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AUTHOR Vanderheiden, Gregg C.
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ABSTRACT

Information systems in public places such as community centers and libraries require some means to provide access to individuals with physical, visual, and, if sound is involved, hearing impairments. This paper proposes a seamless adaptable human interface protocol that would allow users to incrementally modify the command and presentation aspects of the human interface to match their abilities and preferences. The protocol supports multiple control strategies (mouse, keyboard, touchscreen) and presentation forms (standard graphic, large print, voice) simultaneously. In order for the command and control structures to support flexibility and a free flow, a multilevel object-based hierarchy was used. The first implementation of the protocol is in a bibliographic database software package titled Publications, Media and Materials (PMM), which was developed for the Trace Cooperative Electronic Library. Strategies to increase efficiency of access are discussed. Screen displays in various output modes are presented, along with a table listing protocol features for individuals with specific types of disabilities. (JDD)

Use of Multiple Parallel Interface Strategies to Create a Seamless Accessible Interface for Next-Generation Information Systems

Gregg C. Vanderheiden, Ph.D., Director
Trace R&D Center
University of Wisconsin-Madison

Abstract

The next generation of information system is rapidly moving toward touchscreens or pointing devices combined with graphic displays. While these interfaces make the information systems much friendlier for individuals with cognitive disabilities as well as for the general population, they pose significant new barriers for individuals with physical, visual, and, if sound is involved, hearing impairments. Special access software can be used to provide access to personal computers. When these information systems show up in public places, community centers, libraries, etc., however, it is not possible to install individual software to meet individual needs. To provide access to these information systems, a seamless adaptable human interface protocol is proposed which allows users to incrementally modify the command and presentation aspects of the human interface to match their abilities and preferences. A first implementation of the protocol is presented.

Statement of the Problem

The basic objective is to create an interface protocol, including command and control structures, which would support multiple control strategies (mouse, keyboard, touchscreen) and presentation forms (standard graphic, large print, voice) simultaneously. In this fashion, users could mix or match any and all of the control and presentation formats in order to best accommodate their individual needs. While a strictly hierarchical branching structure would achieve this, it also made operation of the system rigid and unnatural. This would cause the system to be unacceptable to commercial parties as a standard interface on mass market products. Thus, the structure also had to be able to support flexibility and a free flow.

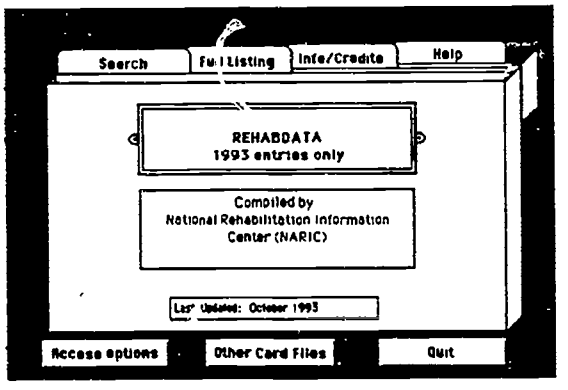
Approach

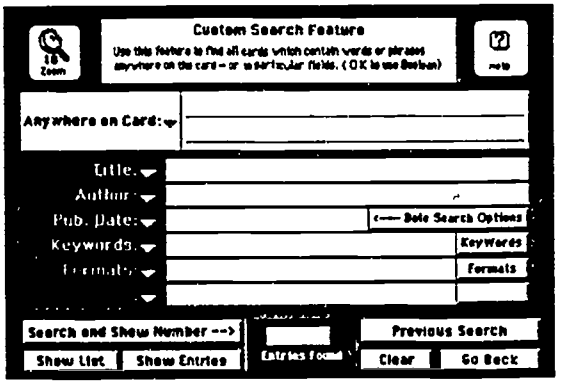
A modified multi-level object-based hierarchy was therefore used. With this structure, the current objects on screen form a context. Using a Tab key or the Control key combined with a letter key, the individual can move around amongst the objects (buttons, fields, etc.) or groups of objects (e.g., a grouping of related buttons). The Space bar and Enter key are used to act on the objects. The Space bar would be used to press buttons and to mark things in a list; the Enter key would function to activate the default button or achieve the same effect as a double-click, depending upon context. Arrow keys would be used to move about within fields. If the voice mode is turned on, the Alt and Control keys can be used with the arrow keys to cause the system to read a letter, word, sentence, paragraph, or the entire text fields, moving either forward or backward.

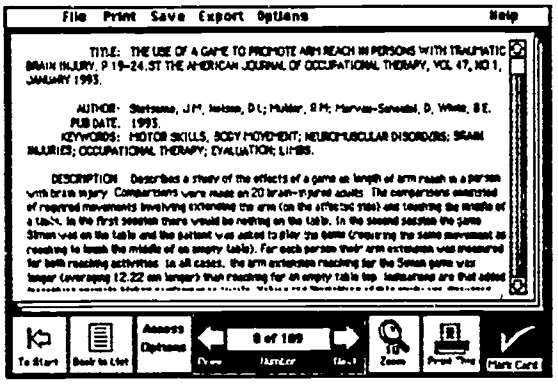
The output options include either standard graphic display, graphic display with larger print in fields where the information changes, voice output, and a large print mode which supports fonts up to 72 point.

The PMM Database Implementation

The first implementation of the protocol is in a bibliographic database software package titled Publications, Media and Materials (PMM). This is a software package which was developed for the Trace Cooperative Electronic Library. The software is compatible with any ProCite or ProCite-compatible bibliographic software (such as EndNote). Figures 1, 2, and 3 show standard graphic screens from the database. The database can be operated using a mouse or can be operated entirely from the keyboard.







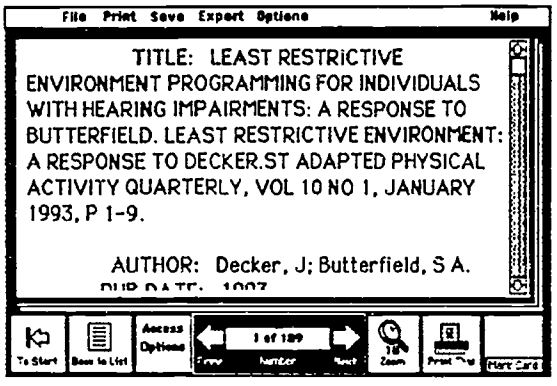
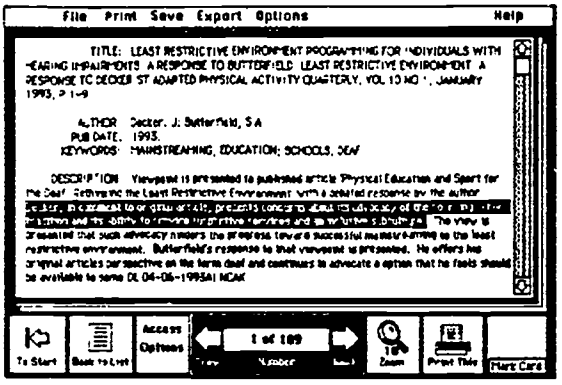


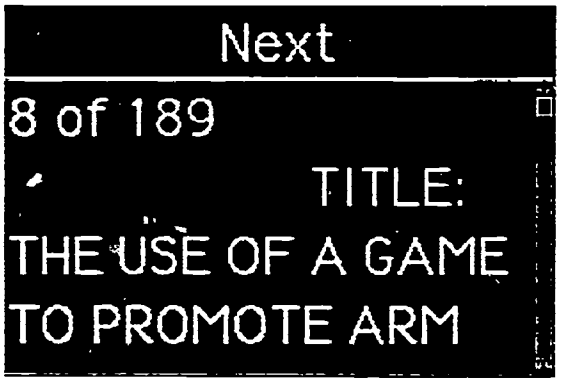
Figure 4 shows the ability of the database to enlarge the text in the data field. For some users, it is unnecessary to enlarge buttons and other controls, since once they have used the database for a short time they can recognize and use the controls without having to enlarge them and use up valuable display space on the screen. However, they need to have the text in the actual data fields enlarged so that they can easily read it.

Figure 5 shows the database in its voice output mode. Using the arrow keys in combination with the Alt and Control keys, the individual is able to highlight letters, words, phrases, sentences, paragraphs, etc., and simultaneously have them read aloud. Similarly, as the individual uses the Tab (or Command-Letter) key to move about on the buttons and fields, the voice output option would read the name of the field or button, along with its state (on, off, etc.). Using the keyboard control mode and this voice output capability, it is possible for individuals who are completely blind to operate the database.

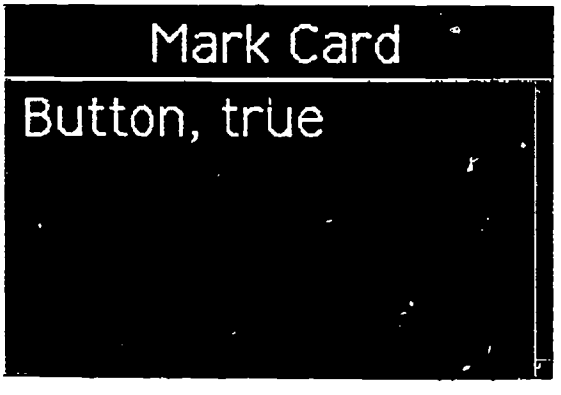
Figure 6 shows the database in its large print mode. In this mode, all of the information is presented in two large fields which can be adjusted in size and font. Their can be adjusted to fill the entire screen, and can present up to a 72-point font.

The top field gives the name of the object (the field, button, screen, etc.). The bottom scrolling field is used to present additional information about the object (e.g., whether a button is on or off) as well as the contents of any field selected. In Figure 6, the individual has tabbed up to the main data field, which is called "Card Text." The text of the field appears in the bottom large print field.





In Figure 7, the individual has tabbed to the button which appears in the bottom right-hand corner of the screen in the normal text mode. This is a button that is used to mark or unmark a particular entry. In this case, you can see from the field that the button is currently turned off. Hitting the Space bar would toggle the button on and off in the large print mode in the same way that hitting the Space bar would toggle the checkmark on and off if the individual had tabbed to the "Mark Card" button (or had used Control-M to jump there). Individuals who were using a mouse would click on the button to mark or unmark the card.



This large print mode has a number of advantages for individuals with severe visual impairments. First, it presents all of the critical information in a very large, high-contrast san serif font. Second, it uses an iso-location strategy for presenting the information to the user; that is, the information is always presented in the same location on the screen. As the individual with low

vision "tabs around" the screen, they do not have to keep searching the screen to try to find out where they are. The information about their location is always presented at the top center of the screen. They also do not have to worry about missing particular buttons or features. By successively hitting the Tab key, each and every button or field on the screen will be presented to them. Once they are familiar with the contents and buttons on the screen, they can jump directly to the items they are interested in by using the Control key along with the first letter of the object (button, field, etc.). If more than one object starts with the same letter, they would simply continue to hold the contro lkey down and hit the letter again until the desired object came up. They can also type multiple letters to instantly call up any item if it shares a common first letter with other objects.

Strategies to Increase Efficiency of Access

In addition to the basic strategies which in themselves provide complete access, there are a number of additional strategies which are incorporated to allow individuals with disabilities to have more efficient access. Whenever an individual is in a list, typing the first letter or letters of an item in the list will cause the highlight to jump to the line or item that begins with those letter(s). The Control-letter function provides a similar jump capability to any object on the screen. In both cases, a minimum-to-distinguish strategy is used which allows the individual to type multiple letters in order to jump directly to the desired item.

In addition, when operating in either the voice output or large print mode, additional context information is provided with some actions. For example, the "Next" arrow button is used to move through the different card entries. Normally, in the large print the individual would tab to the "Next" button and then activate it. They would then have to tab up to the card text field in order to see the title of that next item. In actuality, however, when using the "Next" button in the large print mode, the title of the next entry is automatically displayed in the bottom field along with the count. As a result, the individual can sit on the "Next" button and successively activate it. Each time they do, the bottom field will display the number of the new entry and its title. The individual can then simply use the arrow keys to begin reading any entries of interest.

Conclusion

Although this implementation only demonstrates the technique on a single database, it does provide an interesting opportunity to study the technique while simultaneously providing broad-based consumer access to the Publications, Media and Materials (PMM) database on the Co-Net CD. The technique is now being expanded and implemented on other databases. In addition, its use with touchscreen-based information systems is being explored.

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Gregg C. Vanderheiden, Trace R&D Center, S-151 Waisman Center, 1500 Highland Avenue, Madison WI 53705

User Type/ Characteristics	Features
All users	• Operate using mouse, touchscreen, or from the keyboard, at user option. • Friendly, easy to understand graphical interface. • Ability to have sounds visually depicted for noisy environments or no-sound environments (e.g., libraries). • Zoom data text for easy reading.
Users with... ...manipulation difficulties	• Ability to operate entirely from keyboard. • Print to paper or print to disk.
...somewhat low vision	• Ability to zoom data text, with fonts from 12 point to 48 point. • Operable from keyboard if mouse is difficult to see.
...low vision	• Keyboard operation. • Full-screen large print mode (up to 72 point). • Single focus point information display feature within the large print mode. • Voice output mode.
...blindness	• Operable completely from keyboard. • Full voice feedback mode (does not require screen reading software).
...cognitive/ language impairments	• Easier to understand graphic interface. • Touchscreen capable. • Voice output mode.
...hearing impairments	• Option for all auditory information to be presented visually.