Evaluating the relevance of the 'Real Access' criteria as a framework for rural HCI research

A. Maunder, G. Marsden
Computer Science Department
University of Cape Town
Private Bag Rondebosch 7701
South Africa
+27 650 6300
{amaunder, gaz}@cs.uct.ac.za

W.D. Tucker
Computer Science Department
University of the Western Cape
Private Bag X17 Bellville 7535
South Africa
+27 959 3010
btucker@cs.uct.ac.za

ABSTRACT
Developing ICT software that is useful and usable in a rural context poses many problems. One of the major difficulties is understanding the real needs of the end users and the constraints imposed by the rural environment. Many techniques exist in the field of Human Computer Interaction (HCI) that attempt to understand the needs of the end users but many are not useful in a rural context, or at least not when applied in a standard way. This paper presents some existing HCI research techniques that are applicable in a rural context and shows how they fit into the bridges.org 'Real Access' framework.

Keywords
Usability, Human Computer Interaction, rural development, Real Access criteria, ethnography, user centred design

INTRODUCTION
Human Computer Interaction (HCI) researchers have developed many techniques that allow one to produce software that is useful and usable by the end users. Many of these techniques originated from usability experiments that were conducted in developed world environments and may not be relevant in the developing world. bridges.org [2] feel that solutions that have been successful in the developed world must be re-evaluated before being deployed in a developing world context. When considering a heuristic (expert) evaluation [1], it is clear that a similar re-evaluation will be necessary before this technique can be applied to a rural development project. A user interface based purely on existing heuristics may not be successful when deployed in a rural setting because the heuristics do not incorporate any data relating to the end users and their environment. Even a user centred technique, such as Participatory Design (PD) [6], must be re-evaluated before initiating rural PD sessions. Such PD sessions may fail when faced with language and cultural differences that may exist between the researchers and the end users [1]. In this paper we discuss techniques that are more suited to rural HCI research and show how the 'Real Access' criteria [2] provides a useful framework for evaluating and applying existing HCI research techniques.

BACKGROUND

User centred design
User centred design attempts to understand as much about the user and the tasks that they need to perform. This information must then be analysed and reflected in the design of the system or interface [1]. Understanding the needs of the end user can be achieved by triangulating multiple data-gathering techniques. These include questionnaires, interviews, focus groups and workshops and finally, naturalistic observations.

Ethnographic methods
Ethnography is a naturalistic observational technique that originated from social science research. Ethnographic techniques include some attractive features that enable researchers to gather vast amounts of data about the user and his environment [1]. It has also proven to be particularly useful in rural development projects such as the MuTI project [3,4] for various reasons. Firstly, ethnographic studies tend to run for a longer period of time thus enabling relationships to develop between the users and the researchers [1]. Ultimately this will lead to a user who is less likely to feel intimidated even though they might not be computer literate. Dray and Siegel [5] comment on how ethnographic techniques can provide valuable contextual information, e.g. language and culture. Researchers can then also become aware of more subtle issues that exist within their work environment, thereby informing researchers of factors that are not evident at first glance.

A contextual inquiry

A contextual inquiry is an ethnographic technique that is based on an apprenticeship model where the researcher works as an apprentice to the user [1]. This technique was not utilised as a data capturing technique because of its highly focussed approach (in terms of time span and the intrusive nature of an inquiry) [1]. The resulting models produced by a contextual inquiry may prove to be useful but need to be adapted for use with standard ethnographical techniques. Examples include communication and work flow models.

The 'Real Access' Criteria

bridges.org [2] has published a set of guidelines for Information and Communication Technologies (ICTs) destined for deployment in a developing world context. These guidelines, called the 'Real Access' criteria, highlight what they believe are the key issues that need to be addressed if such ICT projects are to be successful. One of their firm beliefs is that developed world solutions may not be applicable, or even deployable, in a developing world environment as they do not address contextual issues. For example, if we consider that a village in the rural Eastern Cape (South Africa) has limited Public Switched Telephone Network (PSTN) and cellular connectivity, then any web-based solution would not be viable, even though such a service may produce positive results when deployed in a developed world context.

Broadly speaking the Real Access criteria [2] are arranged into 12 focus areas:

- Physical access to ICT
- Appropriate ICT
- Human capacity and training
- Integration into daily life
- Locally relevant content and services
- Trust in ICT
- Socio-cultural factors
- Macro economic environment
- Public support and political will
- Legal and regulatory framework
- Affordability
- Sustainability & the local economic environment

THE REAL ACCESS HCI FRAMEWORK

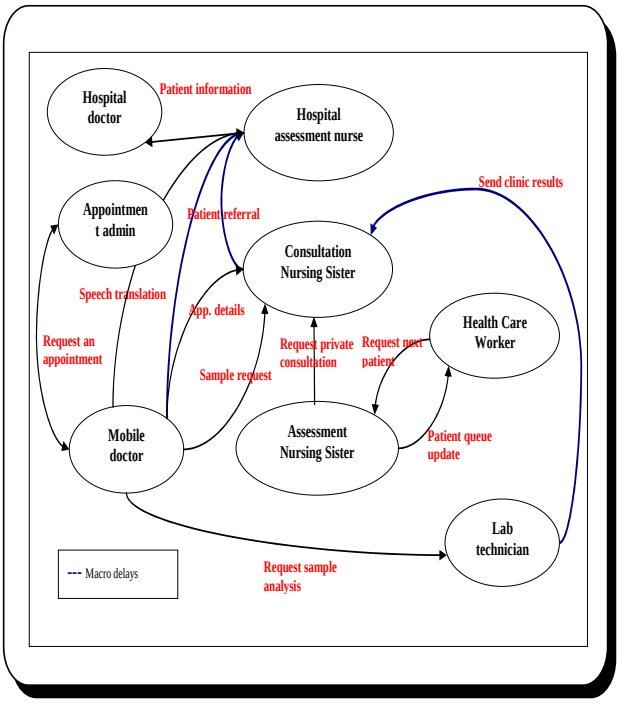
The requirements driving the MuTI rural tele-health system [3,4] were evaluated through the lens of the Real Access guidelines [2], listed above. Initially, the appropriateness of ICT technologies such as VoIP and the legal and regulatory framework surrounding their use were topics of focus. We now wish to evaluate the relevance of the Real Access criteria as a framework for the design and evaluation of the MuTI user interface and comment on its usefulness for future rural HCI studies. This paper focuses on a subset of the Real Access criteria, namely trust, integration and training. These have been chosen due to their relevance to the design and evaluation of user interfaces. For each of these criteria, we consider one or more heuristics from HCI literature [1], provide an example from the MuTI project and then evaluate how the heuristic relates to the Real Access criterion.

Integration

bridges.org [2] specifies that ICT needs to be carefully integrated into the daily lives of the end users. One Real Access criterion states that "ICT use must be integrated into people's daily routine without being an additional burden." bridges.org [2] warns ICT researchers and developers about producing a system that is, in fact, a burden to the end users.

User-centred approaches such as ethnography can be guided by this criterion. The ethnographic data collected for the MuTI project was analysed, and enabled production of communication and work flow models. These models highlight work flows and communication paths that already exist, thus ensuring that the ICT will be applied to a communication pathway or work flow that is already part of the user's daily routine. As an example, the MuTI prototype attempted to support remote consultation sessions between the clinic nurses and the hospital doctors. After the construction of a communication model, it was noted that the consultation communication between the hospital doctors and nurses were almost non-existent.

Figure 1: MuTI communication model



This finding was confirmed in a user interview session when the nurse stated that she rarely needed to ask the doctors for assistance, despite the existence of the

MuTI system. Once an integrated communication pathway or work flow has been identified, the focus can then safely shift to the design of the user interface to ensure integration at a lower level.

Visibility of system status – The users are always aware of the current system status via appropriate feedback within a reasonable time [1]. The recipient (target) of a new MuTI message was not made sufficiently visible. The result was that the users had to search through various folders on the interface to find the new message. Such an interface design flaw can dramatically increase user frustration levels and may cause the system to become inefficient to use. This is particularly relevant when considering that effective integration of the system into a user's busy work flow requires that the total time required to use the system is minimal.

It is clear that existing HCI research techniques, such as ethnographic field studies, can be integrated into the Real Access framework. The construction of communication and work flow models (from contextual techniques) ensured that the ICT was applied to an existing communication path or work flow, and that high level integration occurred. Researchers can then be confident that integration efforts at a lower, interface level will not be nullified by a false integration at a higher level.

Trust

The bridges.org [2] description of trust states that "People must have confidence in and understand the implications of the ICT they use." Confidence or trust in a broader sense could be established by ensuring that the users and community (the people) understand the purpose of the technology and that its benefits are advertised. In an example of trust relating to the MuTI system [3,4], ad-hoc conversations with the nurses revealed that they believed the system allowed the hospital doctors and managers to monitor their activities. In effect, the nurses did not trust the system. If we expand on the notion of trust we see that it also relates to whether the users feel confident enough to use the system or if they feel so intimidated by the technology that they will not even make an attempt without expert guidance.

With the Real Access notion of trust in mind, we now attempt to highlight how existing usability design principles can be used to establish trust in the user interface. Each description contains a definition of the principle and an example where the principle impacted user trust.

Feedback – The interface provides the user with information about an action that has been performed and what the system status is after the completion of that action [1]. A faulty MuTI presence indicator led the nurses into believing that the hospital was frequently offline. This error resulted in confusion such that the nurses were discouraged from using the real-time communication features. Accurate feedback can therefore be seen as an essential component in creating trust or confidence in a technology.

Error prevention – The interface should attempt to prevent errors from occurring in the first place [1]. A clinic nurse accidentally deleted the 'hospital' contact from the MuTI address list. This was problematic in that there was no way for the nurses to recreate it without the IP address of the hospital machine. The system was rendered useless until a technical support member was able to re-create the contact. Trust and confidence in the system was most certainly jeopardised as the nurses were hesitant or nervous to use the system in fear of 'breaking' it. MuTI training session observations have shown that the nurses lack confidence when completing tasks and frequently seek assurance from the trainer that they are indeed performing a task correctly. Critical errors must be prevented if the users are to gain confidence when using the system.

Error recovery – The interface must be able to describe the error in such a way that the user understands it and must present the user with ways of recovering from it [1]. Referring to the point on error prevention, it was not possible for the nurses to recover from a deletion of a contact. No undelete or roll-back features existed and thus rendered the system almost useless until a technical support member arrived. The ability to recover from critical errors will surely improve user confidence in the system and possibly lead to a user who is less intimidated to use the system without assistance.

Human capacity and training

Lastly, an understanding of ICTs and an extensive training program are regarded as essential components for any ICT development project [2]. bridges.org [2] outline this criteria by stating, "People must understand the benefits of ICT and its potential uses and have the training and skills necessary to use the ICT effectively."

The MuTI [3,4] training sessions provided valuable usability information about the prototype interface and system. It is important to note that the initial training sessions focussed on the effective use of ICT and basic ICT literacy before being exposed to the MuTI software. The training ensured that the users gained the required knowledge and skills that would enable them to use the MuTI system effectively. Follow up training sessions focussed on the MuTI software system and again aimed at providing the users with an appropriate set of skills.

The example below shows how the MuTI training sessions provided valuable usability data concerning the process complexity of the MuTI asynchronous messaging features.

Process complexity - The feedback from the training sessions (trainer and user comments) revealed that the nurses required additional training to effectively utilise the MuTI asynchronous messaging features. It was

noted that the total time taken to create an asynchronous message was significantly higher than the total time taken to establish any synchronous form of communication. Typically, a synchronous session could be established with two clicks of the mouse whereas the asynchronous message took the nurses 20 minutes or more to construct.

After analysing the resultant usability data, it was discovered that the mental model associated with the asynchronous messaging features was in fact much more complex than the model associated with the synchronous messaging features. This finding provided an explanation for why the nurses required additional training.

The MuTI training program has shown that such programs are effective in gathering usability data. The Real Access recommendation to implement an extensive training program resulted in valuable usability information being obtained.

CONCLUSIONS

The development of ICT software that is applicable to users in a rural setting requires the researchers to spend time understanding the users context, ie. the language, culture and environment. The Real Access [2] criteria provides a useful framework for incorporating existing HCI research techniques such as ethnography, contextual inquiry, heuristics and usability design principles into a rural development project.

Finally, it is was shown that an ICT training program, as prescribed by the Real Access criteria, is needed as a means to bridge the knowledge and skills gap that exists when a rural user is exposed to an ICT system for the first time. Extensive training programs can produce vital usability data that can be integrated into the design of future interfaces. Training will empower the user, building confidence and trust in an ICT system. The end result is a user who can utilise the ICT technology effectively, understands its relevance and potential uses and ultimately will be able to provide useful usability feedback about the system without feeling intimidated.

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