

A research of HCI applications in developing countries – Thesis design

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INTRODUCTION

This document contains the thesis design for the research project ‘A research of HCI applications in developing countries’. The project is administered by the Vrije Universiteit Amsterdam (VU), with Chris van Aart as supervisor. It is executed by Wouter Stuifmeel, who is a master student for Information Studies at the University of Amsterdam (UvA), which is a shared programme with the VU.

The thesis design describes a preliminary proposal for the research project. The goal of this document is to define the foundational outlines, planning and end-result of the research, in order to have a clear path of what needs to be done for a successful completion of the project.

The contents of the document are the topic and domain of the research, the scientific problem, the main research questions, and the methods used to perform the research, and the planning and duration of the project in a schedule.

1. Research topic

The topic of the research in general is about thinking of ways to introduce new technologies in places where there is limited reach and lack of infrastructure. This is the case in developing countries in Africa, like Mali. Although the use of mobile phones is on a steady rise in the entire continent with an increase of mobile phone usage at annual rate of 65 percent from 2004 to 2009 [7], there is still a lack of reliable infrastructure for things like power and internet access, making it difficult to apply technologies already available in the western world. In addition to that, there is usually a lower literacy among people, and many of the design conventions for interfaces may be familiar to us, but not in the developing world. For instance, try explaining to someone who has never seen a trashcan before that it is the symbol for ‘deleting’ something. It requires a different way of thinking regarding the design, development, maintenance and use of devices and interfaces. Therefore, this research is based on usability and human computer interactions with Malian users.

In this research, we carry out a project for the Web alliance for Regreening in Africa (W4RA), which is “an initiative to help extend the Web benefits of the knowledge society and economy to people in rural communities in Africa.” [10] The VU is one of the development partners of the initiative. The project entails the development of an app to monitor the agro-forestry evaluation of on-farm trees in Mali, in light of the changing biodiversity of the region.

The research will be performed with help and resources available on site, provided via the W4RA and the VU. The W4RA has contacts and projects already running in the country, which will come of good use for this research. Local representatives of Non-Governmental Organisations (NGO's) on site will act as intermediaries for the project.

2. Literature study

When looking at existing literature about research on the use of mobile technologies in the developing world, a number of notable concepts and situations came up across multiple studies. One of the most striking things was that the continent of Africa (or “Sub-Saharan Africa”) is often generalised as one single place. Of course, when reading the details it is specified where the actual research took place and in what kind of conditions, but looking at titles and abstracts [1, 3, 4], it often gives the impression that the situation is much of the same in every African country, while this is simply not true. There are 53 countries in the African continent, containing at least several thousands of different ethnic groups. [6] Even without knowing the specifics of these groups, it seems highly unlikely that their social conventions, way of life and environmental conditions would be the same. However, the title of this project does mention the ‘developing world’ in order to give proper context that this research applies to- and will be performed under different conditions compared to what is conventional in the western world.

Cati Coe [2] has researched the differences and possible challenges of doing research in a developing country, in this case Ghana. Coe suggests that when doing qualitative research by interviewing, one should “observe and imitate interactions more closely” [2] before you begin asking questions. However she adds to the argument that “difficulties go beyond a lack of correspondence in researcher and native communicative frames” [2], and that we should also look at how different cultures perceive knowledge as a whole, and how it is treated as such. (“Local meta-theories of knowledge” [2]). In the western world, knowledge is usually seen as something that should be shared with others as much as possible, while a different culture might perceive knowledge as something that is far too precious to share, and therefore prefer not to give their ‘secrets’ away to a researcher. Coe concludes that “learning local conventions of knowledge transmission is essential to fieldwork.” [2] And that there needs to be understanding for the interpretive frames that questions and interviews in research elicit.

Ane Johnson faced similar difficulties when she researched the use of mobile technology in Kenya. [4] Johnson lists a number of methodological challenges for qualitative research, experienced

during fieldwork. For one, there are ethical considerations, where “participants might be stigmatised by their participation in the research”[4]. There is an example of a research where women from KwaZulu-Natal were engaged to collaborate in making a video on HIV, but participation in the process could be interpreted as “dissent in their patriarchal community”[4]. Another challenge would be the use of language, which is seen as “not a neutral research tool”[4] because it might either become a barrier in the research (having to resort to a translator) or implicate a power relation between a researcher and a participant by the use of English, which implies a linguistic privilege due to the fact that most scholarly work is published in English, and hardly anything in a local language.

Johnson argues that there are even more challenges to find when it comes to research methods. Ranging from participants being uncomfortable with certain elicitation methods, (like asking for a reflection, or addressing certain concepts which might be seen as a taboo) to researchers failing to understand the appropriate unit of analysis for doing research in an African country. For instance, by using a “Eurocentric perspective”[4], which essentialises the individual, instead of the group.

Both Johnson and Coe talk about using “snowball sampling” to gather participants for a qualitative research. This entails asking the participants to recruit more people to join for participation in the research. The reasoning behind this is that it might prove to be more difficult than usual to find participants for a research in a developing country.

Regarding the use of mobile technology, Johnson concludes that “the mobile phone enabled fluid interaction with participants, increased sample size [for research], and inspired new ways of thinking about how phones may be used to manage both the ethical and procedural concerns inherent to research on the continent.”[4] But, within the limits of the local situation regarding infrastructure, government and development of IT.

A paper by Donner [3] reviews the different approaches to the use of mobile technology in the developing world. It focuses on the increasing growth of mobile penetration in countries with average lower income per capita. Where the 2.4 billion people living in the poorest countries show a rise from 177 million mobiles in 2005 to 329 mobiles in 2006.[3]

Donner also discusses the perspective of design and ICTD in research, where studies focus on usability and hardware design within the context of the developing world. The paper suggests for example that different kinds of languages from native societies might prove to be a challenge in text interfaces, or that people from different cultures could interpret user interfaces differently. In addition to this, the mentioned studies of ICTD highlight a hopeful perspective that mobile devices will “contribute to livelihoods and well-being in resource-constrained settings.”[3]

Finally, Medhi [5] goes into detail regarding the design of mobile interfaces for users with low-literacy. Medhi cites that according to UNESCO 41% of the people in the least developed countries is non-literate. [9] Therefore, when developing mobile IT solutions in developing countries, it is important to find out how interfaces can be designed so that inexperienced, low-literacy users can use more advanced services beyond just phone conversations. The study claims to be the first quantitative evaluation of mobile interfaces, spanning text, audio and graphics, executed in an ethnographic research conducted in India, the Philippines and South-Africa. [5] The research is performed in two studies: one involving text versus voice and graphics, and the other in text versus a live operator. The first study requires participants to

complete a mobile banking transaction by using either an interface with text, spoken dialogue or a graphical UI. There was no training for the participants provided, but there were prompts offered during the testing. It concluded that the text interface was unusable if the participant was illiterate, only 72% of participants finished the task using spoken dialogue but “quickly and with less assistance”[5], and 100% of the participants finished the task with the graphical UI, but not as fast compared to spoken dialogue, and it the participants required more assistance to complete the task.

The second study involved entering health data with minimal errors. Participants were again divided into three groups, where they were asked to either enter the data using text with electronic forms, text by sending a text (SMS) message, or by talking to a live operator. There was training for the study, but no help during the testing. The study measured the error rate when entering the health data. It showed that there was a relatively high error rate of 4.2% for electronic forms and 4.5% for text messages. Live operators however showed a lower error rate of 0.45%.[5]

The studies recommend that people with low-literacy need non-text UIs in order to use mobile technology. With the best way being a combination of spoken input and graphical output as an interface. Also, if there is enough (budgetary) feasibility, a live operator is preferred over a text UI in order to reduce errors when collecting data.

Medhi has treated subjects like usability barriers in the research. For instance scroll bars, which were not recognised by over half the participants, and difficulties in language, a returning issue across the literature in this review. The paper advises a number of design recommendations to avoid these barriers, like providing graphical cues, the use of voice annotations, avoiding nonnumeric text input and scrolling, and the integration of human mediators to get users to familiarise with the system. Medhi concludes that the most positive result was the benefit of a live operator. In countries like India it is a “cost-effective solution for reporting small amounts of data” and it is advocated above the use of electronic forms or texting.[5] However, live operators might not always be available, and therefore alternative automatic interfaces are needed as well. In the study, most users seemed comfortable with a voice UI, but for some users it proved to be hard to complete a task. Users with the graphical interface were able to complete tasks, but only with “extensive prompting and encouragement”[5]. Therefore, a combination of both interfaces might be the best option to allow users to engage with a system in a more autonomous way.

3. Scientific problem

The W4RA has conducted several projects where new web-based technologies are introduced in rural communities in countries of Africa, like Mali. Mali is located in the Sahel, a biogeographic transition zone, situated between the Sahara desert and the Sudanian Savanna in the south, where the landscape mostly consists of dry grassland. The Sahel is currently under threat of desertification due to human activities, including “overgrazing, deforestation, surface land mining, and poor irrigation techniques, during a natural time of drought” [8] In light of this, it is of importance to monitor the current state of the biodiversity in the region, and help the local population to preserve it using new technologies. One of the developing projects from the W4RA to support this is Mr. Jiri, a monitoring tool to support agro-forestry evaluation of on-farm trees. Mr. Jiri (Mr. Tree in Bambara, one of the spoken languages in Mali) will be an Android app that aids users in identifying individual trees. The app should register trees by assigning their location through GPS, allowing the user to take

pictures and entering the scientific and local name of the tree. The app is specifically made for local conditions in Mali, where Internet access or even power is not always available. It should not need to connect to the internet while registering trees, the location will be determined by the internal GPS chip of the phone, and power is generated using a small solar panel on the back of the phone. Aggregated statistical information could be exported from the device in the form of an Excel file to a desktop computer.

However, the wishes of the client and end users have changed over time, and additional feature requests were added to the project. They have requested three main new functions for the new app:

- The ability to measure the surface of an area, by letting the user walk on the edges of said area with the phone. The surface could then be measured by utilizing tracked GPS data.
- A function to let the user count the amount of trees in a small area. This could be done using some sort in-app tally counter, and the user should be able to repeat this for two to three times.
- The app should be able to extrapolate the amount of trees and show this on the phone and exported to a desktop PC.

The app needs to take local conditions into account. Meaning that it should be able to operate with no internet or phone coverage, and inadequate availability of electricity to charge the phone.

4. Research question

The research based on this project will test the usability of the application. We would like to find out how the users are using the app, and if there is a possibility to measure the success of the implementation, based on user experiences. The app should also be designed with the cultural differences kept in mind regarding the user, and the fact that the users will most likely be semi- to fully illiterate.

The research question for the project is therefore:

Will the implementation Mr. Jiri application lead to a usable and satisfactory tool to help the local user?

5. Research method

The project is built up in two main parts: the development of the app and the user testing research.

During the development, a number of conditions have to be taken into account regarding the feature requests, the hardware that will be used, and the user experience layer that needs to be tailored to the target audience with regards to possible cultural differences, inexperience in using touchscreen devices and illiteracy.

The user testing research is where the developed app (or at least a functional prototype) will be tested in the field in Mali. A small group of local participants will test the app with the aid of NGO's. The research will be performed in a qualitative fashion, where participants will be asked about their experiences in semi-structured interviews. There needs to be proper instruction on how to take the interviews, and the questions need to be tuned for cultural differences. Some preparatory research in regards to local

customs in Mali might be required. In addition to this, the performance and satisfaction of the app will be tested with a balanced scorecard.

6. Project schedule

The project runs from January to Juli 2014. The project is divided in several activity phases, described below.

Activity	Period
Thesis design	January 2014
Literature review	January 2014
Project break for classes	February – March 2014
Preparatory research for app	Early April
Start with first draft of thesis document	April 2014
App development	April – early May 2014
Preparatory work for user testing research	May 2014
On-site user testing research	May - June 2014
Final version of thesis document	Late June 2014
Thesis presentation and defense	Late June – early July 2014

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