Facilitating Smartphone Use for Blind People through a Human Powered Approach

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Abstract

From a longitudinal study of smartphone adoption with blind users, we uncovered the need for frequent assistance and the opportunity for effective and efficient knowledge sharing. Smartphones are constantly evolving platforms where new applications, features, and consequently barriers, appear every day. Building on comprehensive knowledge of challenges and coping mechanisms employed by blind people, we are exploring how human-powered solutions can contribute. A human-powered approach has the potential to address efficacy, availability and coverage issues by expanding the pool of supporters. Our goal is to devise a set of human-powered tools to facilitate and promote smartphone usage. With in-context solutions we aim to investigate solutions that enable user independence and self-learning. We will augment knowledge sharing interactions and investigate its impact in promoting new smartphone usages.

Introduction

Mobile devices are becoming fundamental for inclusion and independence. Yet, there are still many open research issues in smartphone accessibility for visually impaired users [4]. Currently, learning how to use a smartphone is non-trivial, especially when we consider that the need to learn new apps and accommodate to updates never ceases. When first transitioning from a basic feature-phone, people have to adapt to new paradigms of interaction. Where feature phones had a finite set of applications and functions, users can extend the possible functions and uses of a smartphone by installing new 3rd party applications. Moreover, the interconnectivity of these applications means that users can explore a seemingly endless set of workflows across applications. To that end, the fragmented nature of development on these devices results in users needing to create different mental models for each application. These characteristics make smartphone adoption a demanding task, as we found from our eight week longitudinal study on smartphone adoption by blind people [6].

Visually impaired people often have to require synchronous, co-located assistance from family, peers, friends, and even strangers to overcome the different barriers they face. However, help is not always available, especially when we consider the disparity in each barrier, individual support network and current location. Similarly, people can resort to learning artifacts (e.g. video tutorials, forums and manuals) but not all challenges will be covered. Moreover, even when they are available, most of these artifacts are not adequate for a mobile context. For first interactions many applications guide the user through the basic app features. Unfortunately, they are limited in their scope (i.e. supporting only first usage) and rely on visual metaphors to guide the users (e.g. transparent overlay occluding all the irrelevant content), thus, most are not fully accessible. We aim to investigate in context human-powered solutions improve current smartphone accessibility.

Providing in-context assistance can facilitate users learning process and provide them with the support to tackle challenges [3]. Web Q&A in-context solutions like LemonAid [2] provide users with the ability to ask questions that are made available to anyone. Human-powered solutions can provide the flexibility needed to support the user. Human-powered approaches to assist blind users have been successfully used to identify objects in the real-world through visual questions [1] provide a collaborative metadata authoring mechanism for web accessibility [7] and enabled Q&A in-context in web applications [2].

Building on these works, we propose to explore novel approaches to continuously provide blind people with assistance and opportunities for serendipitous learning. We will investigate if and how human-powered mechanisms can be effective and efficient in facilitating smartphone usage of blind people of all expertise levels.

Research

First, we will further characterize the mobile challenges blind users of all expertise face. Secondly, we will develop and investigate three components to facilitate and promote smartphone usage. We will explore in-context Q&A and interactive tutorials to provide assistance. We will augment current support networks emulating the benefits of co-located knowledge sharing. We will assess each approach proposed individually to understand its benefits and shortcomings in improving smartphone accessibility.

Characterizing Mobile Challenges

Our first study investigated the smartphone adoption process understanding its challenges and influential factors [5]. Next we explored the barriers faced at all levels expertise identifying longstanding issues and the developed coping mechanisms in a workshop setting [6]. We aim to reach wide understanding of the most common and difficult problems tackled by blind users everywhere. As such we are conducting extensive analysis of content created and discussed on the top online community forums for blind people dedicated to smartphones. Lastly, we are conducting user studies to identify the priorities and relevance of each of the identified issues.

In-Context Q&A

Users should be able to overcome every challenge presented by simply interacting with the device. Therefore our goal is to develop solutions that provide assistance in-context enabling user independence and self-learning.

In Rodrigues et al. [6], to tackle this issue, we designed *Hint Me!,* a human-powered Q&A in-app assistance tool for smartphone usage. Using *Hint Me!* as a design probe, we first conducted a user study with six blind participants eliciting their perceptions on the usefulness and acceptance of human-powered networks for smartphone support. The design implications provide the foundation for all the human-powered approaches that will follow during the course of this work. The first step is understanding how to create a platform that allows volunteers to create effective answers.

We are enhancing the platform by simulating the end-user context and providing key information about theirs communication needs. We will further develop *Hint Me!* in preparation of a longitudinal in-the-wild study of the integrated solution.

In-Context Interactive Tutorials

Currently, app developers are solely responsible for the accessibility of their content and the creation of accessible tutorials. Our goal is to change the way tutorials are created, shared and presented on mobile devices. We are developing accessible in-context tutorials that can be, created and shared by any smartphone user, about any app. The tutorials are created with a mixture of user demonstration and voice recording. Furthermore, users will be able to rely on a human-powered platform to request new ones.

We are investigating how to guarantee that individuals with no accessibility knowledge can provide effective assistance to expand the volunteers' pool. We will evaluate the proposed solution in a lab study prior to the in-the-wild deployment.

Promoting Knowledge Sharing

Our previous solutions were designed to allow users to overcome barriers. However, facilitating smartphone usage is not just about allowing users to independently solve issues. It is about promoting smartphone usage, sharing knowledge and serendipitous learning. During the adoption study [5], users that shared their experience with other users adopted the device faster and explored more applications. In the workshops [6], we observed whenever a user had a question participants engaged in a broader discussion surrounding that feature, application or other similar ones. Participants that were unaware of the feature/app were engaged and interested in using them. Moreover, knowledgeable participants were keen to share their experience and give advice.

There is opportunity to leverage telephony IVR to reduce the requirements to access assistance and participate in an active community. We are currently developing an IVR platform that resembles a forum with the following features a Popular Feed, Q&A board, Stories, Lessons and Other. Users will be able to call to browse/share content or request assistance through Q&A. All users are able to comment and rank the content submitted which is solely based on audio recordings. Unlike the previous approaches, the ability to browse freely through content, share and discuss stories and lessons enables users to serendipitously learn from one another.

Outlook

In this research we will first contribute with a holistic body of knowledge covering the barriers blind people face with smartphones, across expertise levels. We hypothesized that human-power technologies can be leveraged to facilitate and promote smartphone usage. To facilitate usage, we will investigate and provide insights into how to develop effective and efficient in-context assistance through a human-powered platform. To promote usage we are assessing how to augment current community groups by designing a common content commissioning platform.

I have concluded the initial formative studies characterizing the problem. I have taken the first steps into designing, developing and evaluating human-powered solutions that target the identified problems [6].

Acknowledgments

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André Rodrigues is a third year Ph.D. student at the University of Lisbon, majoring in Computer Science. His research is focused in the area of human-computer interaction, especially smartphone accessibility for visually impaired users.