Usability of corporate information systems

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The ACM Special Interest Group on Computer-Human Interaction (SIGCHI) has organized this panel session. The focus is on designing and developing Corporate Information Systems for use by managers and analysts who are not likely to be computer professionals and who are not likely to have submitted themselves to the processing required to become "computer literate."

Usability of Corporate Information Systems has several aspects including access, functionality, interfacing, organization, presentation, and communication. The panelists have been asked to comment on and discuss the requirements for usability of Corporate Information Systems and the problems—physical, technological, and cognitive—that will hinder these systems from reaching their full utility as Corporate Information Systems mature and become more usable and available to a wider cross-section of users. There follows a brief discussion of some of the areas the panelists will be addressing.

INTRODUCTION

Webster's New Collegiate Dictionary defines "usability" as that which is convenient and practical to use. The interactive utilization of CPU power, in and of itself, whether in a massive mainframe distributed through networks or in a personal computer dedicated to individual use, does not make a system usable. There is more to making a system usable than simply collecting, organizing, manipulating, and analyzing data interactively. It is necessary to understand how people think about and use information. It is necessary to understand how human thought processes work and how to integrate those processes smoothly into a system so that a true cognitive symbiosis may be achieved. The ACM SIGCHI, through its newsletters, workshops, tutorials, and conferences, provides a medium for discussion and investigation in these areas and for presentation of significant results. SIGCHI presents this panel session as a forum for the presentation and discussion of those concepts pertinent to the usability of Corporate Information Systems.

Corporate Information Systems are an integral part of a corporation's management structure. They are designed to provide a service and be used by managers and analysts throughout the corporation. For the most part, these managers and analysts are living, breathing human beings with needs and requirements of their own. While it may be possible to build systems for people, it is difficult to build people for systems. Therefore, the systems we build must be designed for the people who will be using them. This is particularly true for Corporate Information Systems. Usability demands that the average manager and analyst find both the system itself and the applications to be convenient and practical to use for obtaining the service and results they require.

The issues involved span just about every aspect of a Corporate Information System. For the purposes of this paper, we have organized some of those issues into the standard components of input, functionality, and output/presentation.

INPUT

A goal of user interface development is to allow the user to specify input in a manner that fits the user's frame of reference. Current systems tend to require the translation of information as perceived and understood by the user into data items properly and precisely organized in a form suitable for the software system. Doing so not only introduces another item of work but also provides additional opportunities for error. The translation may not be appropriate or a data entry error may not be evident because of its cognitive distance from the information it represents. Reducing the cognitive distance between information as known by the user and the data tokens as input to the system requires that we know how people think about information. Although understanding the conceptual models that users employ in structuring information is of great importance, it is necessary that we understand the very basic processes of how the human brain organizes, stores, retrieves, and interrelates information, and the processes used to express and communicate information.

One of the fundamental intellectual processes of the human mind is the ability to abstract and categorize. Support for abstraction and categorization would be a major benefit for users of large data base systems. What tools can we provide the user to assist in expressing abstraction? There is no doubt that the actual interaction between a CPU and the stored data needs to be quite discrete (at least with today's technology). But can we properly map the user's abstract specification into the system's internal discrete instructions? It appears that...
intelligent front ends based on expert systems and neural networks may provide some solutions for this problem.

Establishing a compatible means for expressing input to a system is no trivial matter either. People do not communicate by command strings, menus, and forms alone. In fact, these methods of expression could be considered as downright unnatural. These techniques have their benefits and, in some cases, they may prove to be the most effective input method. However, improperly used, they add a burden to the user. If conscious thought, however slight, is required to convert information into a required data form, then we should search for a better method of inputting. Direct manipulation interfaces and speech input are offered as productive alternatives. Are they always better? When is it appropriate to use them and when are commands or forms more appropriate? What unexpected difficulties can we expect to encounter with these technologies? These are issues we must explore and understand more fully.

It seems at times that speech input is the Holy Grail of user interface technology. But are we being mislead by not fully understanding the problems. Consider the strong differences between communication with today’s computer systems and another knowledgeable person. Are there significant factors which will make speech input inappropriate for most interaction? It is interesting to think about the differences between giving a stranger directions to a place across town and explaining a new idea to a colleague. The level of feedback and the mutual frame of reference are critical factors affecting communication, perception, and understanding. However, the technological advances in knowledge systems, pattern recognition, and hardware may result in a significant breakthrough, allowing the computer to function as a knowledgeable partner. Until such breakthroughs are achieved, we can learn how to build better user interfaces with current tools and capability by understanding the additional support and capability required for such advanced technology to be truly usable.

FUNCTIONALITY

At first glance, direct manipulation as provided by systems such as the Macintosh appears to be a very natural means of specifying desired actions and operations. However, a number of experienced computer users feel that such interfaces are relatively limited and do not provide access to the power and complexity available through command interfaces. Are direct manipulation interfaces really kid stuff? Or are they means for extending access to functionality without requiring lengthy training and in-depth system expertise? What are their drawbacks and benefits?

While some users may exult in being system gurus, making a system usable implies the elimination of arcane expertise. It is not only necessary that the average user understands how to invoke and apply a given function, but it is also necessary that doing so is convenient and practical. The conflicts between system requirements for simplicity in use and power in application are not easily resolved. Where are the bottom-lines where trade-offs have to be made and where is there need for additional innovation in user interface design?

Expert and goal-directed systems may also play a significant role in providing access to functionality by assisting the user in determining what techniques are applicable and how they should be applied. This leaves open the conjecture that the user may someday be able to simply specify the goals and let the system do all the work in getting there.

OUTPUT/PRESENTATION

Calculation and analysis does not result in new information—just new data. Before it can become information, the data must be understood by the user, placed into context, and related to other relevant knowledge. The first act in making this happen is perception. Computer graphics provides an excellent means of presenting certain types of data so that it is easily understood. But not all data lends itself to graphical interpretation. Also, quite a bit of information is transient, that is, meaningful only in the current temporal context. Making a system usable requires that the information required by the user is not only available but that access to it is either immediate or obvious and convenient. However, most software designers are not familiar with the art of presentation. Understanding the perceptual processes can make presentation more of a science and less of an art.

More critical for usability are the issues of feedback and control. With the increased power provided by personal computers, researchers are no longer measuring response times to determine if a system is usable but are looking at the semantic level of feedback provided to the user. Increasing the level of semantic feedback can reduce the cognitive distance between presented data and understood information. Such techniques, which are critical to direct manipulation interfaces, increase usability by eliminating interpretive steps and providing support for WYSIWYG (What You See Is What You Get) interfaces. But they may also require substantial changes in the design and support of information systems.

OTHER CONSIDERATIONS

Other considerations which are critical to the usability of a Corporate Information System are related to organizational and social issues. A system implies organization. How can organizations be structured to support and utilize information systems better?

Motivation and desire to use a system are also important concerns. With the autonomy provided by personal computers and the insidious nature of the individual, subversion of policy to avoid unpleasant activities can destroy the cohesiveness of an integrated Corporate Information System. The success of a system may require regular access and use by a significant portion of users so that information may be adequately shared. If access to or use of a system is sufficiently difficult, however, users will find other alternatives for managing information regardless of corporate policy. As such, usability as perceived by the individual may be critical for the success of a fully integrated Corporate Information System.
The five sessions that constitute the Hardware Directions track provide an opportunity to gauge some of the shapes of computing hardware. Some of these shapes of the future are currently under active development; some are still in laboratories, where they are a gleam in an inventor's eye. All help to define the shape of the future.

As information density and throughput requirements continue to escalate, data path bandwidths must expand. The very large information content of beams of light represents an attractive possibility for the use of data paths of large information capacity that can be closely spaced in three-dimensional space. The incorporation of these ideas in hardware constitutes a major theme of this track. One session, Current Developments in Optical Computing, presents two papers from academic research laboratories and one from industry. The "Optical Pattern Recognition" paper discusses the application of optical computing techniques in the area of pattern recognition. "Optoelectronic Programmable Logic Arrays" outlines the successes in wedding optical computing techniques with an exciting parallel architectural concept. The third paper in this session discusses an implementation of ideas behind such neural computing concepts as architectures adaptive to a variety of fields including optical computing. This session will appeal to many technically oriented persons, especially those with interests in computer architecture or neural ideas.

Data storage using optical techniques is the basis of another session, Optical Storage Survey: Market/Technology/Product. The catchword is OD3, optical digital data disks. Representatives of the OD3 industry present and discuss the status of key issues in the optical storage market. Eleven man-years and two million dollars of effort have been expended to date in this area to develop industry standards. Presenters from four of the leading OD3 companies discuss the status of standards and related problems, and the state of the hardware art is addressed from a number of exciting viewpoints. This session should be of interest to a large number of persons, and readers need no technical expertise.

The third session having an optical theme is database-oriented. The CD-ROM and CD-Interactive session is a panel discussion on the topic of CD-ROM, a standardized file format for very large microcomputer-based distributed databases. CD-ROM and a subset, CD-Interactive, databases are being marketed to businesses, libraries, and other specialized users needing up to a 500-megabyte database capability.

Another direction of interest is special-purpose computing. Interesting descriptions and progress reports on a representative and very diverse sample of special-purpose computer architectures are the subject of the Special Architectures and their Applications session. Technically minded persons will find presentations on such state-of-the-future systems ideas
as advanced multiprocessor parallel machines, a pyramid of massively parallel processor planes, hardware for logic machines, and an application of Petri-net ideas for distributed decision making.

Lest all the progress delineated in the four sessions described above induce a certain euphoria, Gene Amdahl presents some sobering thoughts on performance limitations in inter-processor communication that have given pause to some parallel computer architects. In this featured session, Dr. Amdahl discusses these limitations in respect to one well-known architecture, the Hypercube and other pauses for thought are indicated by the relatively small performance advantage to date offered by gallium arsenide technology.