

# Appropriating Technology to Facilitate Mobility: An Exploratory Study of the Use of the “Tune Map” Mobile Application by Visually Impaired Pedestrians in Bandung City, Indonesia

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## ABSTRACT

This exploratory study investigates the way people with disabilities use digital technology in context specific ways. The authors examine the ways in which modern societal structure and organization have systematically disadvantaged citizens with minority attributes. The scope of our study is confined to Indonesia, Southeast Asia’s largest economy. We examine how Internet and Communication Technologies (ICTs) can provide assistance to marginalized individuals, with a particular focus on how people with disabilities use technologically to increase their access and participate socially in communities and environments. Tune Map is a currently evolving mobile pedestrian navigation application that aims to assist users with visual impairment navigate the city of Bandung, West Java. This article examines the effects of using the Tune Map application on the everyday walking experience of people with visual impairment. This ethnographically inspired study investigates the daily lives of three visually impaired pedestrians in Bandung city as means of exploring their subjective experiences. We argue that it is necessary to investigate the subjective experiences of people with disabilities in order to design useful interfaces for visually impaired and general users. Our results indicate that although Tune Map is useful, it requires further development in order to specially addresses the needs of people with visual impairment. Future versions should be designed in conjunction with people with visual impairment as well as people without visual impairment. We conclude that while disability is a social construct, based on the dominant norms by which society and media systems are organized, wider spaces for the mobility of marginalized groups can be shaped through meaningful understanding of the ways in which they use technologies to assimilate into society.

**Keywords:** *Appropriation of technology, ICT, minority, media, mobile application, visual impairment.*

## 1. INTRODUCTION

This exploratory study investigates the experiences of people with visual impairment and the ways in which they use existing technologies to integrate into modern society. This study aims to explore the impact of Information and

Communications Technology (ICT) on mobility by examining the subjective experiences of marginalized users.

The advent of digital technology in the 20<sup>th</sup> century dramatically affected the way society is organized (Wet, Koekemoer, & Nel, 2016). The development of ICT

infrastructure and the global adoption of the internet have improved and drastically transformed modern society (Schmidt, Pflieger, Alt, & Fitzpatrick, 2012). The scope and speed with which communication environments have been transformed by the internet have incited dystopian and utopian academic discussions around the world (Castells, 2014).

In both the developed and developing worlds, the way urban societies are structured has systematically disadvantaged those citizens with minority attributes (Wolff & De-Shalit, 2007). These minority attributes are not neutral but limit their physical and social mobility in a social structure that benefits the most able. Simply put, people with minority attributes are systematically positioned as “inferiors” (Kugelmann, 2007).

The authors begin with the assumption that minority attributes are socially constructed by the same mainstream discourses that are usually attributed to women, children, the poor, and people with special needs (Wolff & De-Shalit, 2007). As distinctive and specific social groups, women, children, the poor, and people with special needs are marginalized from participating in the work force, public discussions, legal representation, and a host of other societal roles (see Wolff & De-Shalit, 2007).

For minority groups, access to the most basic economic and social participation in modern, capitalist society are merely ideological. Firstly, material change is required to open-up spaces to accommodate minorities within society (Vehmas & Watson, 2013). This needs to be followed by a realization that it is less

about the disabilities of minority groups than it is about their systematic marginalization normalized through multiple institutions (see Quist-Adade, 2017; Goodley, 2011), among them the mainstream media.

As such, we posit that the social constructs of the media can be re-constructed using specific channels to suit the needs of minority groups. Through the use of technologies as tools, for instance, we could construct a wider and deeper integration of people with disabilities into social communities and hence could protect them (Khetarpal, 2014). Digital technologies such as mobile applications may be seen as a kind of soft infrastructure that broadens access to basic public services. Although increased mobility would not necessarily reform the social structures that oppress people with disabilities; it could gradually normalize their social participation and interactions in communities (Khetarpal, 2014; Visagie et al., 2019; Crook et al., 2016), and mediate claims to rights, power, and participation in public institutions (see Vehmas & Watson, 2013).

Previous studies focusing on mobile applications that specially address people with disabilities examined how these mobile applications help children with dyslexia learn to write (Tariq & Latif, 2016), assist people with intellectual disabilities to learn everyday life skills (Yeni, Cagiltay, & Karasu, 2019), and how messenger groups help students with visual impairment develop their social skills, specifically discussion skills (Líbera & Jurberg, 2019). These studies propose that digital technology in general, and mobile applications in particular, could improve quality of life for people with

disabilities. Importantly, these studies show how the effectiveness of mobile applications in helping people with disabilities is context specific. This means that the type and extent of ability/disability need to be taken into account (Darcy, Green, & Maxwell, 2017). This includes considering social barriers such as language and technical issues associated with the use technologies (Visagie et al., 2019).

In this study, we examine the social and technological barriers faced by people with visual impairment, and their subjective experiences when using technologies to broaden the space within which they can move. We focus on Bandung, West Java, a city adjacent to capital city Jakarta in Indonesia, the largest economy in Southeast Asia. We explore how ICTs are appropriated by people with disabilities in Bandung to increase their integration into society through improved social mobility. To achieve this, we use the mobile application Tune Map, a navigation system designed to assist users with visual impairment. We argue that it is important to develop assisting technologies from the user's perspective (de Certeau, 1984).

The next section of this paper describes our theoretical standpoint, followed by the context of Tune Map. We will also provide a short overview of the methodology, results, and discussion, and a conclusion of insights gained through this exploratory study of the everyday walking experiences of people with visual impairment.

### ***1.1. Standpoint Theory: Approaching People with Disability***

The authors use the standpoint theory of disability; a theoretical framework

inspired by the feminist standpoint. Historically, this body of work emerged as part of the women's resistance movement in the 1960s. It has evolved as an academic theory that examines the minority attributes shared between women and other disenfranchised social groups. This includes being perceived as weak, vulnerable, and incapable. It is understood in this theoretical framework that women and people with disabilities are subjected to distinctive yet interrelated social processes of marginalization, and that it is in the interests of all parties to fight for the same rights and strive for equality (Garland-thomson, 2002). Standpoint theory provides a point of departure concerning self-determination and empowerment for people otherwise oppressed in a capitalist society.

This theory has been used to talk about disability and to theoretically inform practices to facilitate social change (Sprague & Hayes, 2000). In the current study, the authors use this framework to understand how efforts toward self-determination are limited by interpersonal and socio-cultural relationships. In everyday life, society continues to use discriminative terminologies in reference to people with disabilities (Beckett, Ellison, Barrett, & Shah, 2010). In accordance with academics advocating standpoint theory, we view independence and dependence is part of an illusionary dichotomy and propose that we are all interdependent (Sprague & Hayes, 2000). Ironically, when a member of society appears to be independent, he or she is actually benefiting from the interpersonal relationships and social structures (Sprague & Hayes, 2000) that are also marginalizing others.

The reason some of us seem to be “normal” is that social structures and practices have been designed with our abilities and needs in mind (Sprague & Hayes, 2000). This theory advocates the importance of taking on the standpoints of those who are least empowered in mainstream society (Chouinard, 2015). Importantly, the expression of the “self” occurs within the context of interpersonal and socio-structural relationships. This is what scholars term self-determination. Developing mobile applications to address the needs of people with certain impairments by actively involving these groups may offer a solution. To improve our understanding of how the Tune Map mobile application is used by people with disabilities, we need to understand how they live and the struggles they face in their attempts to integrate into mainstream society (Chouinard, 2015).

### **1.2. *Tune Map***

Tune Map aims to aid the mobility of the visually impaired by providing users with information about nearby places of interest, and about dynamic obstacles such as ongoing ground works, broken sidewalks, or street vendor blockages (@tunemap.id, 2016). Tune Map was initiated by three youths in Bandung, who love to walk around the city. During walking, they often encounter dynamic obstacles on the sidewalks. These obstacles not only inhibit the mobility of pedestrians with visual impairment, but also endanger them. Being convinced that by making facilities safer for pedestrians with visual impairment, they would be making them safer all pedestrians, they developed the Tune Map application (Nofieka, interview, December 9, 2019).

The creators of Tune Map aim to increase public awareness about the need for inclusiveness toward persons with visual impairments. This goal is actioned through campaigns on Instagram and the creation of mobile applications such as the Tune Map application. Tune Map is designed to facilitate interactions between people with and without disabilities in order to stir up a sense of empathy and mutual understanding. Tune Map periodically gathers volunteers to join #MapMyDay. During this event, volunteers use the Tune Map application while walking around the city and report on safe and unsafe sidewalks. The data collected is then used to inform visually impaired pedestrians and also to advocate for change at the government level. There are two versions of the Tune Map application. One for users with no visual issues and the other caters for users with visual impairment. The former is used to gather information about dynamic obstacles on the sidewalks that may endanger pedestrians with visual impairment. The second assists users to choose the best available sidewalks and informs them of any nearby places of interest (Nofieka, interview, December 9, 2019). The Tune Map creators continue to develop both aspects of the application.

## **2. METHODS**

This study examined the everyday walking experiences of people with visual impairment using the critical constructivist paradigm (Quist-Adade, 2017), a qualitative approach (Hancock, 1998), and an ethnographically inspired strategy (Pink et al., 2016). Pink et al. suggests that disability studies and research in related fields have led to a growing emphasis on

increasing and altering the capabilities of digital technologies in order to assist in the everyday life of people with disabilities (Pink et al., 2016).

Our study explores the subjective experience of participants using the Tune Map mobile application as an assistance tool. We examine the daily lives of three visually impaired pedestrians in Bandung city. Firstly, we contacted the co-founders of Tune Map and asked for recommendations of pedestrians with visual impairment who were involved in the development of the Tune Map application. The selection criteria were people who: (1) have installed Tune Map application and (2) joined Map My Day. This allowed us to observe the ways in which they used Tune Map for mobility assistance.

Data was gathered by participant observation and in-depth interviews and analyzed using a qualitative descriptive analysis method to obtain a general description of participant experiences.

Data was collected at two time points. Firstly, during interviews with individual participants. As the Tune Map application had not been launched at that time, we investigated how they used smartphones to assist in their daily activities. Later, at the Map My Day event held by Tune Map community, we studied the participants' experiences as they used the Tune Map mobile application specially designed for users with visual impairment.

**3. RESULTS**

We conducted interviews and observations of three participants (one woman and two men). P, a mother of one, is a provides computer training to people with visual impairment. R is a diploma student majoring in music studies. He is also a massage therapist and judo athlete. Y is a teacher, and a leader of the national community of Muslim people with visual impairment. All three participants actively use smartphones for their daily activities.

**Table 1.** General Descriptions of Participants

<b>Description</b>	<b>Y</b>	<b>R</b>	<b>P</b>
<b>Sex</b>	Male	Male	Female
<b>Age</b>	49	27	34
<b>Activities</b>	Islamic teacher, student, organizational leader	Judo athlete, music student, music teacher, massage therapist	Homemaker, freelance writer, editor, and computer trainer for people with visual impairments, committee member of some organizations
<b>Tools</b>	1 laptop, 1 smartphone	1 laptop, 1 smartphone	1 laptop, 2 smartphones

Each participant owns and uses at least one laptop and smartphone as their portable tools. To access the laptop, participants install a screen reading program, called "Job Access with Speech" that automatically initializes as soon as the

laptop starts up. The sound of the laptop fan allows participants to recognize that the laptop has booted up.

Their lists of top mobile applications included: WhatsApp, Facebook, Google

Maps, and the online transport applications Grab and Gojek. With the help of screen readers, they are able to use WhatsApp and Facebook to interact with family, friends, and students. They use Google Maps in conjunction with the online transport applications to make sure the drivers pick them up from and take them to their desired destinations. Y and P often use Lazarillo—a special mobile application for people with visual impairment to detect nearby places of interest—when they go out of town on business trips. Due to the limited RAM and internal memory of their smartphones, they usually uninstall Lazarillo on returning to their home town.

### ***3.1. How people with visual impairment use their smartphones***

None of the participants in this study were born blind. They became blind through illness or accidents during childhood. Y mentioned that his parents told him that he had beautiful eyes before he suffered an illness when he was 1 year old. If his parents had better medical knowledge regarding ways to overcome his illness, those beautiful eyes might be safe. However, his parents preferred going to the herbalist rather than taking him for medical treatment. When, at last, his parents brought him in for medical treatment, it was, sadly, too late, and he had already lost his vision.

R said that he could see clearly until a pencil accidentally hit one of his eyes. Unfortunately, due to the poor economic status of his family, he did not get proper medical treatment and, instead of being blind in only one eye, he lost vision in both eyes.

*“I was born without visual impairments. However, in 1999, when I was a kid, one of my eyes got hit by a pencil. Due to the lack of knowledge and poor economic status of my family, I did not get proper medical treatment. By 2005, I had lost sight in both my eyes.”* (R, interview, originally in Bahasa Indonesia, January 18, 2020)

P was born without visual impairment. However, an illness when she was 2 years old caused her to have low vision in both eyes. She went to special school from kindergarten. Similarly, to R, her eye was hit by wooden stick while she was playing with her friend at school. As a result, she is totally blind in that eye.

Despite their limited visual abilities, the three participants do not see themselves as pitiable. They realize that they are filled with potential that they are able to develop and use. Notwithstanding this, they also realize that they need to try harder than people who are not visually impaired. They are aware that they are part of a minority group, and, as such, they believe that it is important for blind people to interact with each other and support each other. There is a strong sense of community among people with visual impairments, and almost all those who live in Bandung know each other. They interact mostly via Facebook and WhatsApp Groups. As P explains:

*“Most of the people with visual impairment know each other, even though we live in different cities... If you ask why, maybe because we realize that we are the minority. We have WhatsApp Groups and Facebook to connect with each other. Some of us may never have met each other before, but we know each other through WhatsApp Groups or Facebook”* (P,

interview, originally in Bahasa Indonesia, January 24, 2020)

Regarding their views on assisting technologies, they agree that these tools are beneficial to them. For instance, a white cane helps them walk safely. Braille letters helped them to read and write before the digital era. Personal computers and smart phones help them to work more efficiently. At times, they need non-digital tools more than they need digital tools. For example, even though there is a mobile application to help them read hardcopy papers, they occasionally prefer others to read the paper to them. They also prefer to have the titles of their children's school books written in braille (rather than provided on a mobile application) to ease them into preparing their children's school tools. Also, although a mobile application has been developed to detect surrounding objects, the white cane remains irreplaceable for them.

Although in common use today, smartphones were not the first mobile phones to be used as assistance tools by people with visual impairment. They are, however, much easier to use than older mobile phones since users had to memorize the position of each number on the number pads of older phones and, since they had no screen reader applications, they also had to memorize the phone numbers of dozens of people. Through the development of screen reader technology, users moved to mobile phones that used the Symbian Operating System, which they found to be more helpful, even though those mobile phones provided only limited access to the internet. Finally, they progressed to using mobile phones with Android and/or iOS, which are really helpful since they allow users to access to

the unlimited world of the internet via voiceover assistance. Our participants reported that, although they were not really amazed by them (since they had prior experience of technological developments in personal computers and mobile phones over the years), they found smartphones to be really helpful.

For people with visual impairment, screen readers are the best accessibility tools available. By activating accessibility features in the settings menus of their smartphones, they are able to use the screen reader. This program reads all the items on the screen. Unlike users who are not visually impaired, users with visual impairment must double tap the screen whenever screen reader offers up an application or menu item that they would like to use. The screen reader verbalizes the name of the application or the menu item that they have touched. When screen reader mentions the desired menu item, they double tap at the screen to choose that item. When they want to type, they place a finger on the screen and move it toward the letter that they want to select. They listen to the screen reader and release their finger from the screen when it mentions the desired letter.

The participants reported that they used a variety of different mobile applications designed specifically for people with visual impairment. P mentioned at least four applications for visually impaired users that she occasionally uses. The first is Lazarillo, an English-based application for detecting and navigating to nearby places of interest. The second is TapTapSee, an application used to detect objects and colors that she uses to match the colors of her clothes and hijab. She uses Presmo to read texts to

improve her work as a trainer. Sometimes she uses her smartphone to take a *selfie* using the Selfix application. This application uses voiceover to direct her to move the phone to the right or left, up or down to ensure that she is correctly positioned in front of camera. When she is in the right position for the shot, Selfix says: “Say cheese!”.

As a massage therapist, R often uses a Bahasa Indonesian-based mobile application called *Mas Jawa* to authenticate money using a photograph of the cash. Unfortunately, this application only works for Rupiahs, and R cannot use it to authenticate the dollars he receives from foreign customers.

The three participants agreed that smartphones and mobile applications make their everyday lives easier. However, each mobile application addresses a different problem and it is difficult for them to install all the applications they need for the many different daily problems that they face due to the limited memories and RAM of their smartphones. They hope someday there will be a one-stop application that will solve the majority (if not all) of their daily challenges. Language is also a hindrance and all three participants agreed that Bahasa Indonesian-based applications would be more helpful to them.

### **3.2. Walking Experiences with Tune Map Assistance**

Tune Map only launched their application that specially addresses the needs of people with visual impairment on October 20, 2019. As a result, Tune Map did not appear in our participants’ lists of top mobile applications during the interview stage of this study. Therefore, in

addition to the interviews conducted prior to Tune Map’s release, we investigated the participants walking experiences while using Tune Map application assistance over the course of one day—the Map My Day event held by Tune Map.

Pedestrians with visual impairment were invited to join Map My Day to try out the application that was specially designed for their needs. Together with the Tune Map team and volunteers, people with visual impairment walked around the city with the assistance of the application. Participants were divided into five groups. Each group included three or four pedestrians with visual impairment. Each pedestrian with visual impairment was guided by a volunteer. Before setting off on the walk, the Tune Map team supplied the link to download the application. After logging into the system using their email addresses, participants were able to follow the instructions to use the application by listening to the voiceover.

This application detects places of interest in the vicinity of the user. When the desired place is detected, the voiceover mentions it in Bahasa Indonesian, for example, it may say: “*Susu murni Cisangkuy 5 meter di sekitar Anda*” (Cisangkuy Milk Bar is 5 meters away). Although this is helpful to pedestrians with visual impairment, our participants would have liked more features, such as the ability to detect whether the nearby place is to the left or right, ahead of or behind them. Additionally, they also would like the application to detect nearby objects, such as trees and street vendors, which would help them feel more secure as they navigate the streets. The Tune Map application provides an accurate street location for the user and accurately tracks



the user while in motion. However, it does not automatically recalculate the distance between the user and the nearby public place as the user moves (i.e., although the user may have walked for several meters, the application continues to report that Cisangkuy Milk Bar is 5 meters away. In order to allow the application to accurately update the distance to nearby place of interest, users need to refresh the application frequently by touching the “back” menu. This is confusing as, for most applications, the back menu also serves as the exit path from the application. In this case, however, instead of exiting the application, the back menu refreshes the navigation, and users must touch their “home” buttons to exit the application (R, participant observation, October 20, 2019).

Although some problems persist in the latest version of the Tune Map application, participants appreciate the initiative of the Tune Map team. They reported that this application shows promise as a first step toward helping them to achieve independent everyday mobility. They expressed their sincere hopes that Tune Map would continue to develop the application into the one-stop application they are searching for that will not only assist pedestrians but everyone with visual impairment in Bandung and Indonesia.

#### **4. DISCUSSION**

This study investigated the walking experiences of pedestrians with visual impairment using the Tune Map application as an assistance tool. During our study, we identified several other factors surrounding the use of mobile technology by visually impaired people. Firstly, walking is no longer the primary

means by which they reach destinations. Just like many other citizens, they order online transportation to go almost everywhere in the city. What they need is an application that will detect and relay landmarks to them so that they are able to accurately inform drivers of their pick-up locations. Walking is mainly done for exercise or to reach nearby places, for which they only need their white canes—special sticks designed to assist people with visual impairment—to ensure they walk safely. Moreover, we learned that people with visual impairment tend to have a greater ability to memorize things, including directions and locations.

Also, they prefer walk on the side of the road, rather than on the sidewalk, because they view the side of the road as safer than the sidewalk since there are many obstacles on the sidewalk, such as holes, that endanger them. It is ironic that they perceive the side of the road as being safer than the sidewalk, since there is a greater danger of sustaining serious injury on the road due to the higher risk of being hit by moving vehicles.

In general, participants agree that technological assistance such as mobile applications are valuable tools that empower them. These applications help them feel more confident when taking a trip, or choosing what clothes to wear, without needing to ask other people for assistance.

Our results indicate that the Tune Map application presented some technical issues for its users, which emphasized the need for developers to engage people with visual impairment to test these applications at every stage of development. This also highlights the urgent need to develop

assistive technology from the standpoint of people with disabilities. And not only to develop this technology, but also to upgrade public infrastructure to accommodate people with minority attributes. People in mainstream society, with the privileges we enjoy, should passionately advocate for inclusivity for all.

Many previous studies have examined the role of technology in assisting people with disabilities. Unfortunately, the majority of these studies have been constructed from the standpoint of the technology developers. We argue that greater benefit would be derived when research is conducted from the standpoint of the user (i.e., people with disabilities). Moreover, further research is required into ways to improve accesses and remove the

barriers faced by people with disabilities as they attempt to empower themselves in the mainstream environment.

## 5. CONCLUSION

Disability is a social construct created by the organization of mainstream society and through the influence of dominant media streams. We do not merely need deconstruction; we need greater authentic action. Applying the logic of the appropriation of technology, ICTs such as the Tune Map mobile application can be utilized to facilitate the social participation of minority groups in mainstream societies. This would lead to friendlier cities which embraced not only to those socially constructed as people with disabilities, but also all citizens in general.

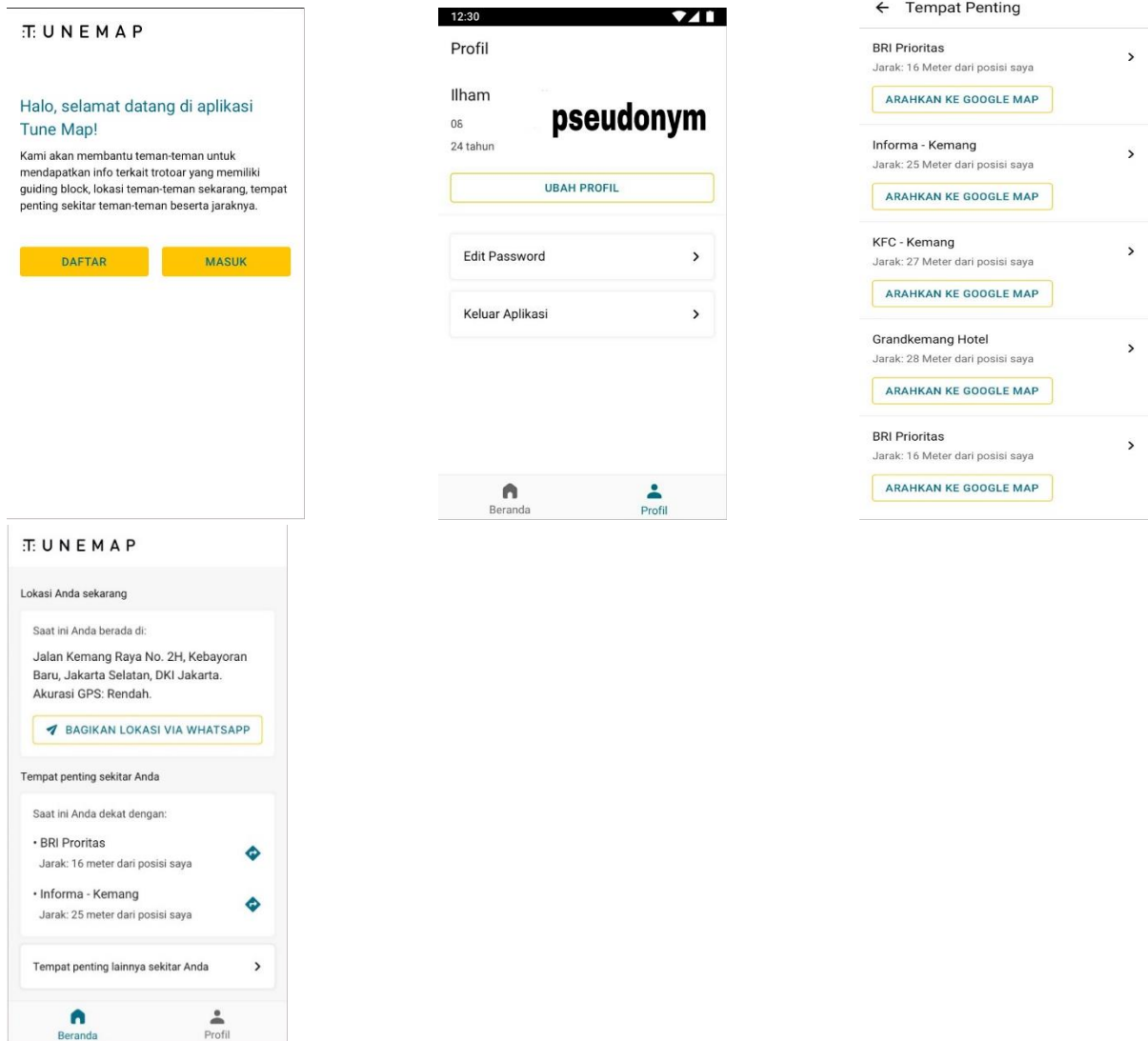
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## Appendix



*Image 1. Tune Map Application Interface for People with Visual Impairment*

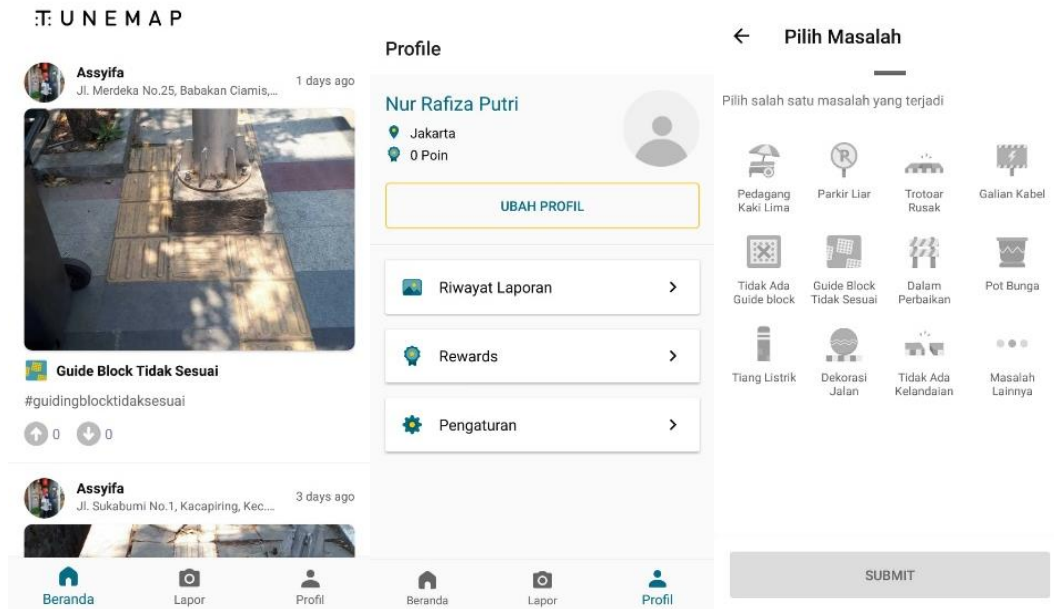


Image 2. Tune Map Application Interface for People without Visual Impairment