

EVALUATING THE USABILITY AND SUITABILITY OF MOBILE TAGGING MEDIA IN EDUCATIONAL SETTINGS IN A DEVELOPING COUNTRY

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ABSTRACT

Due to the portability, mobility as well as the significantly enhanced processing and computing capabilities of mobile phones, applications based on the use of mobile phones are increasingly being used in the learning environment. However, there have not been comprehensive studies of how accessible these phone-based educational applications are, or how easy it is for novice users to learn to use them. This paper presents a study that focuses on the evaluation of 2D visual tag (or barcode) systems for accessing digital library content. The study is designed to determine the ease with which novice users can learn to use a tag-based system, and the appropriateness of use of such systems in Africa. The results show that visual tag applications are appropriate for use in Africa, and are also easy to learn to operate. The study incorporates guides on how to further enhance the usability of visual tag-based systems. It is expected that these findings are applicable to developing countries in general.

KEYWORDS

Visual Tags, Mobile Learning, Image Inputs

1. INTRODUCTION

This research project focuses on the investigation of the 2D visual tag systems that are currently available for the linking of physical objects to information about the objects in ways that make social, educational and other interactions with the tagged objects possible. A visual tag is a 2-dimensional barcode. Whereas traditional 1D barcodes are normally read using a special laser scanner, a visual tag is read using an ordinary multi-purpose camera. A visual tag *system* refers to such a tag, a camera (usually a cellphone camera) for capturing the tag, and the tag reader, which is image processing software for extracting the information embedded in the tag. This information is typically a URL, but it can be any electronic information. The visual tag reader has to be downloaded and installed on the user's camera phone. However, in Japan where visual tag use is quite established, mobile phones often come equipped with the QR code reader software (<http://reader.kaywa.com/>). The physical objects that are tagged could be anything, including buildings and educational resources. For instance, a visual tag may encode the URL for a sculpture, a book, a manuscript or lecture notes. The student can there and then find out more about the educational resource in question by going to the relevant link.

Visual tags offer two specific benefits. One is the immediacy of access to information about an object, almost as though the object spoke. The second is the ease of input: URLs are notoriously difficult to type and especially so for small computing devices that do not have a full QWERTY keyboard. The question addressed in this study is therefore not so much whether visual tags are beneficial as an aid to learning, but rather how usable they are in the African context.

To evaluate the ease with which visual tagging systems may be accessed and suitably deployed, the following tagging platforms were examined: BeeTagg (www.beetag.com), ConnexTo (www.connexto.com), Shotcode (www.shotcode.com), Semacode (semacode.com) and UpCode (www.upcode.fi). This research project was designed to answer the following questions: 1) How natural and easy is it for novice users to interact with and use a 2D visual tag system without explicit guidance? 2) Are 2D visual tag applications suitable for deployment in the African environment?

2. BACKGROUND

Significant efforts have been dedicated to research on the use of mobile devices as computing tools in educational and other settings. In (Jones et al, 2004) for instance, a system is described that enables students to use their cell phones to SMS the lecturer their comments and questions, and to also respond to multiple choice questions during a lecture. In (Marsden et al, 2002) the authors describe a novel system that can be used to digitally archive African artifacts and artworks. Cellular phones are shown to be the most suitable mode of accessing the digitized artworks. Furthermore, (Marsden et al, 2005) explores the use of PDAs as a tool to facilitate interaction with a digitally recreated museum of historical significance in South Africa known as District Six. While the actual environment changes, the digital version preserves its history. The PDAs were deployed as viewing terminals during a museum exhibition and thus served as a type of “peephole time machine” into the old District Six. In (Parikh, 2005), on the other hand, the focus is on the use of a mobile phone as a primary data-capture and data-entry device in a document-processing system that is targeted at the micro-finance industry in a rural African setting. Some of the other research efforts on the use of cell phones as input devices include (Miyaku et al, 2004), (Madhavapedy et al, 2004), (Aalto et al, 2004), (Rhos et al, 2004), (Ballagas et al, 2006) and (Ballagas et al, 2005). However, there is no significant research, to our knowledge, targeted at measuring the usability of mobile applications by novice users.

3. PROCEDURE

In this section, we present the methodology employed for this study which consisted of (1) Ease of Learning to Use evaluation sessions and (2) application of the Real Access criteria framework. The experimental sample is presented as well.

3.1 Ease of Learning to Use

The Ease of Learning to Use evaluation sessions were designed to provide feedback on the research questions. Therefore participants were given a set of tasks to perform using a Nokia 6280 camera phone pre-installed with the appropriate readers for the visual tags selected for this study. Participants were asked to capture a 2D visual tag and try to use a visual tag application on their own, without any provision of specific guidelines. The application was started and the menu displayed before the phone was handed to the participants. The purpose of this testing phase was to evaluate how easy and intuitive it was for novice users to learn to navigate visual tag-reading systems.

3.2 Real Access Criteria

The Real Access criteria were developed by bridges.org (Real 2007) and consist of a twelve-criterion framework through which ICT applications and solutions developed in the industrialized world may be assessed for efficient and effective deployment in a developing country. The three criteria we deemed most relevant to assess the readiness of 2D visual tagging systems for deployment in South Africa are:

- Physical access to technology
- Appropriateness of technology
- Affordability of technology and technology use

3.3 Sample

There were 20 participants for the Ease of Learning to Use evaluation sessions. The participants were mainly students and non-academic staff from the University of Cape Town. None of the participants reported any previous interaction experiences with tagging media. Also, all participants used cell phones either regularly or occasionally, although not all owned a cell phone.

3.4 Test Environment

The Department of Manuscript and Archives (MSS) at the University of Cape Town (<http://www.lib.uct.ac.za/mss/>) was selected as the test bed. The MSS library has an extensive collection of original research material – manuscripts, photographs, etc. – relating to the political, social, cultural and economic history of the Western Cape in South Africa. The subjects covered include art, music, education, literature and language, botany, politics and architecture. However, most of these collections are in print form. Only a few of the collections have been digitized. The collections that can be accessed online include the San (Bushman) online photographic collection which was selected for this study. Visual tags that encode the URL for the San photo album were created. The visual tags were then placed next to the print equivalent of the photographs, and participants were asked to interact with the tags.

4. RESULTS AND DISCUSSION

This section focuses on the presentation and analysis of the results of the Ease of Learning to Use evaluation sessions as well as the assessment of the suitability of 2D visual tagging systems in Africa through the application of the seven selected Real Access criteria framework.

4.1 Ease of Learning to Use Evaluation

The Ease of Learning to Use evaluation sessions were a measure of how quickly and efficiently novice users could learn to use a visual tagging system. Analysis of the results of the Ease of Learning to Use evaluation sessions suggests that mobile phone users can be placed into three categories, namely, basic, intermediate and advanced users, according to the type of phone they own and the types of mobile applications they use. Advanced users own feature-rich phones and regularly make use of those features. Intermediate users do so to a lesser extent. Basic users regard the phone as a calling device and nothing more. Advanced users decoded tags in 2 minutes or less, intermediate users in 2 to 4 minutes, and the basic users took more than 4 minutes on average. The basic user group largely comprises older people, those from previously disadvantaged communities or those with limited education. This group of users tended to require some form of guidance or prodding in the right direction to be able to decode the visual tags. The conclusion from the evaluation sessions was that it is generally easy and intuitive for novice users to use a visual tag system on their own with minimal instruction, and without the help of a manual and/or instructor.

4.2 Visual Tagging Technology Adoption

In this section, the feedback from participants about their attitudes towards the adoption of visual tag systems is presented. The barriers that could limit the rate of adoption and frequency of use of visual tag systems are also highlighted.

4.2.1 Attitudes towards Adoption

The comments from participants after interacting with the visual tagging systems used during this study and their responses to the post-testing interviews clearly show that participants are overwhelmingly in favor of the regular use of visual tag systems. A participant was very much impressed with the potential of visual tag systems to connect the physical and virtual worlds. Some participants were excited about the novelty of tag-based applications. Others were impressed with the efficiency of the systems and how they make the entering

of long URLs on the inconvenient cell phone keypad unnecessary. Furthermore, we observed a positive side effect of the study. The fact that one could access the Web on a mobile phone was new to some participants. They were excited about being able to obtain information wherever they were, such as maps and directions while on transit. Although feedback from participants suggests that most would consider using tag-based systems on a regular basis, they indicated that they would only do so in limited circumstances, for example when venues where they normally got information were closed. We ascribe this to the normal, passing skepticism with which people (other than early adopters) regard unfamiliar technology.

4.2.2 Barriers towards Adoption

The primary and single most important barrier that was cited by participants was cost because camera phones are far more expensive than basic phones which have no cameras. Participants also associated mobile Internet browsing with considerably higher billing rates than desktop-based Web browsing or text-messaging. Apart from cost, some participants were concerned that only highly educated, affluent, and English-speaking individuals may get to use visual tag systems due to the unavailability of the systems in local languages. This group of participants also felt that the use of the systems needed to be adapted to incorporate local content that would appeal to people living in underprivileged communities.

The experiences participants had browsing the Internet also impacted their views about the limitations of using visual tagging systems to decode URL links. The inability to access some Internet sites, mostly due to network unavailability, and the often slow download times curbed the enthusiasm of some. These conditions are expected to improve rapidly in the coming years as the deadlines for millennium development goals loom and third world governments strengthen their ICT programs in response.

4.3 Real Access Criteria-based Evaluation

During and after each evaluation session, participants were observed and also interviewed about their experiences. They were asked both structured and unstructured interview questions firstly in order to capture their views about the applicability of visual tag systems in Africa, and secondly in order to provide an understanding of how the symbol-reading systems investigated met the Real Access (Real 2007) criteria relevant to the deployment of visual tag technology in the African environment.

4.3.1 Physical Access to Technology and Appropriateness of Technology

In theory, the 2D visual tagging paradigm, in terms of physical accessibility, is potentially available to most people within South Africa because most South Africans have a cell phone (Samuel et al, 2005). The main challenge, however, is that only a few people have the more advanced phones that are supported by visual tag systems because they are expensive.

The second aspect relating to physical access to technology and appropriateness of technology is the presence of visual tags. Visual tags are easy to create and place. One need only visit a website such as shotcode.com and follow the instructions for converting information into a tag. The tag can then be printed and affixed onto the physical object that the information is about. Thus the general public need not be just consumers of content, but rather they can actively participate in the creation of it and in the facilitation of access to it.

4.3.2 Affordability of Technology and Technology Use

Most study participants cited cost as a major concern and possible barrier towards the adoption and regular use of 2D visual tagging systems. However, this was based on the erroneous assumption that mobile Internet costs were prohibitive. But once they were shown that simple Web browsing (with no sizeable data/image download) was much cheaper than sending an SMS or browsing in an Internet café, and also far cheaper than they had expected, they decided Internet browsing cost was not a limiting factor to the regular use of 2D visual tagging systems. In addition, there are other ways that 2D visual tagging systems may be made more affordable. For instance, the use of visual tagging systems for Web-related activities could be limited to simple browsing (e.g. reading documents online) that will not involve any major data (especially audio and video) downloads. Furthermore, 2D visual tags may be used to encode data that, upon decoding, will yield only text – that is, Internet browsing is not involved at all. This is particularly relevant for mobile phone users who are on pay-as-you-go plans, and for whom every cent spent on telecommunication counts. The only

concern here is that tags tend to be quite limited in the amount of information they can encode. However, a dynamic tag is described in (Karodia et al, 2007), which indicates this limitation can be alleviated through proper design.

5. CONCLUSION

The study found that most participants were able to decode the 2D visual tags provided within 3 minutes—in spite of the fact that they had no prior experience using such a system. Only minimal guidance was given to basic phone users at the beginning—these users needed no further help.

Study data also clearly shows that participants were impressed with the use and purpose of 2D visual tag systems. A significant number of participants also indicated interest in using visual tagging systems on a regular basis, even if that means buying new advanced cell phones. However, most cited cost as a possible major deterrent to the frequent use of visual tag systems. Overall, it can be concluded that the attitudes of users towards the adoption of the 2D visual tagging paradigm are positive.

An evaluation of the visual tag paradigm against the Real Access criteria framework shows that visual tag systems surpass the minimal criteria threshold for effective and efficient deployment within an African context. But the visual tag platform still needs to be localized for its services to be available and accessible to a wider South African population.

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