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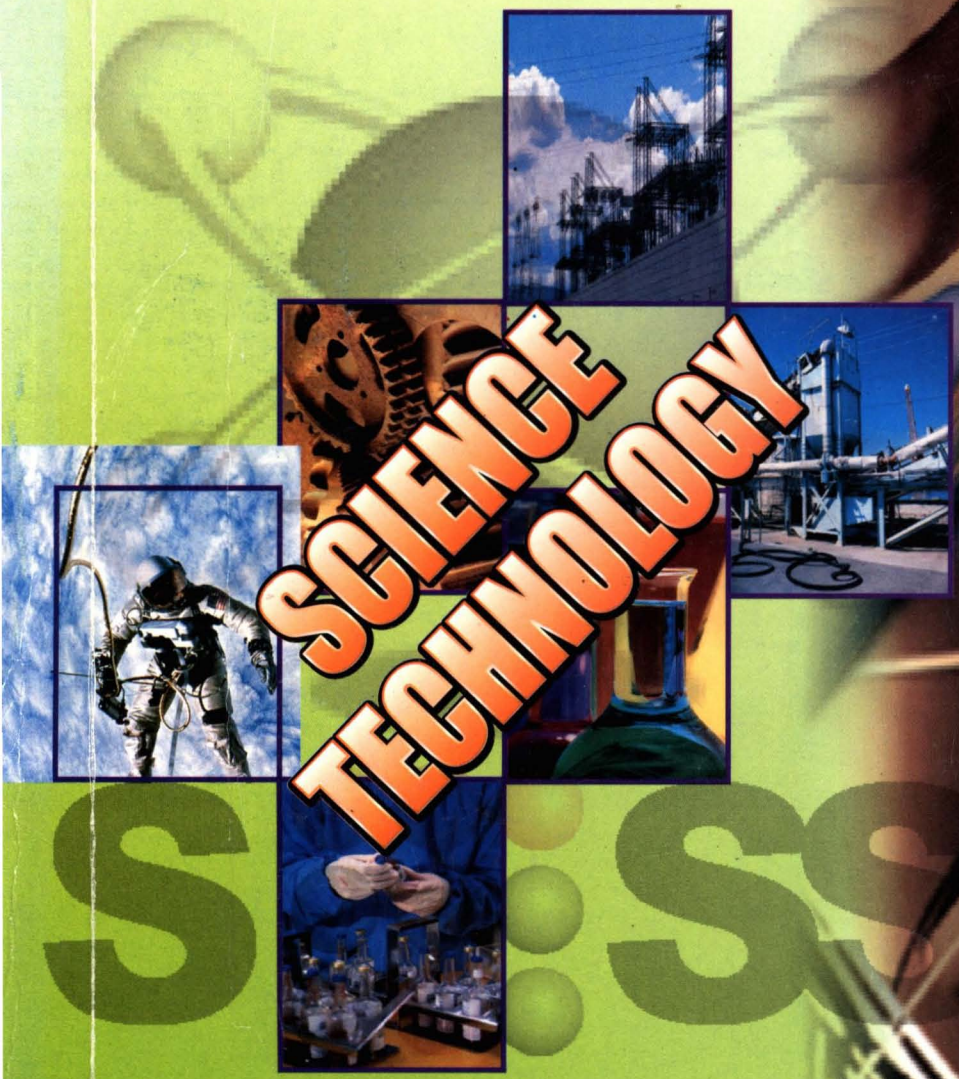

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The Principles of Human Computer Interaction (HCI) in User Interface Design

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ABSTRACT

People interact with computers by means of a user interface or the "window" into the computer application. The system may have a myriad of functions, but if the user cannot find them, they cannot use them. A discipline that addresses humans using computers has evolved called Human-Computer Interaction (HCI), as well as basic principles of interface design and a user centered process to ensure that people can truly "use" the interface. Human-Computer Interaction (HCI) is the study of how to improve the design of user interfaces in order to support human activity. The goal of this paper is to present and discuss the HCI principles need to be concern in user interface design to making a usable system and product. Design means being good, not just looking good. A good interface makes it easy for users to tell the computer what they want to do, for the computer to request information from the users and for the computer to present understandable information. Clear communication between the user and the computer is the working premise of a well-designed interface. Therefore, the user interface is important to prospective viewers and may help gain attention and build confidence in using computer systems.

Keywords: *Human-Computer Interaction (HCI), Human-Computer Interaction principle, screen design, user interface design*

Introduction

A fundamental reality of application development is that the user interface is the system to the users. What users want is for developers to build applications that meet their needs and that are easy to use. Too many developers think that they are artistic geniuses; they do not bother to follow user interface design standards or invest the effort to make their application usable, instead they mistakenly believe that the important thing is to make the code clever or to use a really interesting color scheme. The reality is that a good user interface allows people who understand the problem domain to work with the application without having to read the manuals or receive training.

Interface design is important for several reasons. First of all the more intuitive the user interface the easier it is to use, and the easier it is to use the cheaper it is. The better the user interface the easier it is to train people to use it, reducing your training costs. The better your user interface the less help people will need to use it, reducing your support costs. The better your user interface the more your users will like to use it, increasing their satisfaction with the work that you have done.

The point to be made is that the user interface of an application will often make or break it. Although the functionality that an application provides to users is important, the way in which it provides that functionality is just as important. An application that is difficult to use will not be used. It will not matter how technically superior your software is or what functionality is provides, if your users don't like it they simply won't use it. Do not underestimate the value of user interface design.

The Basic Principles User Interface Design

In this section we represent a compilation of principles for designing user interface. The principles or guidelines presented in this paper have been drawn from various books on interface design and some from seminal works of theories in HCI (Marcus 1992; Ambler 2000; Ask 2005; Norman 1988; Fowler et. al. 1995; Mayhew 1992; Nielsen 2005; Talin 1998; Galitz; 1997). Most of these principles can be applied to either command-line or graphical environments. These principles will help interface designer to improve the interfaces that they create.

The principle of Consistency

The most important thing that can possibly do is making sure that user interface work consistency. Consistency is a strong determinant of success of systems (Schneiderman 1998). Lack of consistency has even lead to dire consequences e.g. positional change of gun trigger and ejector control in Spitfire Aircraft, resulting in pilots ejecting rather that firing during dog fights in World War (Dix et al. 1993). Consistency in the visual interface helps people

learn, easily recognize the graphic language of the interface and allows users to apply previously learned knowledge to new task e.g. All windows applications use the same quick commands for cut, copy and paste. Put the buttons in consistent places on all of the windows, use the same wording in labels and messages, and use a consistent color scheme throughout. Effective applications are both consistent within themselves and consistent with one another. A consistency user interface allows the users to build an accurate mental model of the way that it works and accurate mental models lead to lower training and support cost.

The Principle of Stability

The only ways to be able ensure consistency within our application is to set design standards and then stick to them. Users feel comfortable in a computer environment that remains understandable and familiar rather than changing randomly. The design of interface requires a check to see if there is a standard for colour, shape and placement. Software standards provide consistency from one application to another. For example, dialogue boxes look the same in different windows applications. Minimization and maximization button are all standardized in the operating system rather than the application. This consistency provides user advantage because a new program can be utilized immediately without having to learn how to save a file. In order to maintain the perception of users stability, the interface should be provides a clear, finite set of objects and finite set of actions to perform on those objects. Even when particular actions are unavailable, they are not eliminated from a display but are merely dimmed.

The Principle of Aesthetic Integrity

Aesthetic integrity is concerned the study of the beauty (Matthews 1999), how screen is look like. An aesthetic user interface ensure the information in screen design is well organized, good looking and consistent with principles of visual design. Every visual element that appears on the screen potentially competes for the user's attention. Aesthetic user interface provide an environment that is pleasant to work in and contributes to the user's understanding of the information presented. Aesthetic user interface can be achieved by improving the screen appearance with a good object arrangement. The good arrangement is important to maintain consistency in the "look and feel" of each screen even when the objects change. Example uses white space and boxes to group associated data.

The Principle of Direct Manipulation

Direct manipulation is a human-computer interaction style (Schneiderman 1998), which involves continuous representation the objects of interest, rapid, reversible, incremental actions and feedback. Incremental feedback allows a user to make fewer errors and complete tasks in less time because they can see the results of action before completing the action. User must see the visible cause-and-effect relationship between the actions they take and the objects on the screen. Direct manipulation allows the users to feel that they are in charge of the computer's activities and directly controlling the objects represented by the computer. For example, in the Date/Time properties dialog box, you can use the mouse to drag the first and second hands around the clock to set the time rather than having to key in the time via the keyboard.

The Principle of See and Point

This principle of see and point is tried to reduce user cognitive overload. Do not make the user memorize information when they deal with the system. The users cannot learn how to use the system if the systems hide major functionality from them. One of the most frustrating practices of developers is to misuse pop-up menus (Mayhew 1992). In this principle, the people should be able to see what they need, when they need it and they can find all the available features in the system application. Example, menus present list commands, so people can see their choices instead of having to remember and type command names. These also allow the user to choose the information from the list. For example, provide a drop-down list of states to choose from when filling in an address instead of requiring the user to remember the two-character abbreviation.

The Principle of Feedback

Whenever a user operates a switch, presses a button, turns a dial, clicks a mouse or interacts in any way with a system or machine, there must be feedback that is unambiguous. Feedback can come in the form of a sound, a light, text on a screen, dialogue boxes etc. However the ideal form of feedback is allowing users to see things happen. The

principle of feedback ensure the system always keep the user informed about what's happening and provide immediate feedback and also ensure that the feedback is appropriate to the task (Ambler 2000.). Example is progress bars are shown in many applications where processing takes more than several seconds. If a system gives no feedback, the user may assume that the command has not been received, accepted and acted upon. This may cause the user to press the button again, repeat the command or even think that the device is no longer working. Therefore the feedback is important to take account by the interface designer while designing the user interface. The proper feedback can avoid users frustrating during they deal with a system.

The Principle of Forgiveness

The users can encourage to exploring the system by building in forgiveness. Forgiveness means the users actions on the computer should be reversible. Users need to feel that they can try things without damaging the system, create safety nets for people so that they feel comfortable learning and using the system. A good user interface design is it can facilitate exploration and trial and error learning. Example is the system allows the user multiple levels of "Undo" for most actions.

The Principle of Unity

Unity is coherence, a totality of elements that is visually all one piece. With unity, the elements seem to belong together (Fisher and Smith-Gratto 1998-99). The unity principle group things on the screen effectively. Items that are logically connected should be grouped together on the screen to communicate that they are connected, whereas items that have nothing to do with each other should be separated. Unity can be achieve by using similar sizes and leaving less white space between collections of items to group them or put boxes around them to accomplish the same thing. Unity can be achieved by consistency in shapes, colors, text style and themes.

The Principle of Simplicity

The best interface designs are simple. Simple designs are easy to learn and to use and give the interface a consistent look. A good design requires a good balance between maximizing functionality and maintaining simplicity through progressive disclosure. During designing a visual presentation, user interface designer should avoid cluttering the screens with unrelated information. Tried to design as a simple but in a good form and meaningful to the user's (Fisher and Smith-Gratto 1998-99). By optimizing the number of elements on a screen and minimizing the alignment point's can be achieved the simplicity in screen design.

The Principle of Regularity

Regularity is a uniformity of elements based on some principle or plan. Regularity in screen design is achieved through consistent spacing (spaces horizontal and vertical alignment points for the screen elements) and grouping of components (minimizing the alignment points).

The Principle of Sequences

The principle of sequence refers to the objects arrangement in a screen in a way that facilitates the movement of the eye through the information displayed. In the Western societies, people read starting from the left to right and top to bottom. Therefore, the objects in user interface design should be organized by arranging the elements to guide the eye through the screen in a left to right and top to bottom pattern (Ngo, Teo & Byrne 2003).

Conclusion

The good qualities of user interface design are important to take account by the interfaces designer because the good of displays could help us to more reliably build displays that have these high qualities. Poor design criteria are responsible for wasting computer users time and are a hindrance to effective interaction with human centered systems. Therefore, it is important that before any design of an interface is the interface designer should be follows the design principles or design guideline. This paper has been discussed eleven of design principles. Here, the principle or guidelines exist to help designers create more attractive user interface. Besides, the proper user interface

designs are important to prospective viewers and may help gain attention and build confidence in using computer systems. As a conclusion, the principles of user interface design are playing a greater role in affecting system usability and acceptability than we might be willing to admit.

References

Alan Dix et. al. (1993). *Human Computer Interaction*. New York: Prentice Hall.

Ambler, S.W. (2000). *User Interface Design: Tips and Techniques*. New York: Cambridge University Press.

Ask TOG. *First Principles of Interaction Design*. Retrieved on October, 2005. [On-line[Available: http://www.asktog.com/basics/firstPrinciples.html

Ben Schneiderman. (1998). *Designing the User Interface: Strategies for Effective Human Computer Interaction*. 2nd ed. Addison-Wesley: pp.13.

Fowler et. al. (1995). *The GUI Style Guide*. Boston: Academic Press

Galitz, W.O. (1997). *The Essential Guide to User Interface Design*. New York: Wiley

Kiana K. Matthews. (1999, July 25). *Aesthetics and Usability: Advanced Topics in User Interface Design*. University of Colorado at Boulder.

M. Fisher & K. Smith-Gratto. (1998-99). Gestalt Theory: A Foundation for Instructional Screen Design. *Journal of Educational Technology Systems*, 27(4): pp. 361–371.

Marcus. (1992). *Graphic Design for Electronic Documents and User Interfaces*. New York: ACM Press.

Mayhew, D.J. (1992). *Principle and Guidelines in Software User Interface Design*. Englewood Cliffs NJ: Prentice Hall.

Ngo, D. C. L., Teo, L. S., & Byrne, J. G. (2003). Modeling Interface Aesthetics. Computer in Human Behaviors. Elsevier Science Publishers, *International Journal of Information Sciences*: pp. 25–46.

Nielsen, Jakob. *Ten Usability Heuristics*. Retrieved on September, 2005. [On-line] Available: http://www.useit.com/papers/heuristic_list.html

Norman, D.A. (1988). *The Psychology of Everyday Things*. New York: Basic Books.

Talin. (1998). *A Summary of Principle for User Interface Design*. Retrieved on October 2005. [On-line] Available: http://www.sylvantech.com/~talin/projects/ui_design.html

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