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The Post-GUI Web Interface (PoGWI): The End of the WIMP as We Know It?

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ABSTRACT

This article briefly discusses origins of the graphical user interface (GUI), the field of Human Computer Interaction (HCI) and the World Wide Web (Web). Using the principles and information set forth the author informs how HCI principles can be applied to reshape existing Web user interfaces into an all-around sensory experience. The development of a Perceptual User Interface (PUI) through which users can navigate the Web is the focus of this study. Preliminary data and a prototype of a Post-GUI Web Interface (PoGWI) will be presented.

BIRTH OF THE GRAPHICAL USER INTERFACE

During the 1984 Super Bowl, a bizarre advertisement appeared on the TV screens of millions of viewers. The scene opened onto a gray network of futuristic tubes connecting bleak, ominous-looking buildings. Inside the tubes, gray-clad subjects marched towards a cavernous auditorium, where they sat transfixed before an Orwellian Big Brother figure emanating a rhetoric of assimilation from a giant "black and white" TV screen. One lone woman remained unbroken. Dressed in colorful running attire and chased by storm troopers, she runs up to the screen, hurls a sledgehammer with a heroic yell, and shatters the TV image. As the screen explodes, bathing the bewildered audience in the bright light of freedom, a voice-over announces, "On January 24th, Apple Computer will introduce the Macintosh. And you'll see why 1984 won't be like '1984.'"

With Apple's release of the Macintosh graphic user interface (GUI), computing moved into a new era. The Macintosh was the first commercial release of the GUI that many people since have become familiar with. It did have its predecessors: Xerox's Dynabook, the Star (also Xerox), and Apple's Lisa. Licklider's research into "symbolic relationships" between computers and humans and Sutherland's work with Sketchpad, a system that users "display, manipulate, and copy pictures represented on a screen" (Preece et. al, 1994, p.18), paved the way for the Macintosh and systems that followed. For example, Microsoft Windows 95 and above has also help set a standard for interface design. With its sheer number of users, Microsoft Windows is a GUI metaphor understood by many.

EVOLUTION OF HUMAN COMPUTER INTERACTION

With the GUI and related computer developments in the early '80s, such as the mouse, came the birth of a new field of study: Human Computer Interaction (HCI). According to Preece (1994), the term "acknowledged that the focus of interest was broader than just the design of the interface and was concerned with all those aspects that relate to the interaction between users and computers" (Preece et. al, p. 7). Moreover, Preece (1994) notes that the definition has evolved and now is characterized—according to the ACM SIGCHI definition—as "a discipline concerned with the design, evaluation and implementation of interactive computing systems for human use and with the study of major phenomena surrounding them" (Preece et. al, p. 7).

Using a brief HCI history, Church (1999) builds on the various definitions of HCI taken from Booth (1989) but adds a component of communication. Using Card, Moran, and Newell (1983, 4), who define communication with the computer interface as "dialogue because both the computer and user have access to the stream of symbols flowing back and forth to accomplish the communication," Church builds a definition of Computer Human Dialogue that informs the ways in which humans cognitively process information with computer systems. The ways through which humans reason and interact with computers in this manner can inform the ways in which HCI can be improved and effectively implemented.

PERCEPTUAL USER INTERFACE

Since the early '80s much of the research concerning the interaction between humans and computers has focused primarily on creating and improving the GUI. Although computing power has increased tremendously in the past twenty years (Moore's Law in action), the interface has made minimal improvements by comparison. Discussing the GUI, Turk and Robertson (2000) note that the GUI:

> properties provide the user a clear model of what commands and action are possible and what their affects will be; they allow users to have a sense of accomplishment and responsibility about their interactions with computer applications. Although these endeavors have been very successful, and the WIMP (windows, icons, menus, pointer) paradigm has served to provide a stable and global face to computing, it is clear this paradigm will not scale to match the myriad of form factors and uses of computers in the future . . . Pointing, clicking, and typing—though still appropriate for many uses of computers in the foreseeable future—will not be how most people interact with the majority of computing devices for long. (Turk and Robertson, p. 33)

Turk and Robertson propose that new computing systems need a new paradigm, which they term the "perceptual user interface" or PUI. According to Turk and Robertson, the PUI is "one that adds human-like perceptual abilities to the computer . . . making the computer aware of what the user is saying or what the user's face, body, and hands are doing" (Turk and Robertson, 2000, p. 34).

Turk and Robertson note that the PUI combines three essential modes in user interaction. Perceptive User Interfaces (UI) allow for a computer to know users' actions as they interact with the

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system. For example, if you move your head, smile, or wave your hand, the computer could react appropriately. Multimodal UI emphasizes creating interfaces that integrate humans' verbal with other paralinguistic cues to facilitate communication between the computer and user. Finally Multimedia UI interprets information and presents it via text, graphics, audio, and video. (Turk and Robinson, 2000, p. 34)

MAINSTREAM PUI USE

PUI combines all of the three modes to interact and present information to humans in various ways. While many users and interfaces still rely on vision as the main sense for interaction, the PUI computer might now use vision to track user movements instead of relying on a mouse and keyboard for input. Tactile feedback, sound, and even olfactory applications are currently being developed.

However, many of the PUI devices still remain in the research stage or are used in a limited fashion. For example, wearable computers, virtual reality simulators, and smart rooms are great examples of PUI devices, but most users still don't have ready access to these either because of availability or price. Of course, technological progress will surely close this gap.

Still many items exist that can be used by consumers. Force feedback mice and controllers (like joysticks), data gloves, and limited use VR headgear are becoming available for computer systems and gaming rigs. More applications of speech software for interaction are becoming prevalent.

Most of these still fall short in terms of PUI applications though. As Pentland notes, it won't be until "machines [are] aware of their environment . . .[and] sensitive to the people who interact with them" (Pentland, 2000, p. 36) that we will truly begin to unlock the power of PUI. Here computers fall short of our expectations.

ENTER THE WEB

While computers sometimes fall short, more often they continue to amaze us. Before the notion of the PUI and after the birth of HCI, a major breakthrough in how humans interact with computers occurred: the World Wide Web. The beginnings of the Internet is well-documented (Haefner, 1996; Berners-Lee, 1999; Zakon) and will not be discussed in detail here. But one aspect that truly brought the Internet to the public as a whole is most arguably the World Wide Web (or Web, for short). Let's explore why.

The Internet started as a collection of academic and government institutions sharing information via text. Using Telnet, humans could log into various systems around the world and utilize the system's resources. With the advent of File Transfer Protocol, data could be shared between people. E-mail became a way for users to communicate with one another as well. Soon, a plethora of programs became available, such as Gopher, Internet Relay Chat, and USENET (Users' Network) to facilitate communication and data exchange.

However, it was not until the early '90s that any of these resources became readily available for mass consumption. Histories disagree on the exact beginning of the Web. Much of this contention stems from what people define as the first manifestation of the concept which ultimately led to what is viewed as the Web today. The more widely-accepted origin for the Web is in 1991 when Tim Berners-Lee—then at CERN (Counseil Europeen pour la Recherche Nucleaire)—released a program that worked with CERN's computers and allowed users to make connections between documents and concepts located throughout the system. However, Rea and White (1999) also note that Robert Calliau, a co-author of the original document proposing the Web "sets the origin of the Web at 1980 . . .when [Berners-Lee] wrote a notebook program, 'Enquire-Within-Upon-Everything'" (Rea and White, p. 423). This program allowed for what we now term hyperlinks that connect various files in a system.

But the idea for connecting files appeared well before Berners-Lee's implementations. In 1945, Vannevar Bush wrote an article, "As We May Think," in the Atlantic Monthly. Bush called for a machine called the Memex that would mechanically link all information retrieved and then organize this information on microfilm using strict codes. These codes would allow scholars to annotate and cross-reference all information therein. Many pioneers built on Bush's theories and added to the journey that has lead us to what we call the Web. These include Ted Nelson's concepts of Xanadu and his docuverse (1960s), George Landow's use of InterMedia to teach literature (1990), and Bill Atkinson's development of Hypercard (1987), which is still used today by many educational institutions (Rea and White, p. 424). However, it was not until 1993 when Marc Andreessen, a graduate student at the University of Illinois-Chicago, presented Mosaic for X, which ultimately became Netscape Navigator. This signaled the beginning of the mass-consumer graphical browser as we know it today.

WEB EVOLUTION

In the short time span we've seen many improvements in the Web browser as user interface. Web browsers started with plain ASCII text, moved into formatted fonts and images, and downloadable audio and video files. As computing power increased, Web browsers have incorporated multimedia, streaming audio and video, and offer simple virtual worlds and environments. Selker notes: "new paradigms for using computers are created as we change the roles computers play in our lives" (Selker, 1996, p. 69). And the Web browser is no exception. From its start as a tool to share information, it has evolved into a communication conduit, artistic medium, business tool, and personal portal among many other uses.

Since 1993 the Web browser has become more accepted as the interface of choice. Businesses managers talk of creating Web-enabled applications: programs that are accessible using a Web interface. Corporate Intranet use is on the rise as society moves from an industrial to an information era. E-Commerce is the "hot topic" of industry today with more "dot.com" companies making their way into the Web (even though many don't survive). Moreover, businesses are looking for ways to educate their employees with "just-in-time" training to keep workers current and viable contributors to the company.

Academia is not far behind in this educational venture. Courses are now expected to have a Web component and Virtual Universities are becoming more the norm. Rea, White, McHaney, and Sanchez (2000) argue that "recent technological changes have propelled a change in the way modern universities think about their educational delivery systems, and have significantly impacted on the nature of modern education" (p. 135). Many of these changes involve delivering courses (or parts of courses) via a Web interface.

WEB USER INTERFACE

A major challenge is how to effectively relate the billions of Web pages to users on a variety of systems. Nielsen argues that while we cannot depend on a single navigational UI, we must focus on four methods to relate information:

Aggregation: showing a single unit that represents a collection of smaller ones

Summarization: ways of representing a large amount of data by a smaller amount

Filtering: eliminating whole wads of stuff the user doesn't care about

Elision: instead of showing everything, show some examples and say something like "3 million more objects" (Nielsen, 1999, pp. 69-70)

While the Web allows humans to quickly incorporate it for their own use and application, it still depends on the same types of interface metaphors such as the WIMP or the printed page to display information. Some inroads in terms of minimalist VR applications have been made, but issues such as insufficient bandwidth, latency, and varied system requirements have limited these applications.

Building on Nielsen's principles, we can now look to develop a new paradigm to help humans interact with vast amounts of information available via the Web. This PUI, post-GUI Web interface, or PoGWI, will be a new means for humans, and humans and computers, to interact with one another.

EVOLUTION OF THE STUDY

Year 1

The study is in Year 1 of a three-year implementation plan. In Year 1, three concurrent activities are being conducted:

1) Seeking grant and other support funds;
2) Creating and revising instruments to measure current end-user satisfaction and usability levels;
3) Designing an initial prototype for the PoGWI interface.

Year 2

Year 2 of the study will focus on deploying a revision of the initial prototype and constantly refining and deploying versions of the prototype according to feedback acquired via the instrument. All data will be collected via forms and fed into databases. By the end of Year 2, a workable prototype will be tested in a wider environment and then released to all users for testing via the Web.

Year 3

Year 3 will continue testing, data collection, and revisions, and culminate in a final release and deployable product available to all educational institutions. Throughout the study, interim versions and reports on finding will be discusses and submitted to various conferences, such as IRMA. For the 2001 conference, an initial prototype and results from preliminary instrument surveys will be presented.

METHODOLOGY

Currently in the first year of the study, the project is collecting user data in order to set a baseline of Web usability. From these findings an initial prototype will be tested and re-evaluated. For statistical analysis the Doll and Torkzadeh Satisfaction Instrument (DTSI) for measuring end user computing satisfaction (EUCS) is used (Doll and Torkzadeh, 1988). In addition the Technology Acceptance Model (TAM) measures usability, acceptability, and perceived ease of use. (Davis, 1989).

Both of these instruments have been modified for the initial survey instrument. A copy of the instrument is included as Appendix A.

IMPLICATIONS OF RESEARCH

Using the Web as a "standard" interface for training and education does make it "easier" for content to be delivered since the medium is a known element. However, the "goals of HCI are to produce usable and safe systems, as well as functional systems" (Preece et al, 1994, p. 14). Evaluating existing Web interfaces in terms of HCI then becomes an important component to determine the efficiency of these systems for training and educational purposes. Moreover looking for new paradigms in Web Based Training (WBT) may provide educational ventures with means to incorporate multimedial PUI (or Multimedia UI) as defined by Turk and Robertson (2000, p. 34) into existing Web browser GUI interfaces and extend the capabilities for cognitive learning to various audiences.

A study of existing Web GUI interfaces used in various training and educational applications will set a benchmark that then can be revised and modified into a new HCI paradigm which will extend capabilities for the existing Web GUI interface in order to increase training and educational opportunities. Not only will this research lead to new evaluation tools, heuristics, and rubrics but also to working models from which prototypes and new applications using the interface can be developed. Ultimately a Post-Gui Web Interface (PoGWI) could prove another historic step in the HCI/PUI evolution.

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