User-Centered GUI Standards Design: A Case Study

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ABSTRACT Many organizations are aware of the benefits of standardizing their GUIs and go to the effort of creating their own standards. However, oftentimes the standards languish on the desk of human factors specialists, and fail to impact those who actually design and develop software user interfaces. Best practice, as reported in the literature, includes involving the end user, understanding the user's needs, providing flexibility, and allowing for evolution. This case study describes how a project to create GUI standards at a large telecommunications corporation attempted to follow these guidelines, while working under a tight schedule.

KEY WORDS standards, GUI standards, user-centered design, case study

1. INTRODUCTION

The Ameritech human factors group has been in existence since 1989. Ameritech provides communications and information services, mainly to customers in the midwestern United States, with growth into national and international venues. Services include traditional telephony (local and long distance), cellular telephone service, cable television, home security, teleconferencing, business communications, etc. Ameritech was originally part of the AT&T Bell

System, and was created when AT&T was divested in 1984.

The group's goal is to ensure that all products and services receive appropriate human factors support. Activities include participation in ideation; creating conceptual demonstrations; and iterative prototyping, testing and redesign throughout product/system development. Members of the group participate in development teams; work to resolve conflicts among requirements, usability and implementation constraints;

and follow through with field testing. (See Lund, 1994, for a more detailed description of Ameritech's human factors department.)

Partly as a result of historical factors, including divestiture, Ameritech internal systems and software are very diverse across business units. As one example, in 1996, six different voice messaging systems were offered under the Ameritech brand. In Fall, 1995, the company created a corporate-wide umbrella organization, Technology Solutions (TS), to tackle the diversity problem. TS was formed to first develop and then communicate a unified standard across information systems, including environments, architecture and the software development lifecycle. In early 1996, Human Factors was invited to flesh out the usability-related portions of the software development standards and to otherwise become involved in the standardization program.

Under the banner of the Ameritech Look & Feel Initiative (ALFI), a group from human factors worked on three different efforts to launch the initiative. One was the creation and announcement of a Look & Feel Policy. The policy stated that the Human Factors group defines, publishes and maintains Ameritech's look and feel for all interactive systems. It also stated that all systems sponsored by the corporate Information Systems unit were required to use the Look & Feel process. The second effort was the enhancement of the existing software lifecycle process to include usability. The Look & Feel process document laid out usability efforts and signoffs that were to be part of any software development effort, whether internal or externally staffed. The final effort was directed toward supplementing the existing general graphical user interface guidelines with more platform- and application-specific standards. The guidelines had originally been published in 1992. They cover three different GUI environments - Apple, Motif and Windows 3.x - and discuss general principles of design. There was no attempt to focus the guidelines on typical communications software. They were and continue to be publicly available on Ameritech's web site (<http://www.ameritech.com/news/testtown/library/standard>).

It is the design and creation of the new GUI guidelines which is the focus of the current paper. One of our first steps was to review some of the existing literature on the development of style guides and standards, and on the role standards can play in the system development process.

Hopper, Hambrose and Kanevsky (1996) describe the development of a GUI interface to create a comprehensive, integrated computing environment for financial consultants and other professionals, most of whom were not computer literate. Aside from the design challenge itself, they were working with a big development team, a large portion of whom came from a mainframe environment with no GUI development experience. Faced with a demand for user interface standards, the group initially produced guidelines which "didn't go beyond the UI guidelines already available from software manufacturers and industry experts" (p. 491). Furthermore, the guidelines "...failed. Standards spoke of what a control was, but offered little assistance in how a control was to be used." (p. 492) A second standards document incorporated more corporate standards which promoted the company's look and feel. The team found, however, that the document needed amendments and updates on a relatively frequent basis.

Gale (1996) outlines what a style guide typically contains, and the benefits of using the guide from the perspective of end users, developers and business. He also lists a number of reasons why style guides fail. These include:

- a. The document is difficult to use, often as a result of sheer length.
- b. The document is never updated.
- c. Little consideration is given to how the guide is introduced into the organization.
- d. Often, the release of the guide is seen as solving usability problems, and no further action is needed.
- e. The guide is perceived as moving the responsibility for usability out of the hands of the developers.
- f. Developers and users are not involved in creating the content.
- g. The guide does not explain how it is to be used in practice.

Gale goes on to describe a development approach used in his organization characterized as "collaborative". This approach involves engaging the potential end users of the guide in its creation, providing support materials and training when the document is introduced, educating the users on the rationale, and allowing evolution. In addition, the author suggests going beyond the document by providing such things as checklists for conformity, quick reference cards, interactive demonstrations, competitions to spot the deliberate mistakes in user interface designs, and source code, custom controls and property tables for sharing.

Miller (1996) also discusses pitfalls and successes related to standards. An initial attempt combined standards with information on the design and implementation of usability engineering within the organization. This approach appeared to overwhelm developers with information, was difficult to apply to specific situations, and did not map well with the realities of project development. A second approach involved the development of a prototypical model application which was used to show what an application would look like if the standards were implemented. Because the prototype did not apply well to the broad range of projects the group was involved with, it has since evolved to skeletal framework that a range of design options can be plugged into to create prototypes. Other activities including educating developers, and being closely involved with the developers during a project. Miller's group was working in an environment where conformity was enforced by budgeting. Key activities, including usability tasks, had to be completed in each stage before funding was approved for the next stage.

These reports paint a clear picture of an approach to developing and integrating standards into an organization that will maximize the probability of success. Not surprisingly, a key factor is involving the end user during development. Another key factor is getting to know the users' needs by working along with them to a common goal. It is also clear that standards and processes need to be flexible to meet the resource demands placed on projects, and that they need to

evolve as projects become more varied and complex, and as technology and styles change.

Unfortunately, as often occurs, there was a gap between what best practice prescribes, and what was feasible within allotted resources and time. For this project, we were faced with a very short development time. The organization-wide standardization effort was well underway before the human factors group became involved. The older GUI standards were still being used, and were causing confusion. The time to impact upcoming projects was rapidly approaching. It was important to get a new version of the standards published quickly.

Our approach was to view the short development time as a "feature". Clearly, there was not enough time to involve end users to the extent we would have liked, nor to create an encompassing set of standards. We decided to publish a basic set of standards, and to encourage the end users to evolve and grow the standards with us. However, we were aware that it would be very detrimental to completely exclude end-user input during initial development.

2. METHODOLOGY

A consultant (the second author) was hired to facilitate development of the standards in conjunction with members of the human factors group. A group leader from the human factors group (the first author) was in charge of the project and acted as a liaison to the consultant. The liaison assigned human factors' members to help with various portions of the standards development as small blocks of time became available in their schedules. This helped to make standards development a group effort, at least within the human factors group.

Work was started in mid-May of 1996 with the goal of releasing the standards document around the end of August. The first step was for the consultant to become familiar with the types of applications and interfaces currently being used and developed at Ameritech. She looked at the multi-platform guidelines that were available on the Ameritech Web site. Decisions had recently been made at Ameritech concerning platform standards for future application development. Using this information, the consultant and the liaison

formulated several possible approaches, based on prior experiences as well as information from the existing literature.

2.1 Collecting Initial Input

Early on, a meeting was set up with the human factors group and the consultant. During this meeting, the group was asked for thoughts on:

- the use of the guidelines
- tensions between the needs of various groups and the structure and content of the standards document
- ways to encourage development groups to use the guidelines
- barriers to developers using guidelines
- good structures of guidelines
- providing different ways to access guideline information
- electronic versus paper guidelines
- support for legacy systems
- evolution of guidelines
- evaluating the impact of guidelines
- what constitutes “look and feel”.

The consultant and the liaison also interviewed some Ameritech software developers about their development process for interfaces. During the interview, the developers expressed their opinions about what would make a standards document useful for them. In return for this information, the consultant and liaison provided a heuristic review of their prototype. This also provided information as to the type of guidelines that were needed.

The heuristic evaluation revealed the following problems:

- redundant menu terminology
- lengthy menus containing seldom or never-used functionality
- inconsistent button order
- inefficient grouping of text entry boxes
- inconsistent use of button vs. menu vs. toolbar icon
- inconsistencies in placing results of searches (main windows vs. dialog window).

Based on this example, our discussion with the human factors group, and collective experience, we

classified the types of guideline and heuristic information needed to provide solutions to GUI development problems as:

- general interface guidelines
- a user task analysis or early functionality testing
- platform-specific interface guidelines
- corporate “look and feel” guidelines.

Our specific goal, however, was to focus on platform-specific and corporate guidelines. We felt that general interface guidelines are readily available from any number of sources, and were perceived by developers, in general, as not pertinent to “getting the job done.”

2.2 Requirements for the Standards

We collated the information collected from the developers and the human factors group into requirements that the standards document had to meet. They were:

- The main use of the standards will be for design with conformance support as a secondary use.
- The main users of the standards document will be developers and human factors professionals.
- The standards document should contain guidelines for signature (look and feel), platform and operating-system specific guidelines as well as more general interface guidelines.
- Users of the standards document should be able to quickly access needed information.
- The document must be easy to maintain.
- The document should provide for easy evolution.
- The document must be accessible by those without access to the Ameritech intranet, as well as to those with access.
- Developers and human factors professionals should be able to contribute “best practices” easily and quickly.
- The document must serve both internal users and, eventually, external users.

To meet the requirement for easy maintenance, we determined that there would be one version of the standards document that would be kept current. Any other formats would have to be produced from the maintained format. Given that all of the UI guidelines published by the human factors group are accessible on the Web, the Web was chosen as the primary

publication site. An added advantage of a Web version is that it facilitates collecting feedback and input from users. However, because not all employees have access to the intranet, and because many prefer a paper version, a printed version needed to be produced as well. This necessitated finding a way for paper users to be kept up to date on changes made to the intranet version.

Because the initial version would include Ameritech signature, an edited version would need to be created for public release. Thus, an additional consideration was easy generation of an alternative, external version.

Developers do not want to spend time reading many pages of text in order to answer a simple question. However, we wanted to provide easy access to in-depth information if it was so desired. Thus, the document would contain guidelines at the control level (e.g., menu design), at the task level (e.g., searching for a keyed record in a database), and at the level of general principles (e.g., screen layout). Links would be provided to small portions of more detailed information, as well as links to other relevant portions. Current best practices were to be used as illustrations.

To provide developers with significant benefits at a low cost in effort, we decided to produce templates for them to use in producing interfaces. Because the corporation uses four different development languages, the ultimate goal is to produce multiple templates and allow all developers access to the associated reusable source code.

Based on the need for fast turnaround, we prioritized what would appear in the first deliverable. Because the design of a Web-based version posed hard design questions, initial attention was focused there. We concluded that it would be more profitable to do the Web design first, keeping in mind how the paper document could be generated from this, than the other way around. Although the eventual goal was to have reusable code along with the standards document, initially the document would include text and static examples. Dynamic examples would be added later, followed by reusable code for each of the different development environments.

2.3 Design and Implementation

At this point, the "to do" list looked about like this:

- Develop control guidelines
- Collect possible examples for "best practices"
- Evaluate the chosen examples
- Put together a "task" list based on current applications
- Design the look of the intranet document.

The control guidelines were written by a contractor who was working in the human factors group at Ameritech. She and the consultant worked together to decide upon a style that seemed easy to read and quickly locate information. They developed a template for control information and refined it by writing the guidelines and descriptions for several very different controls. The contractor then worked in the time blocks she had available producing the guidelines and descriptions for the rest of the controls. One member of the human factors group worked on collecting examples of "best practices". The human factors group was in the process of doing some evaluations on different products at the time and many of their redesigns also became examples. The consultant oversaw the work on controls and worked on developing a possible task list. The task list was produced by noting commonalities and frequently-used fields, buttons and menus from the examples collected by the human factors group. Using this information, a template was designed that could be used to describe tasks and guidelines for them. As with the controls, this template was developed iteratively.

The consultant brought in a programmer to help with the actual intranet development. They came up with several possible designs based on existing information, including guidelines published on the Web by Ameritech (Schumacher, 1996). The Ameritech requirements for the document and information from the consultant, based on Web evaluations that she had just completed were also factored into the initial designs. Several designs were prototyped and feedback was gathered from the human factors group.

A more advanced prototype was generated and an evaluation was done. Draft versions of guidelines about the controls were circulated at Ameritech for feedback. Example screens were also circulated to the human factors members. They were asked to comment on the

layout of these screens and how they related to other implementations within the company.

A usability evaluation was conducted with potential users of the standards document. One part of the evaluation focused on collecting terminology appropriate to describe the tasks we were using. For the most part, developers discussed the tasks in terms of the end-user task being done, and not in terms of the controls used or the underlying program function. Participants were also asked to look for answers to six different types of questions using the prototype. Feedback was collected on navigation, expectations about where information would be found. We also noted how much instruction was necessary for them to use the Web version of the standards document. The basic design was refined based on the collected information. The sessions also served to get buy-in from potential users.

3. VERSION 1.0

The final format design made use of frames. Normally, Web usability guidelines suggest avoiding frames, due to variation in net browsers (e.g., Deitweiler and Omanson, 1996). However, because Ameritech standards direct the use of Netscape 3.0 or Explorer 3.0 (or higher) versions for employees, there was justification for assuming that frames would display properly on all users' screens. Furthermore, it appeared that their use would facilitate navigation. An example of the use of frames as done throughout the document is shown in Figure 1. Figure 1 shows the Introduction section, which describes the structure and use of the document. The main frame (the largest) contains the contents of the Web page currently being viewed. The frame on the left side contains the table of contents, which enables users to quickly navigate to another section. The table of contents lists the general sections, a task section and a control section. The task

Figure 1: A Sample Screen from the Standards Document

and control sections can be expanded to list the individual sections, much like many present day file managers. Users can also view only the contributions by expanding the "show notes" section and selecting the individual entries to view.

The menu items are paired with "option buttons" that show what is currently selected and provide feedback about which section a user is viewing. The frame in the bottom of the screen contains functionality that exists on all pages on the Web site. Buttons for "print," "e-mail," "download" and "search" are displayed here. "Print" allows the user to print the entire document, rather than having to print each individual page separately. The "e-mail" button allows users to send an e-mail message to the standards maintainer. A "post notes" button appears at the top of each page and allows users to make contributions to individual pages in the form of comments that can be viewed by all future users. The notes area will also be used to post notices about revisions to individual sections. The first version included numerous graphics, as well as several executables in Visual Basic. The "download" button on the pages takes users to a page which serves as a menu of downloadable controls and tasks. The page contains a list of all controls and tasks available. The user can choose to see a screen "snapshot" of the item and/or download the executable file and, eventually, source code for the all executables. Individual executables can also be viewed and downloaded as they are encountered in the document.

To facilitate rapid access to information, a search function that returns a list of places where the entered term is found was included as a button in the lower frame. Because users are not always familiar with the "correct" terminology, a terminology cross-reference section was included. The section supplied other terms commonly used (synonyms). For example, what many interface designers refer to as a "radio button" is called an "option button" by Microsoft. By including this alternate term in the terminology section along with the common term, the reference appears when users search for "radio button."

The templates for the guidelines were designed so that users could quickly locate the desired type of information within each control, task, or general

section. A standard set of links was provided at the top of each control or task. For example, every control contains "Proper Use", "Behavior", "Guidelines", "Used By", "Related Topics", and "Show Notes" as standard links at the beginning of the page. These links take the user directly to that section of the page. Rather than embed many links within each individual section for the first version, all external links were placed in the "used by" and "related to" sections. This was done for two reasons: 1) to avoid adding complexity, and 2) because the proportion of users who would access the document from paper as opposed to accessing it on-line was not clear. Keeping the links compacted in two sections helps users reading the paper document understand the links. The "used by" section will eventually link to all tasks in which the control is used to allow users to see examples incorporating the control.

Task pages had similar links, but contained a "Uses" link. This link allows users to access information about a component control and, if desired, view any particular control for more information. Using these links also makes it possible to limit the amount of scrolling users need to do to view a specific section of the controls and tasks. The sections on general guidelines contain direct jumps to specific information appropriate to the individual section.

Users need information about enhancements and updates. From the beginning, the developer created a "development page" to communicate what had been done. Because this technique proved so effective during development, we decided this was a good approach to incorporate into the final version. It was modified to say "what's new" and it is used by the maintainer of the document to note change information. In addition, each page was implemented so that the date it is posted on the Web server appears automatically on the top of the page. This allows users to see how recently a particular page had been revised.

The document was delivered less than one week later than planned, and was operational at Ameritech the next week.

4. CONCLUSIONS

The challenges we faced were, broadly speaking, threefold: 1) to produce GUI standards that would support designers and developers, be highly usable, and be easy to maintain and evolve, 2) to enhance usability and acceptance through user involvement, and 3) to do so in a short time frame. This required some hard decisions, prioritization of resources and some creativity.

To address challenge 1, the document was carefully designed and prototyped to ensure that it conveyed just the most essential information in an easy-to-find, easy-to-understand way. The use of hypertext on intranet facilitates this goal by allowing the user to unfold detail as needed, to search quickly through the document, to easily contribute content, and to always have the latest version available.

Challenge 2 was addressed by obtaining input from a wide variety of sources, including end-users and human factors specialists. Although these activities could not be done to the depth or breadth ideally desired, we used "fast and cheerful" methods that brought in much good information and raised awareness of the project.

At this time, two months following the publication of the standards, the word is spreading about their availability. A means of counting hits on the Web site was built into the standards document and will be used to monitor access. Although the organization does not enforce the use of standards, human factors members who are on projects involving GUIs are using the standards and working to educate others on the projects about the standards and their use.

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6. NOTES

¹ The second author, Jean Scholtz, was an independent consultant at the time this work was done.

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