Meeting the Challenge of Global Mobile Phone Usability

Design and practices

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Abstract— **How can mobile phone design increase usability and the user's experience in a global setting? The purpose of this paper is to put forth general design principles to enhance usability. We use a structured literature review of 307 peer-reviewed papers. We find that shared interaction, intuitiveness and personalization should drive mobile phone design. Industry practices are examined and future research avenues are suggested.**

Keywords-usability; design; principles; global practices.

I.   INTRODUCTION

How can mobile phone design increase usability and the user's experience in a global setting? Information technology (IT) and mobile phones, commonly referred to as Information and Communication Technologies (ICT) are now pervasive in our everyday lives and that pervasiveness increases as computers and phones converge as they are fast becoming information appliances. While there are still non-adopters, the non-adoption of ICTs may be explained by a range of attitudinal, skills-related and infrastructure-related factors [1]. However, non-adoption, as it relates to literacy issues, is weaker in the case of mobile phones [2]. Possible explanations are the availability of complementary infrastructure, efficient enough providers [e.g., 3], and easily accessible related innovations [4]. This implies that mobile phones are within reach of most of the world's population: Somalia – a failed state – ranks 16th out of 42 African countries in terms of penetration [5].

In the global arena, mobile phones are an empowerment tool as they help develop human capital [6]. In Mexico, they free users from geography-related institutional constraints [7]. In rural Indian areas, they help the less fortunate and are a catalyst for social change [8]. In the Middle East, they positively influence economic freedom [9]. Conversely, a lack of access to mobile technologies may hinder development [10] and even promote inequalities [11].

This paper is structured as follows. First, we state the problem we are addressing which is that of designing an optimal user experience in a global and diverse context. Second, we explain the context of this research as it relates to the impact of literacy on ICT use. Then we look at how users' familiarity with technology influences design in terms of accessing information. Third, we discuss the methods

used which consist in a structured literature review of a large number of articles. Fourth, the resulting design principles are examined in terms of their contribution to the improvement of usability and some industry practices are presented. Finally, we conclude and discuss potential implications for academics, businesspeople and policymakers.

II.   PROBLEM STATEMENT

Mobile phones – and ICTs in general – have proven very popular in recent years. Globally, they are used in a variety of contexts: from highly educated and "sophisticated" users who exploit every single functionality, to utilitarian users that focus exclusively on core functions (i.e. dialling calls only or simple web surfing), to users with low or no literacy who have developed strategies to overcome this obstacle in order to make mobile phones a tool for meaningful interaction and/or community engagement. Also, there are a wide variety of geographical and cultural challenges to mobile phone usage as pictograms and input-output methods and devices may be culturally biased even if they are globally standardized.

Notwithstanding this, accessing information is highly dependent on interface design and usability. Tools and technique are evolving at a rapid pace and user adaptation would be easier if interface design followed sets of principles that would be consistent globally and culturally, among other variables.

Thus, in extremely diverse usage contexts as reflected by an ever-increasing global user base, it is important to determine how mobile phones may be designed for optimal usability notwithstanding the potential users' levels of literacy or familiarity with technology.

III.   CONTEXT

A.   Literacy

In the global arena, the challenge of literacy is often overlooked when considering usability issues. The traditional concept of literacy tied to the written language is obsolete as it is not essential to access information and knowledge anymore if only because of the penetration of television and mobile phones [see 12]. Literacy is now considered to be « digital » [13] insofar as access to ICT is now deemed

essential by UNESCO [14]. Thus, designers need to provide an information-rich experience to users of ICTs notwithstanding their literacy level, in synch with the growing migration of content on these platforms.

B. Familiarity with technology

Similarly, users' familiarity with technology is another design challenge. Traditionally, user interface tools for accessing information have consisted in series of menus that may be classified in three categories. First, hierarchical menus are a commonly used tool that reflects the organization of information. Although they are not necessarily intuitive and require a great deal of both classical and digital literacy skills, they have the benefit of being systematic. Second, fisheye menus blow up certain parts of the information a user is querying to make it easier to discriminate between the choices offered to this specific user. They often rely on text and icons. Third, tag clouds organize information according to its popularity. This is very useful for users with preferences and search patterns aligned on those of related groups of users. Designers need to find ways to divorce familiarity with technology and access to content so that ICTs become an enabler for all potential or actual users.

IV. METHODS

We used a structured literature review process in order to determine a set of principles and practices for the design of highly usable mobile phones and ancillary applications. We reviewed a total of 307 peer reviewed papers that focused on keywords related to mobile phone usage and design like: literacy, usability, sales, adoption, etc. Papers were then grouped by themes that were clustered around design principles and industry applications.

With regards to the validity and reliability [15] of this review, the breath of articles we surveyed allows for a good level of reliability, while the keywords chosen and our preoccupation for examining diverse research fields and cases [16] provides validity to this research. We were thus able to extract design principles and industry practices that increased usability and user experience.

V. DESIGN PRINCIPLES AND INDUSTRY PRACTICES

Our structured literature review first led to general design principles. Then, real-life examples were extracted in light of those general principles.

A. Designing interfaces for usability

Usability is thought to be a driver for interface adoption. As a general rule, interface design should be centered on the user to allow increased confidence and meaning in their interactions with – and through – mobile phones. Especially in the case of interface design for low literacy users [17], any sustainable solution must be coherent with their geographic or cultural contexts [18]. Thus, design principles may be drawn around three core ideas: shared experience, intuitiveness, and personalization.

1) Allow users a shared interactive experience: A common experience, in the form of a common platform or

as an ability to access and exchange similar content, is conducive to higher quality knowledge flows between users [19]. It must also allow for various modes of interaction (i.e., with keyboards, touchscreens, videos, or other input/output modes, etc.) [see 20, 21]. Massive multiplayer online video games are a case in point [see 22]. Thus, social relationships and interface interactions benefit greatly from being designed like human relationships [23].

2) Focus on intuitiveness: Reducing the users' cognitive load increases their interaction accuracy. This implies that processes underlining a given interface have to make it user-friendly and rich [e.g., 24]. Minor changes to handsets and a streamlining of the interface (colors, symbols, etc.) significantly improve usability [17]. Furthermore, an elegant interface influences the perception of usability [e.g., 25] as this concept has both objective and subjective components [26].

3) Personalization and user-control matter: Some systems offers choices for increased personalization [27] that go as far as being sensitive to a particular context [28]. Usability may also be improved by increasing the level of control exerted by the user and through a « help » section [29]. Social tagging [30] and the combination of visualization and voice activated features are another set of useful tools [31].

These principles also find their way into industry practice.

B. How global industry leaders do it: some examples

Global industry leaders have embodied these principles in their practices and products to varying degrees. These may be grouped into three categories: 1) the relationship between literacy and the handset; 2) interacting with the mobile phone; and 3) leveraging the possibilities offered by a mobile phone.

1) The handset and literacy: Few global leaders have focused on low literacy customers. Yet in many emerging markets, these customers constitute the bulk of mobile phone users. In developed countries, many users have literacy-related challenges as well. In 2008, Nokia and Motorola have come up with different ways of addressing these challenges from intensive R&D effort into the matter. While Nokia focused on the physical ergonomics of the handset, simpler menu functions, and an icon-based menus; Motorola opted for a larger screen with bigger letters and numbers as well as more classical, yet streamlined, hierarchical menus. At that time, both handset makers focused on trying to increase intuitiveness while providing limited user control through a less complex phone.

2) User interaction with/via a handset. Global industry leaders have often sought efficient ways to leverage user interaction with – and through – mobile phones. Web browsing, email, social media, film and picture applications – and eventually 3D applications – provide additional

richness and connectedness beyond the voice transmission capabilities of traditional mobile phones. Handset makers offer users differentiated modes for interaction (reticular screen vs mini-keyboard) and different means for scrolling content. While the iPhone and traditional Blackberry handsets offered very different user experiences, the Blackberry Torch constitutes an example of the possible convergence between these products as it offers a reticular screen and a physical QWERTY keyboard. It also offers "apps", just like Android-based phones and Apple devices do; the latter having been the pioneer in marketing "apps" efficiently.

3) Leveraging the handset. Mobile phones offer increasing possibilities for interaction trough web-browsing and "apps". Google is a case in point. Its search engine interface design is extremely simple, streamlined yet very efficient, especially for mobile devices. It is intuitive as it only has one text-entry box. It allows for personalization as users may filter search results according to certain preferences. It is easy to use on mobile platforms and is a recognized leader in keyword searches. The Amazon Kindle also embodies these principles. While one can procure a physical e-reader, it is also possible to download a Kindle application that allows one to read Kindle books on an iPhone, an Android handset or a Blackberry.

VI. CONCLUSION AND IMPLICATIONS

More broadly, a continuous focus on design for user-centered usability has many implications for business, government and research.

A. Implications for business and government

Business and governments will benefit greatly from better mobile phone and interface design. This will provide for better, high-context and information-rich transactional environments. Service delivery will be improved for all customers, including those with literacy challenges. Furthermore, it will enable implementation mechanisms that will not be sensitive to geography or context, thus providing value-added solutions to emerging economies as well as developed ones.

B. Implications for academics

This research has a range of implications for academics. First, it is a multidisciplinary foray into mobile phone usability in a global context. Second, it helps refocusing this research field beyond engineering requirements or marketing issues, which are useful but provide a partial picture.

C. Future research

In conclusion, the literature, the design principles and industry practices derived from this research call for a return to basic user-oriented principles to drive future research: 1) more should be done to find ways to reduce the cognitive load attached to mobile phone usage; 2) both engineering and the social science aspects need to be simultaneously considered to tackle the issues that surround usability; 3)

simplicity and interaction richness need to become a focus for industry leaders. Immediate future steps for this research involve a careful examination of the impact of literacy that could help explain the effect of this variable on mobile phone usage for complex tasks and transactions, especially for users with no or limited levels of literacy. Furthermore, the related technical challenges need to be dealt with following the determination of a roadmap detailing the engineering requirements and technology development that will flow from this research. In-depth cases, examples and user life stories are tools that will lead to an increased understanding of the particular technologies that are bound to shape the implementation of these principles. From healthcare management challenges in the emerging world [32] to more participation and citizen engagement in Africa [33], mobile phones have become a part of global communities and thus should be on a path to increased usability by the widest range of customers on a global scale.

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