Context-Aware Peer-to-Peer Service Exchange

(Technical Report)

Accessibility Needs of Senior Citizens as a Factor for Designing Mobile Applications

(STS Research Paper)

A Thesis Project Prospectus Submitted to the

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Alexander W. Zummo

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On my honor as a student, I have neither given nor received unauthorized aid on this assignment as defined by the Honor Guidelines for Thesis-Related Assignments.

Signature _____

Approved _____ Date _____
Sean Travis Elliot, Associate Professor of STS, Department of Engineering and Society

Approved _____ Date 12/9/20
Aaron Bloomfield, Professor, Department of Computer Science

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Introduction

Mobile apps have promised to make our lives better in every way possible, whether we like it or not. Now that 'there's an app for that' is the answer to so many questions, smartphones are rapidly becoming a prerequisite to accessing a multitude of services for everything from community involvement to food delivery. While the convenience and new opportunities that mobile apps afford us may be clear, there is a substantial population that is often not considered when building this technology: senior citizens.

The technical project will seek to build a mobile application that uses context-aware matching to match people with their peers to fulfil each other's service needs. The project is currently hypothetical but will likely be as described below.

The STS prospectus examines how the needs of senior citizens may shape the way mobile applications and technology are developed. This discussion will take place within the Science, Technology, and Society (STS) framework of the Social Construction of Technology.

Technical Project: Context-Aware Peer-to-Peer Service Exchange

The technical project will seek to build a mobile application that uses context-aware matching algorithms to allow community members to connect with one another for the purpose of fulfilling each other's service needs, with emphasis placed on timeliness and context awareness of notifications and matches. For this project, "context-awareness" will refer to the app's use of a user's current state, such as location, habits, skills, or profile information, to make decisions. When a user first signs up for the app, they will be prompted to enter what services they can provide and what services they typically need. For instance, a particular user may have

experience with web development and have a big truck that can be used to help move things, but also often need someone to walk their dogs or cut their grass.

Whenever a user posts a request for a particular skill, the app will use a combination of location (distance between users), skillset, and history of accepting/declining jobs to send a notification to users that are most likely to accept the job. This context-awareness is what separates the app from something like Craigslist, which features static listings with no apparatus for matching potentially interested users to postings. The app will further seek to improve the likelihood of a match's success by examining users' context history (data collected by the app about users' habits) to deliver push notifications at a convenient time. If a user needs someone to go to the store for them, for example, the app will find users that typically travel past or live close to the store and deliver them a push notification when they are in the area.

The mission will be to increase community 'closeness' by increasing instances of people getting needs that can be fulfilled on a casual basis fulfilled by residents of the same community. The app will completely generalize what services may be offered or requested, as well as how users compensate each other, to adapt to the specific needs of each community. This is especially relevant during the COVID-19 pandemic as supply chains and consumer behavior shift, small businesses fail, and public health guidelines are constantly changing. If a particular service is displaced by the pandemic, those needing the service can turn to this app to look for a member of the community with the skills to fill it.

This project is an excellent example of an instance of the community shaping how technology is used. Although the application will be developed by engineers, the users will ultimately dictate what content is found on the app, as well as influence how the app may be updated or changed. This is also another case in which someone who has difficulty accessing

mobile applications could be left out of a service that exists as an app. If the app's interface is difficult for senior citizens to interact with, then there may be users (especially older users) who simply give up after becoming frustrated when trying to use it or cannot use it effectively.

Social Construction of Technology (SCOT) and App Accessibility

Technological constructivism, also referred to as Social Construction of Technology (SCOT), argues that society shapes the way technology is developed and used. SCOT rejects technological determinism, which argues that technology determines how society will develop. While it may make sense that technology shapes society (life has indeed changed in many ways since mobile phone technology became widely available), SCOT would make the case that the way that humans act and make choices influences how mobile phones and apps are developed. This societal feedback on mobile technology is immediately evident when examining the boom in value of apps that people like. Tik Tok, a popular new video sharing app, was valued at over $50 billion by its parent company Byte Dance in July 2020 (Wang et al., 2020). One could argue that this is due to technology shaping how people communicate. I would argue that the app did not make people love sharing short videos, rather the makers of the app observed from the success of vine and snapchat that people love sharing short videos, and released a product designed to meet this desire. Similarly, apps that seek to take over existing services, like Uber took over the taxi service or Grub Hub took over food delivery, grow to meet the needs of their users. It follows, then, that if a huge subset of users is unhappy with or unable to use an app, the app needs to change to meet those needs if it is to succeed. The exploding population of senior citizens especially in the United States means that there is a growing demographic of users that mobile app designers must thoroughly research and design for.

Senior Citizens and Accessibility

The U.S. Census Bureau projects that adults 65 years and older will outnumber children under 18 in the U.S. for the first time by 2034, with the total population of seniors roughly doubling from 49 million in 2014 to 94 million by 2060 (U.S. Census Bureau, 2020). Despite any stereotypes about seniors always hating whatever was invented after their time, there are some serious accessibility challenges that older users face when using mobile applications. We will define a senior citizen to be any adult aged 65 or older, as the federal Medicare program does (U.S. Department of Health and Human Services, 2014). Individuals from this group may vary in ability but are generally more likely to suffer from declines in cognitive function, eyesight, and hearing, and are more likely to suffer from one or more disabilities than younger individuals (Manini, 2013). These factors could make using a small smartphone screen difficult, and an app with poor visual accessibility even more so.

App developers have myriad considerations to make when designing a user interface. They are forced to strike a balance between having a sleek, beautiful interface and one that is clearly labeled and intuitive. Many buttons can be hard to see, such as a tiny ellipsis next to a larger button or a gray symbol on a black background. Some gestures like swipes and drags could be less than intuitive to someone who is unfamiliar with apps. Some fancy menu designs may be difficult to navigate. A study conducted by Trinity College Dublin in 2019 identified a list of 20 design checkpoints for evaluating the accessibility of mobile applications to seniors (see figure 1) (Alamo & Golpayegani, 2019). Alamo & Golpayegani suggest that apps with highly visible and intuitive controls will make a mobile application more accessible to senior citizens. Some companies have already taken the initiative on this front. Apple, for example, has options to increase contrast, bolden and largen text, and a handful of others in its recent IOS

Principle	Dimension	Checkpoint	Code
Perceivable	Small screen size	Reduce information	SG-01
		Font size	SG-02
		Form field below label	SG-03
	Magnification	Text resizing	SG-04
		On-screen control to change text size	SG-05
		Zoom	SG-06
Operable	Touchscreen gestures	Easy	SG-07
		Touch-end event	SG-08
	Buttons	Accessible	SG-09
Understandable	Screen orientation	Support both	SG-10
	Consistent layout	Multiple pages	SG-11
		Screen orientations	
	Page elements	Important page elements before page scroll	SG-12
	Operable elements	Group operable elements performing same action	SG-13
		Visually differentiate actionable elements	SG-14
	Instructions	Available	SG-15
		Easily discoverable and accessible	SG-16
		Available anytime	SG-17
Robust	Data input	set virtual keyboard to the type of data entry required	SG-18
		Reduce amount of text entry required	SG-19
	Support characteristic properties of platform	Zoom	SG-20
		Font size	
		Captions	

Figure 1 Design Checkpoints for Accessibility of Mobile Applications by Senior Citizens, identified by Alamo & Golpayegani

distributions (Aquino, 2019). However, more research needs to be conducted to examine how widespread such options are in other apps.

To add to the problem, those who design apps are younger by roughly a generation or two. Stack Overflow, a company that runs a popular Q&A forum for developers, found that three quarters of the nearly 90,000 software engineers who answered their annual developers survey were aged 35 or younger (*Developer Survey Results*, 2019). The cultural difference between those making apps and those senior citizens who must learn to use them should be examined. For example, many mobile apps make liberal usage of symbols in place of button labels. Feathericons.com, an open-source library of icons for use in mobile apps, has a nice list of such symbols and their typical meanings. A pencil often means edit, a trash can means delete, three

horizontal line segments means menu, the list goes on. Older and younger users may interpret them differently.

Conclusion

It is hard to know exactly what needs to be done to make apps as accessible as they can be by senior citizens. It is a huge and diverse demographic with a wide array of abilities, disabilities, cultures, stigmas, emotions, and more. The design factors identified by Alamo and Golpayegani may serve as an excellent place to start, but it will ultimately be up to app designers to seek out data on what users need and ways to make their applications most accessible. At the end of the day, people will find ways to connect with their older friends and loved ones. Apps that fail to adapt to the needs of seniors may find that society will construct technology that does, leaving them next to the petabytes of other apps that were survived by the fittest.

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