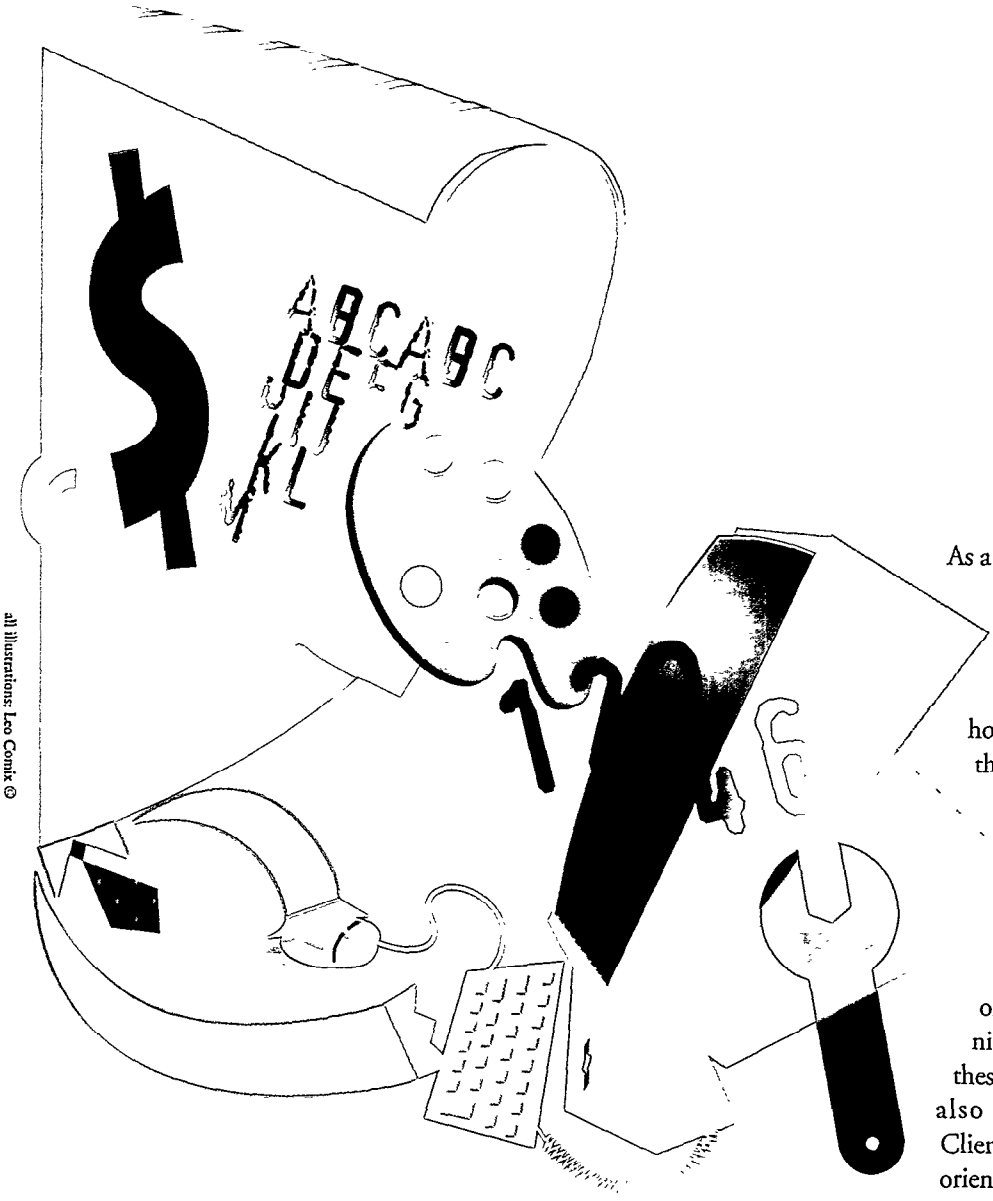
SUSAN DRAY

The Importance of Designing Usable Systems



all illustrations: Leo Comix ©

As a consultant, I have had the opportunity to see how a lot of different organizations accomplish our kind of work. I see how they succeed, and (more often) how they struggle and even fail. And the thing that is causing so many of the problems they face is change. It is almost a truism today that Information Systems (I/S) is changing dramatically, and along with it, the roles and skills of I/S professionals. Many companies are trying hard to adjust to these changes in real time, as they are also attempting major design, Client/Server development, Object-oriented design, in a climate of increasing cost-consciousness and staff cuts.

In such a climate, I/S must scrutinize every expense and every activity. Therefore, it is more important than ever to make sure that we communicate clearly the importance of the User Interface, and find practical, cost-effective ways to make systems more usable.

The following is adapted from a White Paper initially written for a client to help their internal UI group to get buy-in from their management. The happy outcome in the case was that their senior management team became major backers of the work.

What is the User Interface?

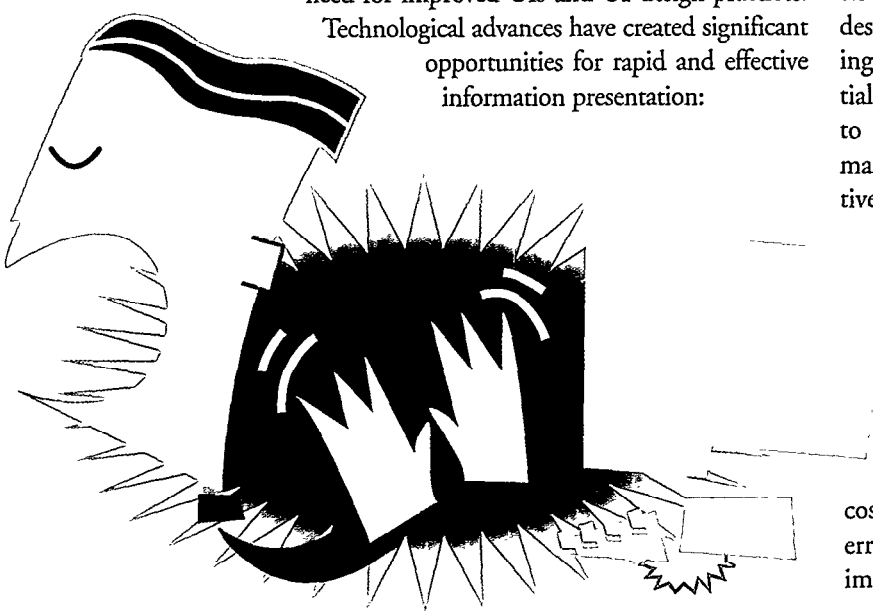
Developers often see the functionality of a system as separate from the UI, with the UI as an add-on. Users, however, do not typically make distinctions between the underlying functionality and the way it is presented in the UI. To users, the UI is the system. Therefore, if the UI is usable, they will see the entire system as usable.

User interface is often thought of as referring only to how screens look. But because users see the UI as the system, this is too narrow a definition. A broader definition of UI includes all aspects of the system design that influence the interaction between the user and the system. It is not simply the screens that the user sees, although these are certainly part of the UI. The UI is made up of everything that the user experiences, sees and does with the computer system. This includes:

- the match with the tasks of the user
- the metaphor that is used (e.g., the desktop, etc.)
- the controls and their behaviors
- navigation within and flow between screens
- integration among different applications
- the visual design of the screens

Technology and Business Trends

Recent developments in technology and the business environment have dramatically increased the need for improved UIs and UI design practices. Technological advances have created significant opportunities for rapid and effective information presentation:



- Networked and distributed systems allow access to information across an enterprise. The day is coming when everyone will be linked together.
- Greater memory and faster processing are available for ever decreasing costs.
- More people have access to computing power. A recent Gallup poll found that 2/3 of Windows users work with 5 or more programs at once, and many use 10 or more in a single day.

The technology now exists for improved UI design. However, new interface technologies alone do not produce usable interfaces. Graphical user interfaces (GUIs), for example, are not intrinsically more usable than traditional character-based user interfaces (CUIs), and can, in fact, be far less usable if they are not designed correctly.

Not surprisingly, the UI represents an increasingly large portion of the investment in I/T. GUIs require a significant portion of total code for an application. Recent data suggest that:

- the user interface is 47% to 60% of the lines of code [1]
- a GUI is minimally 29% of the software development project budget [2]
- a GUI may take as much as 40% of the development effort [3]

Because the UI is the user's key to the functionality of the underlying system, poorly designed UI can be the limiting factor preventing a system from fulfilling its functional potential. Companies which do not design usable UIs to maximize the benefits that the technology makes possible will be at an increased competitive disadvantage.

Changes in the relative cost of technology and of human capital are also pushing for a greater emphasis on UI. In the business environment, at the same time that the cost of technology is going down, the cost of human capital is going up. Therefore, investments in technology which help reduce the human costs, in terms of training, task complexity, error recovery, etc., will have a significant impact on the bottom line. With a common

"look and feel," training can be reduced, and can focus on teaching the new business processes rather than simply the new system. Well-designed UI plays the major role in achieving these results.

Businesses are facing a continually escalating emphasis on customer service. This requires that employees be able to respond flexibly to the customer's information needs. In turn, this means that users must be able to use the "system" in an increasingly dynamic fashion. UI must support the user in meeting these demands.

Substantial bottom line impacts result from attention to usability through user-centered design, including such things as improved efficiency, reduced training time, reduced system maintenance costs after implementation, fuller utilization of system functionality, and others.

Failure to properly consider the user interface can also impact the bottom line. Examples of UI problems defeating major system development projects are common [4]. For example:

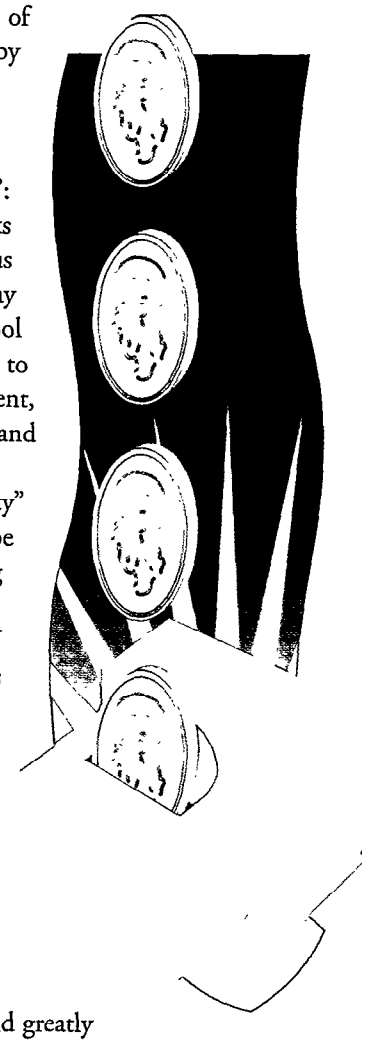
- An insurance company invested $3 million in an application to be used by independent agents to support them in selling this company's products. However, agents simply refused to use the application, because the interface was "unlearnable and unusable."

- A financial services company had to scrap an application it had developed, when, shortly before implementation, developers doing a User Acceptance test found a fatal flaw in their assumptions about how data would be entered. By this time, it was too late to change the underlying structure, and the application never implemented.

- In a Customer Service organization, training on the system took six months, but employees typically had a tenure of only 18 months in this department.

- Extensive and expensive functionality in a Human Resources system was not used at all because users forgot how to access it a mere week after training.

At the same time, users' expectations have changed. They have seen what is possible in commercial applications which are "user-friendly," and they want similar kinds of software to make their jobs easier by reducing cognitive demands.



Designing Usable Systems

Well-designed systems are "usable": They work the way the user thinks they should and let the user focus on the task without having to pay attention to the technology tool itself. Usable systems are easy to learn, remember and use, efficient, and designed to minimize errors and to promote user satisfaction.

But, this so-called "usability" does not just happen. It needs to be designed in. Success in designing usable UIs requires awareness, commitment, the application of appropriate user-centered tools and processes.

Benefits of Good UI Design

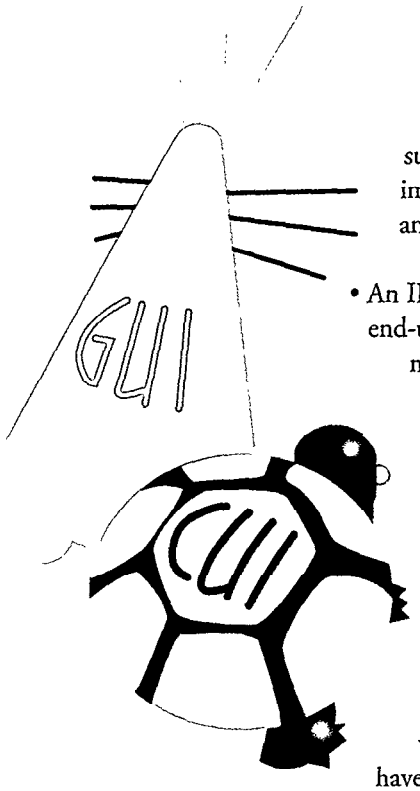
There are important benefits of usable UIs for the business. These include:

- reduced errors
- lower support costs
- lower initial training costs, and greatly reduced retraining
- less productivity loss when the system is introduced, and more rapid recovery
- more focus on tasks to be done, rather than on the technology tool
- lower turnover and better morale
- reduced rework to meet user requirements
- high transfer of skills across applications, further reducing training needs
- fuller utilization of system functionality
- higher service quality
- higher customer satisfaction.

Although some of these benefits are traditionally considered "soft," there are also numerous documented bottom line impacts of usable systems. Studies have consistently shown that well-designed, "usable" user interfaces can improve productivity significantly. For instance:

- One study at NCR showed a 25% increase in throughput with an additional 25% decrease in errors resulting from redesign of screens to follow basic principles of good design such as those cited above [11].

- In another company, business representatives did a cost-benefit analysis for a new system and estimated that a well-designed GUI front end had an Internal Rate of Return of 32%. This was realized through a 35% reduction in training, a 30% reduction in supervisory time, and improved productivity, among other things [12].



- An IBM study showed that end-user training for an internal system with a well-designed front-end was one hour, as compared to one week for similar systems without such a front-end [4].

- While GUIs are not automatically more usable than CUIs, well-designed GUIs do have the potential for significant benefits for both novices and experts. Studies carried out at the Swiss Federal Institute of Technology in 1992 [14] showed that expert GUI users are over 50% faster than expert CUI users for the same tasks.

User-centered design methods also have been shown to have quantifiable benefits. Clearly, anything which makes it easier to identify and fix errors early has a significant impact on the cost of the system. User-centered design methods, such as evaluating paper prototypes with users, improve communication between the business and I/T early on, so as to reduce later redesign costs. Better requirements definition and early agreement about the map of task to the UI also naturally lead to better estimates, and simultaneously builds "partnership" and "buy-in." In addition, these activities save time overall in software development, in addition to increasing quality.

This column presents a rationale for increasing an organization's efforts to improve the design of the user interface. Usability must be designed in from the beginning through good UI design principles and user-centered design methods. For many organizations, this requires changes in system development practice along with significantly greater user involvement. However, these changes will serve to establish an environment which promotes standard, effective, and consistent user interface design.

BUSINESS COLUMN EDITOR
Susan Dray
Dray & Associates
2115 Kenwood Parkway
Minneapolis, MN 55405
Phone: +1 (612) 377-1980
Fax: +1 (612) 377-0363
email: dray.chi@xerox.com
or sdray@mr.net

References

[1] MacIntyre F., Estep, K. & Sieburth (1990) Cost of user-friendly programming. Journal of Forth Application and Research, 6(2), 103-115.

[2] Rosenberg, D. (1989) A cost-benefit analysis for corporate user interface standards: What price to pay for a consistent look and feel? In J. Nielsen, ed. Coordinating User Interfaces for Consistency. Boston, MA: Academic Press.

[3] Wixon, D. & Jones, S. (1992) Usability for fun and profit: A case study of the design of the DEC RALLY version 2. Internal Report, Digital Equipment Corporation.

[4] Bias, R. & Mayhew, D., eds. (1994) Cost-justifying Usability. Boston, MA: Academic Press.

[5] Gallaway, G. (1981) Response times to user activities in interactive man/machine computer systems. NCR Technical report HFP 81-25.

[6] Dray, S. & Karat, C-M. (1994) Human Factors Cost Justification for an internal development project. in R. Bias & D. Mayhew, eds. Cost-justifying Usability. Boston, MA: Academic Press.

[7] Rauterberg, M. (1992) An empirical comparison of menu-selection (CUI) and desktop (GUI) computer programs carried out by beginners and experts. Behaviour and Information Technology, 11(4), 227-236.