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Abstract

McClellan's Nuclear Radiation Center (MNRC) control console is in the process of being replaced due to spurious scrams, outdated software, and obsolete parts. The intent of the new control console is to eliminate the existing problems by installing a UNIX-based computer system with industry-standard interface software and incorporating human factors during all stages of the graphical user interface (GUI) development and control console design.

Introduction

The current thrust of human-machine interface (HMI) development is headed away from the use of traditional alphanumeric displays and toward the use of advanced or ecologically dynamic graphical interfaces of one form or another; centered on the complexity of the cognitive tasks.

For the MNRC displays, an advanced approach allows the information to be perceived by the user as continuous, real-time interactive displays. This approach is thought to be more feasible, because the relative values will be displayed and the relationships between the values would be immediately apparent, thus allowing for faster accessing and processing of information from the user end. However, real-time continuous effect can be limited by the developer's ability to predict responses from the user and the user's recognition or reference of the information being presented. Consequently, the importance of understanding how the designer and user process and store their information is fundamental to design of GUIs in addition to such attributes as vivid colors, animation, icon reference, format, etc. All of these factors become an essential part in promoting a continuous effect.

What follows is a brief description of some of the guidelines used in developing the MNRC's GUIs as continuous, real-time displays.

User Parameters

Several criteria must be met in designing effective advanced GUIs. One crucial aspect is the user's representational system (visual, auditory and kinesthetic).

Most of us use all three primary sensors, *visual, auditory and kinesthetic* to gather information, but we each process and store information differently based on our preference to the sensor modality we tend to favorite most (*primary representational system (PRS)*). Therefore, some of us access and store our information primarily visually first, some auditorially and others kinesthetically (through touch and feel), which, in turn, establishes our information processing patterns and strategies, and external to internal (and subsequently vice versa) experiential language representation.

Also, most GUIs developers are 20 to 30 years of age, having younger eyes, better hearing, faster responses, but limited interactive experience; hence, modeling the system through their eyes, feelings, or sounds of experience. Based then on the auditory and kinesthetic MNRC user preferences, their physical attributes , e.g. age, gender, etc., and basic human factors guidelines, specific criteria were identified in the design of the advanced GUIs.. For example:

- A light-blue background is selected, since both auditories and kinesthetics prefer blue backgrounds, where visuals are more concerned more with clarity.
- Too many colors and text can clutter up the screen, increasing search times especially for the auditories and kinesthetics; therefore, no more than five to six colors are used per display.
- Color schemes are saturated earth-tones (e.g., brown, blue-green, red-brown) favoring the kinesthetics, and acceptable to the other two states.
- Icons and symbols are used whenever possible making search time and pattern recognition quicker especially for the auditories and kinesthetics.
- The information is dynamic and/or animated which is consequential for the kinesthetics and helpful to the auditories.
- A general problem inherent to all computerized displays is the "keyhole" effect causing information to be placed in close proximity to each other and not easily identifiable. To overcome this problem, pop-up and pull-down menus are incorporated for accessibility to secondary information from the main display.
- Auditory feedback from the computer is set low to mid range since many of the users are males over the age of 40, who have a tendency to lose the high frequency tones.
- The number of alarms that are introduced by the computer during one event is crucial for visuals. These individuals have a tendency to physically or mental turn off sounds when disseminating large amounts of information.

- Since MNRC users have been identified as both left and right handed the input device should be located directly in front of the monitor(s), placing the keyboards on retractable drawers which would slide under the control console. This prevents the left-handed individuals from having to adapt to a task that is normally set up for the right-handed individual.
- Avoidance of certain color combinations such as red on blue or cyan and vice verse, and red on a black reduce or eliminate eye fatigue and eye strain.

All of the above and more, are the framework in generating displays that are more in line as continuous, real-time interactive displays for quick and easy retrieval and process of information, with the probability of reducing inherent errors.

Conclusion

Well-designed graphical displays that have a good use of color, symbology, dynamics, animations, etc. and implement such techniques as advanced cognitive modeling, are undoubtedly extremely powerful in disseminating information. But proceeding with caution is still necessary, since of such complex displays is still in the earlier stages of scientific research