Example of thesis on the integration of natural user interfaces (nui) for illiter...

Art & Culture, Symbolism

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INTRODUCTION

This project is undertaken to find out how natural user interfaces can enhance the use of devices for illiterate people. This is given the fact that the rate of illiteracy is an issue of concern in South Africa and the world over. This chapter will focus on previous research which have been carried out and the gap that is lacking in this field. It is important to understand the work that has been carried in order to research on what is still lacking in this field.

What is Natural user interfaces?

A natural user interface (NUI) is a system for human-computer interaction that the user operates through intuitive actions related to natural, everyday human behavior.

A NUI may be operated in a number of different ways, depending on the purpose and user requirements. Some NUIs rely on intermediary devices for

interaction but more advanced NUI's are either invisible to the user or so unobtrusive that they quickly seem invisible, as stated by (Rouse, 2011).

KEY CONCEPTS

User interface design

There are different definitions that have been put across to define a user interface. Nadin (1988: 53) defines an interface as the place where two different entities are to come into contact so that they are able to communicate. Interfaces which do not have text is easy to use for many users when they are looking for easy access and simple understanding of the contact. It is simpler to understand graphical user interfaces than text interfaces; the use of pictures and visual aids will help people get messages without seeking for any form of assistance. Kang and Kim (2007: 124) state that the user interface should be designed in such a manner that the normal users of the devices should make use of the device without having to consult the user manual. They should be in a position to make use of the primary functionalities of the device. The users should also be able to comprehend the meaning the graphics and get the feedback from them. Another scholar Smith (1997: 52) also states that there are three elements that effective user interfaces should have. The first element is efficiency. This can be achieved with the use of shortcuts. The second element is supportiveness. This can be achieved through the use of feedback which is relevant to the user. The third elemtn is acceptability. This is achieved by providing a match between the user tasks and the satisfaction that the user gets from the use of the interface.

Source: Naddin 1988

Figure 1: System interface

In addition to this, Kang and Kim (2008: 52) make use of the belief that is posed by Shneiderman and Plaisant (2004: 271) that successful User Interface Design should follow eight golden rules. The first golden rule of interface design is that the interface design should be consistent. The second golden rule is that the interface should provide the user with universal usability. The third is that the interface should provide feedback which is meaningful to the user. The user interface should also provide the user with an exit interface. The fifth rule is that the interface should prevent the occurrence of errors. The sixth rule is that the rollback should be easy. The user interface should also able to be controlled. It should be controllable. The eighth rule is that the user interface should reduce the data that needs to be memorized. There are also five rules that are advocated by Ferre et al. (2001: 62) which include efficiency, learnability, repeatability, error rate, and satisfaction. All these are important aspects that should be taken into consideration by designers of user interfaces.

Visual interface design

There has been research on designing, and how important this program development process is to the user. The developer has been seen to be the person who will determine how usable the interface is to all users. The use of visual design for designing user interface is effective when solving the communication issue with the users. The emergence of Graphical User Interface (GUI) enabled many people to use computers. This is because there

was minimal use of text in the design of the interface. There were interfaces which made use of visuals. Many people find the use of visuals for communication more appealing and effective than with the use of text. In an ironical sense, graphic design that is oriented towards communication achievement is one of the main objectives of graphic designs. This is often described to be a visual communication design.

Baecker et al (1995) contends that graphic design is the principle of developing effective visual communication. An effectively designed graphic interface is easy to implement and is valuable as well as satisfactory to the user. Block (1988) supports this sentiment terming graphic user interface as the most intuitive, easier, and functionally rich approach in computing. Graphic user interface has obviously become the priority number one for managers who aspire to increase productivity. According to Cardinali, (1994), many microcomputers like Macintosh support GUI, and while this interfaces are increasingly becoming user-friendly, they are gaining more support. Marcus, (1995) nicely introduces application of user interface to interface design. He comes up with the term visual language which refers to the graphical techniques used to communicate the message or content. These techniques and components include layout, format, proportion, grids, color, texture, typography, imagery – use of signs, icons, and symbols. Others include animations which represent dynamic displays that are suited for video elements and multimedia systems, sequencing – the general approach of storytelling, sound or ear cons, and visual identity – the rules that lead to consistency.

Image and Representation

In the absence of an effective visual representation mechanism, GUI is no different from an ineffective character based interface with unfamiliar script. Mullet and Sano (1995) agrees that imagery is the key component for communication in user interfaces. The duo outlined three reasons why imagery is so important throughout the product user interfaces; communication, identification and expression. Images make identification easy and the first thing a person's mind registers after looking at a poster is the picture and its meaning rather than the text surrounding it. In the same way, conveying a message through semiotic/sign elements such as images, gestures, or words is found to be a more effective means of communication. Carr, (1973) further clarifies Mullet and Sano assertion by stating that pictorial signs are more superior to verbal signs when representing inherently spatial concepts such as traffic directions under brief representations and poor viewing conditions. Expression differentiates the image and the text. The rendering quality of the image brings out the determining factors for success or failure to a designer. Symbols communicate the message with simplicity and immediacy but are a factor of the culture in which the meaning is derived. Nadin, (1989) concurs that ideas can be delivered with semiotics and defines semiotics as the general concept of practice of signs, including all that is interpreted by humans as signs, and the circumstances under which interpreting those signs will lead to better understanding and improved use of it (Mullet &Sano, 1995 p. 171).

According to Nadin, sign is a product of the parameters, Representation, Object and Interpretant/ user who interprets it and becomes part of it for the

time of the interpretation.

(Source: Nadin, 1989 p. 172)

- Icons, Symbols and Signs

Icons, signs and symbols are familiar in today's interfaces and are the subject of discussion wide just as other graphical computer objects. They have replaced textual commands as a conceptual representation of the software commands.

Tan, (2006) and Marcus (2003) explores the meanings of icons, as well as other terms such as symbols, signets, ideograms, index, phonograms, pictographs/pictograms and symbols on how they are closely related as well as confusing. According to the authors, signs are perceivable or conceivable objects that convey meaning while symbols are signs that convey meaning by convention and are often nonfigurative in nature. Icons indicates the self-evident, natural and realistic signs for a set of interpreters such as photograph, a realistic painting or a left facing arrow that indicates direction.

Tan defines index as a special semiotic sign that illustrates cause and effect in space and time and gives an example of a photograph illustrating a scene. Ideograms refers to symbols that refer to concepts or ideas, example being " I" that stands for " information" or " available information". Phonograms defined as symbols that stands for sounds e. g. letter " s" while pictogram stands for an icon that have pictorial similarities with an object or event. For instance, a men's room signage that shows a simplified drawing of a man. According to Ehrich et al, two major differences exist between communication that relates to semiotic distinction signs and symbols. The

first difference is that there needs to be a signifier and the signified (object), but often, the relationship between the symbol and the referent is arbitrary and conventional. The second difference is finding the relationship between the signified and the signifier. The author is concerned with the way signs and symbols are represented and for that matter, propose an alternate visual representation of the two relationships. This relationship is demonstrated by Ogden and Richards (1923) and latter cited by Ehrich and Williges, (1986).

(Source: Ehrich &Williges, 1986 p. 66)

Here, the relationship between symbol and referent is represented in a dotted line depicting that the connection is established through the reference. The relationship between sign and referent is depicted using a solid line to show the necessary relationship between elements. These concepts of communication are crucial for studying human communication and focuses on the use of sign system over symbol system.

Though the use of icons is more beneficial to visual design, replacing texts with icons is an uphill task as large amount of information should be presented in a small image. Non-verbal signs and symbols have played a crucial role in communicating ideas, and as such, signs and symbols should be distinctive enough to be easily identified. According to Gregory, (1994) icons can be immediately identified and understood by speakers of different languages. Brown coincides with this line of thinking and states that when icons are used in a system comprising of different language speakers, it reduces language barriers. However, he points out that icons should be efficiently designed to make them legible and identifiable hence deliver

value. However, because icons cannot completely replace words, he cautions that it should not be forced on every interface; icons do well in interfaces that comprise lots of data, though some can be clearly represented in graphical contexts. Horton (2005) list advantages of icons, includes: enhancing productivity and reliability, are better than words for spatial concepts, save space, accelerates search process, enhances recall, reduces the need for reading, are internationally recognizable, and facilitate intermediate recognition.

Pictograph

Mullet and Sano defines pictograph/pictogram as an ideogram that delivers meaning through pictorial resemblance to a physical object. It essentially does not refer to a word in a particular language but rather a physical object in the real world. According to the authors, pictographs should be simple and direct, bold and clear, balanced and well integrated with the background. Concepts of imagery are utilized in pictographs and its advantages are only realized through appropriate image designs.

Kang and Kim defines the 8 golden rules of successful UI design while a research conducted by Temple, Barker and Sloane Inc. in Massachusetts and cited in Cardinali underlined seven measurable benefits of graphic user interfaces as high productivity, low frustration, low fatigue, improved speed, improved ability to teach oneself, better learning capabilities and better work.

Graphic user interfaces improves application capabilities and make it easier to learn than character-based interfaces. The seven benefits outlined above

create numerous corporate benefits.

- Human Computer Interaction

Humans interact with the computer through human interaction interface. This is referred as the communication medium. Applying the concepts of human computer interface in system design facilitates the users interaction with the interface. It leads to more productivity and less problems. A system that is learnable is easy to use and this is what human-computer interface has been about in system development. The fundamental system design principles integrates several strategies that has proven essential in the design process. Management buy-in, group participation and design trade-offs are critical to the success of human-computer interface design (Brown, 1988).

Functionality needs explores the specific tasks which users are required to undertake in order to operate the interface. Physical needs, on the other hand, are the requirements that suits the physical characteristics of the user, and lastly, aspirational needs support the medium- to long term aspirations of the user.

These needs are considered vital in the inception stages of system development. In order to understand the needs of the users, sampling techniques such as interviews, observation, questionnaires, group interactions, focus groups, experimentation, and storyboarding and document collection are put to use.

- gOETZE & STROTHOTTLE APPROACH

Few studies have concentrated purely on the user interface design for illiterate users. Goetze &Strothottle, (2001) conducted a research into

developing a web-browser that replaced individual words on the page with pictures that represents their meaning. The system allowed the user to hover over a word in order to display its meaning represented in an image or an audio prompt. The project highlighted that web pages need no special encoding and users neither were nor restricted to a subset of the page. A user could navigate freely and choose to view pages anywhere in the internet and the browser could automatically converts texts into picture-words. An interesting aspect about this browser is that it hides the complexity of the operating system behind the browser. Instead by using a touch screen or stylus, it allows the user to point out words that require meanings or to drag across them to read them aloud. Novice computer users would likely enjoy using the interface since it mimics familiar interface paradigms such as pen and paper. Nevertheless, Goetze and Strothottle is impractical due to some reasons. Natural languages have large lexicons and morphological productivity, thus it is improbable that picture dictionary would ever be sufficient to represent all words that the system will have. Even for a limited subset of the vocabulary of a given language, it is unlikely that intuitive, salient pictures could be found for all words in the vocabulary. If the system were to be used in multiple locations with diverse cultural traditions and metaphors, images used must be sensitive to these variations.

Goetz and Strothottle approach is dependent on picture language interpretation and sometimes it may require the system to memorize pictures to increase speed. The cognitive complexity of learning this visual vocabulary is like that or learning to read and write. However, by learning to

represent words in pictures the user is not acquiring any new skill but rather learning how to read and write. The disadvantage with the interface is that it does not encourage the user to develop any written skill through its use, thus it accomplishes less. Second, the browser does not address the input aspects of interaction. Users will use the picture icons and text-to-speech functionalities of the system to interpret the content on the screen but essentially have no way of entering the text in the system because of lack of literacy skills. The application does not, however, support advanced activities such as e-mail and search.

Bevan and Macleod (1994) explored the difficulties of developing software applications. According to the author, it is difficult to develop software's because of design principles. Usability of most computer applications is unsatisfactory and in most scenarios usability cannot be achieved even though it still remains a fuzzy concept. Usability is difficult to evaluate and measure.

- CONCLUSION

Neilson (1993) states that usability exhibits multiple components and is associated with five attributes including: learnibility, efficiency, error, satisfaction, and memorability. According to the author, usability is only useful if it is aligned to a specific context. The major considerations include those of users, their tasks, the environment and the kind of activity in perspective. When the environment is altered, usability characteristics shift, so that the functioning of the system should be known in advance.

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