

User Interface Design for Low-literate and Novice Users: Past, Present and Future

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Abstract

One of the greatest challenges in providing information and communication technology access is that about 775 million people in the world are completely non-literate and many are able to read only with great difficulty and effort. Even though mobile phone penetration is growing very fast, people with low levels of literacy have been found to avoid complex functions, and primarily use mobile phones for voice communication only. This monograph looks at how we can design ICT user interfaces (UIs) such that novice and low-literate users can access a broad range of services and utilities, increasingly available to them, with minimal training and external assistance. It begins by observing the challenges in designing for low-literate users, and in conducting user studies among low-income communities in the developing world. It discusses techniques used by researchers in overcoming some of these challenges. It presents a review of existing examples of UIs for novice and low-literate users, which have used various combinations of input–output modalities other than text. It goes on to discuss strong trends that are starting to emerge in this design space and concludes with opportunities and future directions for research and design of UIs targeted at populations with low-literacy.

1

Introduction

Today Information and Communication Technologies (ICTs) are becoming increasingly available to people around the globe. The prices of devices are rapidly dropping and people across income groups are getting access to a range of technologies, from mobile phones and PCs to handheld tablets. If we consider mobile phones, as of 2014 there were about 6.9 billion of them in the world and 78% of the subscribers lived in developing countries [ITU, 2014]. Beyond facilitating communication, ICTs have transformed the way people send money, manage health, check market prices, engage with government, manage emergency response, and many other things. Therefore, many entities with a global development focus have turned to ICT as a potential platform for delivering services related to international development.

PC penetration may not be as high as mobile phones. But in the past decade there has also been a surge in public kiosks and telecenters [Best and Kumar, 2008, Heeks and Kanashiro, 2009, Kuriyan et al., 2006]. A telecenter is a public place where people have shared access to PCs and the internet so they can create, learn, and communicate with others while developing digital skills. The primary objective of telecenters is to contribute to the development of a community by bridging

the digital divide, promoting health issues, creating economic opportunities, and reaching out to youth (Telecentre.org retrieved July 7, 2014).

However, one of the greatest challenges in providing any kind of services on ICTs — mobile phones, PCs, and others — is that 775 million people in the world are completely non-literate, and even more are able to read only with great difficulty and effort. Of the non-literate population 85% live in 41 countries, most of which are between developing to least developed [UN News Centre, 2012]. And among poor populations in these countries even the literate typically are novice users of ICTs. Research shows that non-literate populations avoid complex functions, and primarily use phones for synchronous voice communication only [Chipchase, 2005]. For many low-literate people, even the contact function on their phones is too difficult to use, so they dial numbers from scratch every time they need to make a voice call [Medhi et al., 2011].

Indeed there is reason to believe that UI design should be different for low-literate users because they have a different set of cognitive skills. Studies by cognitive science researchers in developed countries (e.g., the U & Netherlands) have shown that low-literate people with limited formal education differ from people with good educations in their performance on a variety of cognitive skills: language processing, visual organization and visual memory, mental spatial orientation, speed of cognitive processing, vigilance, divided attention and perceived self-efficacy [Van Linden and Cremers, 2008, Manly et al., 2003]. These skills have been said to be essential for realizing interaction on ICTs. Indeed one conception of “digital literacy” proposes that it requires a variety of complex cognitive, motor, sociological, and emotional skills, and a mature understanding of cyberspace “rules” so as to function effectively in digital environments [Eshet-Alkalai, 2004].

All this brings us to the question: how can we design ICT user interfaces (UIs) such that novice and low-literate users can access a broad range of services and utilities that are increasingly available to them? Researchers in the domain of Human–Computer Interaction for International Development (HCI4D) have been investigating this question, exploring how UIs can be made more user-friendly for low-literate

users. HCI4D is an emerging domain of research in the field of Information and Communication Technologies and Development (ICTD). In this monograph, we first examine the various challenges that have to be taken into account while designing these interfaces. We discuss issues of low formal education and low textual literacy, limited exposure to ICTs, and other cognitive challenges associated with low education. We also discuss challenges in conducting user studies in low-income, low-literate communities, and techniques researchers in HCI4D have used to overcome the same. We then go on to review different examples of UI research done over the last several years that have proposed non-textual designs. We review research conducted in the context of non-literate adults; work done with children is outside of the scope of this monograph. Note that many of the studies reviewed are from India, as much of the research has been conducted there and we are more familiar with this work. Of course, other regions and cultures have their own unique context, but we believe many of the findings also apply to these areas.

Studies in HCI4D have used various input–output modalities other than text. Researchers have looked at speech or voice and touch as input mostly because it is a natural means of expression than typing [Patel et al., 2010, Sherwani et al., 2007]. Other forms of input modalities studied are pen-based and touch-tone input [Raza et al., 2013, Underwood et al., 2013]. In output or information display a number of research studies have explored the use of graphics and imagery [Grisedale et al., 1997, Huenerfauth, 2002, Medhi et al., 2011]. Researchers have also studied the use of audio output combined with graphics or text and on Interactive Voice Response systems (IVR) [Frisciria et al., 2012, Koradia et al., 2013, Parikh et al., 2003]. Video output has been used to help low-literate users overcome the inability to read text [Medhi and Toyama, 2007, Smyth et al., 2010b]. Other design features have included consistent help, no scroll bars, use of numbers, ultra-simple navigation, fewer menus and dedicated buttons [Jones and Marsden, 2005, Kurvers, 2002, Medhi et al., 2011]. In addition to the above there have also been comparative studies examining the trade-offs between various combinations of input–output modalities going from inflexible to flexible in

input (such as typing, structured speech and freeform speech) and lean to rich output (such as text, audio and graphics+audio) [Chakraborty et al., 2013, Cuendet et al., 2013, Patnaik et al., 2009]. We make design recommendations for UIs for low-literate users based on current work.

Above and beyond these examples we review strong research trends in HCI4D that are currently starting to emerge in the design of UIs for low-literate users. Researchers are beginning to look at how non-literacy is not just about the inability to read text, but is correlated with cognitive skills such as the ability to transfer learning in video-based skills training [Medhi et al., 2012b], and the ability to navigate hierarchical organization of information architectures [Medhi et al., 2013a,b]. These studies have offered implications for design for both PC and mobile UIs. Another emerging trend we review is of UIs for production of content by low-literate users. Most of the examples we review leverage IVR systems to overcome issues of non-literacy. These are in citizen journalism [Mudliar et al., 2013], agriculture Q&A [Patel et al., 2010], a virally spread voice manipulation and forwarding system [Raza et al., 2013], and a community moderated talent competition [Koradia et al., 2013]. In addition, we examine a trend for natural UIs, but for literate and tech savvy users, that use gestures, speech, touch and other forms of natural interaction [Windows Phone Cortana, 2014, Google, 2014, Xbox 360 + Kinect, 2014, Google now, 2014, Apple Siri, 2014] (retrieved July 18, 2014). Through these examples, we discuss how design principles for literate users and non-literate users could be starting to converge.

Research in design for low-literate users presents interesting challenges because of the environment and ecosystem that these users live in. Urban environments could be vast informal settlements found in a rundown area of a city characterized by substandard housing, and commonly referred to as ‘slum areas’ [UN-HABITAT, 2007]. Average areas of households are small (<200 sq.ft.) for about 6–7 family members per household. And infrastructure in water, electricity and sanitation are constrained. Rural environments could have comparatively larger household areas, but the infrastructure conditions are similar. In both these rural and urban environments exposure to ICTs also tends to be constrained. Given this, as a follow-up we discuss conversations

that have started emerging in designing UIs for low-literate users that goes beyond usability. These issues relate to socio-cultural and socio-psychological concerns such as shared and mediated uses of technology [Parikh and Ghosh, 2006, Sambasivan et al., 2010] and intimidation caused by technology [Medhi et al., 2010].

Finally, we present opportunities in low-literate UI design research for future work. We discuss directions for studying UIs for training effects and how learning occurs through longitudinal field deployments. We also discuss opportunities in designing for multiple users for both collaborative and competitive scenarios. In addition, we think there is scope for designing for the uptake of technology in mediated and assisted scenarios, such as when a technology is seeded into a community through a human mediator. We identify opportunities in UI and product design research for lowering intimidation among low-income, low-literate users, for both formal evaluations and pilot deployments. We discuss opportunities for studying how cost-consciousness can impact user experience. We conclude with some thoughts on how research in this area may impact livelihoods among low-income, low-literate communities.

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