alternative alphabetical layout would not have provided the affordances necessary for serendipitously finding information as we observed in our studies. One serious usability issue we observed was that items on the outside rim of the wheel were grouped strongly, with users often assuming that they all belonged to the same category. Careful use of alternative perceptual coding for semantic categories could alleviate this usability problem in future versions of the browser.

For *satisficing during browsing*, for example, looking for some nonspecific information in a topic area, Perspecta's® Smart Content Viewer (http://www.perspecta.com), which was predicated by work reported by Rennison [9], has some promise. The Perspecta browser has a fly-through navigation system. Although many users could have difficulty using the

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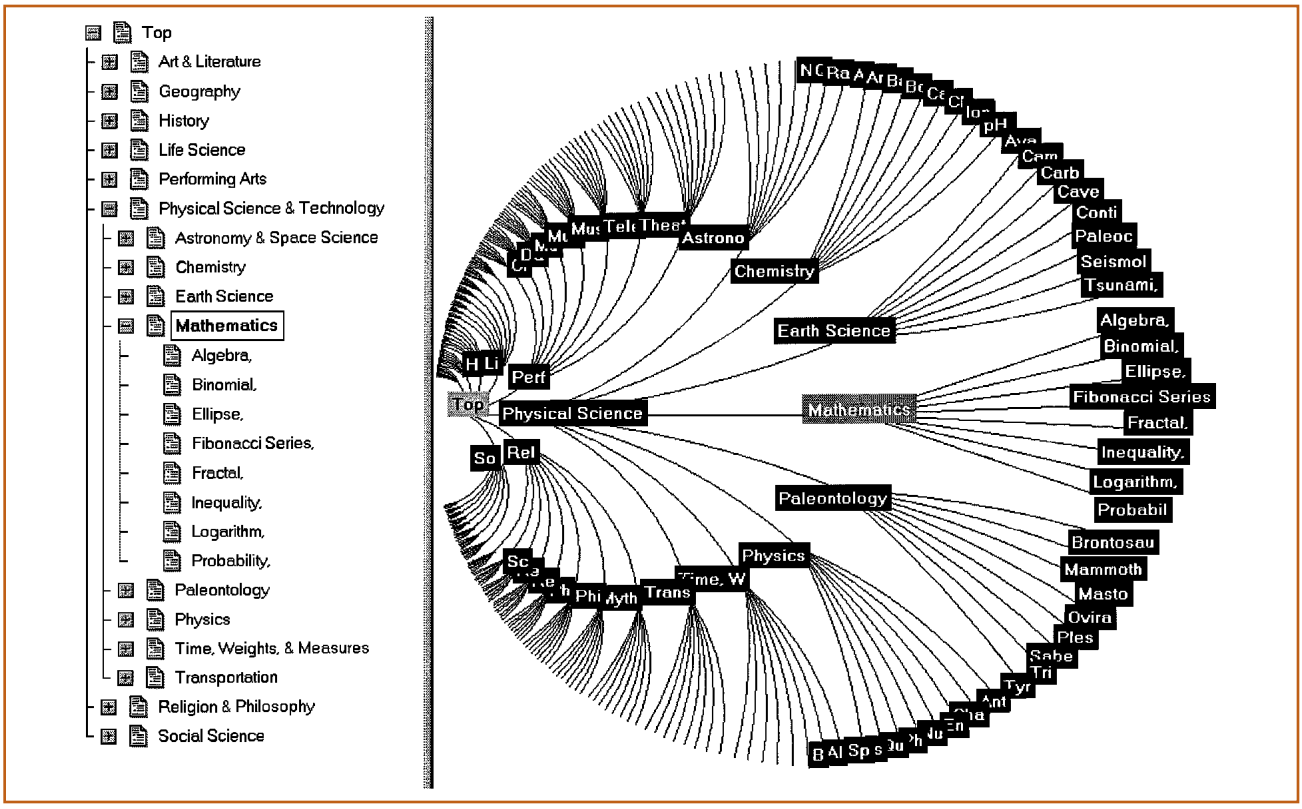

Figure 1. A hierarchical tree control user interface and Inxight's Hyperbolic Browser.

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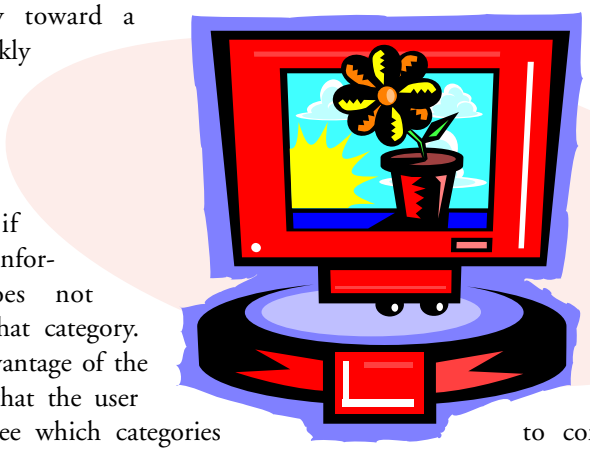
navigation controls of such a browser, it is generally regarded as "cool." Visible on the screen are the top-level items spread evenly across the display. As the user flies toward a node (either via holding a mouse button down or double clicking on a node), the node begins to appear much larger and closer. Also, the items subordinate to that node now appear closer to the user, although their size is smaller (i.e. they are more distant from the user) in relation to the parent node. The advantage of this system is that it is quite easy to fly toward a node, quickly see previews of what is there, and then fly elsewhere if the desired information does not appear in that category. Another advantage of the browser is that the user can easily see which categories have the "biggest bang for the buck" in terms of the number of links from the main category node. The browser encourages exploration. On the negative side, users could get lost in hyperspace with this browser and could have a difficult time remembering where they have already traversed, as well as flying back out to a global point of view.



Comprehensive browsing necessitates having an effective global/local perspective, getting great overviews and previews before navigating to categories, and having semantically meaningful category labels, as well as having the ability to visualize related clusters of information in an intuitive manner. Few to no novel browsers have sufficiently managed this rather ambitious task to date, although our group at Microsoft, as well as many others, is working hard on this problem [1, 3, 10].

Background Knowledge Requirements

It should be obvious from the positive and negative features listed earlier here that the future designs of Web browsers will be complex. The HCI professional will necessarily need to understand a variety of phenomena related to visual, auditory, and perhaps even tactile or haptic perception. The methods used in the traditional study of these domains, even psychophysical methodology, will become invaluable during iterative testing and design of these user interfaces. Understanding how to measure cognitive load, selective attention, memory, and situational awareness also become critical to the HCI professional—more so than ever before. As one example, psychophysical studies in our group have shown that extremely subtle auditory cues (often no more than 50 ms in duration) can provide a wealth of semantic meaning to computing events associated with large information spaces on the Web. However, the key is to use these cues as an extra, complementary channel of information that does not interfere with the current task at hand. In order to ensure that the auditory display is indeed accomplishing a high meaning to disruption ratio, dual-tasks studies are going to be performed in which the user is interrupted by an auditory cue while engrossed in a primary visual task. A familiarity with this paradigm will help answer the key questions involved in peripheral, auditory displays. Understanding the guidelines and principles from years of basic research will also necessarily become the recommended background for professionals working in this domain [4, 6, 11].

User modeling and Other Helpful Technologies

Adaptation

Exploratory studies in our laboratory have confirmed what Amazon.com and several other online purchasing Web sites have known—

users appreciate automated suggestions for browsing and categorizing their personal Web information. In fact, our studies have shown that a simple suggestion provided by the user interface in terms of how to categorize a favorite Web page may end up resulting in a halving of the time it takes to subsequently retrieve that page. In this research, we also examined different kinds of similarity metrics. For instance, we used similarity metrics that were derived from co-occurrence matrices based on previous users' organizations of Web pages versus a content- (word) based similarity metric. Although qualitative data suggested that subjects were more satisfied with their organizations using the co-occurrence metric, no reliable difference between metrics emerged during a test of the retrieval of previously stored Web pages. In order to develop novel visualizations of personal Web information spaces, as well as to develop the similarity metrics that drove our automated suggestions used in this research, expertise in computer visualization, human perception, memory, and information retrieval was required.

Agents and Conversational User Interfaces

It seems that the days of debating whether conversational agents should be used during Web interaction are numbered. Frankly, agents exist and will proliferate on the Web in the years to come, whether personified or not. How can the HCI professional best approach this design situation, and what methods and guidelines are appropriate? Luckily, there is a middle-ground perspective emerging that can provide the professional facing design choices in this area with assistance. Hopefully the next year will mark a time when careful studies of the effectiveness of agents and their designs during Web interaction are reported and made available to the CHI community. Knowledge about social psychology, sociology, and anthropology are critical to this avenue of research and design, in addition to our standard sets of HCI principles.

Non-Speech Sonification

Taking advantage of the auditory channel is another way we can help make sense of large information spaces. Currently, computer auditory feedback is limited to an alerting buzz when an error has occurred and a ding when new mail has arrived. A number of research labs are attempting to create a set of non-speech auditory cues that provide valuable information to the user. Studies of what genres of information can be conveyed through non-speech auditory channels will provide valuable contributions to this problem. As mentioned earlier here, the skills contributing to the designs of auditory displays range from computer science and psychology to the auditory and music engineering disciplines.

Multimodal Input and Output

Studies in our lab, as well as the research of others [8], have demonstrated that users relish the chance to be able to use gestures and speech in combination with computing tasks, including those on the Web. Given the current state of speech-recognition systems and the breadth of speech commands available to users for any given task, the combination of speech and gesture is a strong and complimentary HCI partnership. As Oviatt [8] has shown, the combination of speech and gestures during HCI actually reduces disfluencies in speech while improving accuracy of both the speech- and gestural-recognition systems. Understanding the design issues involved in user interfaces requires expertise in speech recognition, linguistics, and computer science. User studies in this domain need to focus heavily on error recovery and the "n-best" gestures a user is willing to proffer naturally or learn over time.

CONCLUSION

This article was written to outline what we considered to be novel trends in HCI for the Web, as well as to discuss how an HCI professional might best prepare and participate during these exciting design opportunities. We only briefly touched on the vast amount of knowledge now considered critical to an HCI professional in the Web design/usability field. It is our hope that by highlighting these skills and methods in future computing scenarios,

we have hinted at what it will take to build widely accessible, satisfying Web interaction techniques for tomorrow.

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