

Paula R. Rigoli. Choosing Between Smartphones, Tablets and Laptops: User Perspectives On Using Multiple Mobile Devices. A Master's Paper for the M.S. in I.S degree. July, 2012. 47 pages. Advisor: Brad Hemminger

This study describes a semi-structured interview conducted to evaluate how users with multiple mobile devices choose which device to use. The interviews were conducted at the Chapel Hill Public Library and University Mall with a total of 21 participants. Participants were asked to indicate how frequently they used a particular device, depending on the task to perform and the context. Four follow-up questions asked participants to describe how they originally intended to use their devices, how behavior has changed as they've started using them, if or when they multi-task and to summarize what each device is used for.

Results indicated that smartphones are heavily used for a variety of tasks and users continue to find them increasingly useful for their ease of access and pervasiveness. Also, tablet users expressed frustration at the limitations of tablet affordances. More research is needed to determine how self-reporting of usage differs from actual usage.

Headings:

Human-computer interaction

Information needs

Mobile computing

Mobile device applications

CHOOSING BETWEEN SMARTPHONES, TABLETS AND LAPTOPS: USER
PERSPECTIVES ON USING MULTIPLE MOBILE DEVICES

by
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1 INTRODUCTION

Mobile computing and mobile devices are becoming increasingly prevalent. Smartphones are becoming cheaper and more widely used and tablets are growing in adoption and usage every year. These devices are designed for specific contexts that are meant to supplement what users do on laptops and desktops. For many users the initial draw to purchasing and using a smartphone device is to have access to timely information and communication while “away” from home or the office. However, observations in the HCI community suggest that users may be using applications designed for the “away” context even while they are sitting right next to their laptop at home or in the office. This suggests that other contextual factors besides location influence decision-making when it comes to selecting a device to satisfy an information need.

In fact Whitney Hess (2012), a prominent user experience design consultant recently wrote: “[...] we have gotten into the habit of presuming that mobile means on-the-go, desktop denotes a desk, and tablet is on the toilet. But [...] this year I have learned to see devices as location agnostic and instead associate them with purpose – I want to check (mobile), I want to manage (desktop), I want to immerse (tablet). This shift away from objective context toward subjective context will reshape the way we design experiences across and between devices, to better support user goals [...]” (“Location Agnostic”). Such observations suggest that not only is location not always an appropriately assumed context, but also that different platforms offer different

affordances to complete similar tasks that users have begun to take advantage of to better support their goals.

Current research has provided a plethora of information about how users are using their smartphones, tablets and laptops individually. For example, recent surveys are finding that tablet users are playing lots of games, shopping and sitting in front the TV (Brill 2012). Other research breaks down how smartphones are used throughout a day, finding that games peak in the evening, while communication and social networking remains steady throughout the day (Xu et al. 2011). Despite such research so far, little exploration has been made regarding what factors influence the use of one device over another and how users switch between using these devices throughout a day. A further step to this consideration is how user behavior changes in response to a new device platform and its affordances.

The present study seeks to answer some of the questions regarding device adoption and use. It is hoped that by gaining a better understanding of the various contexts that influence how devices are used, the user experience can be improved to better support user goals as well as design applications across platforms that are better suited to usage contexts.

In order to better understand user goals and choosing a device, this study focuses on specifically answering the following questions:

- 1). How does context (location, task, affordances or subjective norms) influence the intention to use a smartphone, tablet or laptop?

2). How do device cues or user habits influence the decision to use a smartphone, tablet or laptop for a particular context?

To answer these questions a semi-structured interview was conducted with Chapel Hill area residents at the public library, located in the local mall. Participants were eligible to participate if they owned two or more combinations of a smartphone, tablet or laptop. They were asked to fill out a survey matrix and answer follow-up interview questions regarding their answers. The matrix listed tasks and contexts and the participants were asked to indicate how frequently they used each device given the task and context. Participants were also asked to “think aloud” regarding their various choices. After filling out the matrix, the participants answered follow up questions to describe in more detail what factors influence how they use their devices.

Several interesting themes were found when analyzing responses to the survey. Participants reported an overall reliance on their smartphone for a majority of the tasks across contexts. Some tension about the expected use and affordances of tablets was found for the tablet users. Overall, tablets remain a “fun” device used primarily for consuming media. During the interview portion, participants emphasized the importance of mobility and efficiency over concerns found in other literature such as cost, usability, privacy and social expectations.

2 LITERATURE REVIEW

The present study draws on recent research analyzing user behavior with smartphones and tablets. Such research draws on a variety of theoretical frameworks describing how users adopt and use technology. Two prominent adoption models are based in social psychology and include the theory of reasoned action (TRA) and the theory of planned behavior (TPB). Along with these models the research also draws on the technology acceptance model (TAM) and task-technology fit model (TTF). Many of the studies use “extended” models, borrowing and integrating the various models to get a true picture of user adoption and usage.

Use of information technology devices is also frequently considered in terms of information needs and information theories such as sense-making and collaborative information seeking. For example Weilenmann (2001) looked at how a group of ski instructors on a weeklong ski trip used a prototype of a mobile device. While Weilenmann’s (2001) provided the communication devices, they gave no instructions on how or when to use it. They found that the participants began negotiating appropriate contexts of use immediately, through discussion and action. Weilenmann (2001) found that there were some who believed the devices were to be used only on the ski slopes for working, while others thought they were supposed to be using after work hours as well, while socializing and partying. This study showed how affordances of a technology can be the same, but usage is dependent on perceptions of subjective norms that are continually be negotiated between a group of users.

Another theoretical context presented in the literature draws on research in cognitive psychology to consider how mobile devices integrate into user behavior and cognition. Such research looks at technology use in terms of the cognitive “rewards” and “cues” using a device or application provides, thereby influencing user behavior.

2.1 Smartphones

Previous work has analyzed what contextual factors influence the use of smartphones and mobile applications. Several sources find that there is significant usage diversity among the population. Falaki et al. (2010) describe mobile phone usage as a spectrum – from infrequent to extreme (500 minutes a day) – along which users are scattered rather than clustered into groups. Despite usage patterns not corresponding with demographics, they found that heavy users tended to use their mobile phones throughout the day, while infrequent users tend toward time-specific bursts of activity.

In addition, Heimonen (2009) found that while participants did use their mobile phone applications to look-up timely or location-specific information, much of the activity that takes place is more task-specific and related to the perceived availability and ease of use of looking up information on a mobile phone.

Interestingly, Oulasvirta et al. (2011) suggest that smartphones are habit-forming and encourage a “checking behavior” among adopters. This could be a useful explanation for the results found from Falaki et al. (2010) and Heimonen (2009). Their research suggests that this habit creates information needs that did not exist before through the promise of informational rewards and a sense of increased awareness.

In addition, Xu et al. (2011) breakdown mobile application usage by genre, location

(region), mobility of user and time of day. Like others, they find that social networking and communication tends to be used steadily throughout the day; while games, entertainment and reading apps are concentrated in the evenings. They also find that region-specific applications, such as news or weather, make up 2% of the national network traffic and 20% of an individual's application usage. This usage behavior provides significant opportunity for customizing recommendations based on location. It also supports Oulasvirta et al.'s (2011) observations that mobile phones are used for checking and a sense of awareness.

Liang and Yeh (2011) also analyze contexts of use in relation to mobile games. They find that the predictive power of the TAM and TRA models depend on the context. For example, at home the "perceived usefulness" (or perceived "playfulness" in the context of games) is more likely to influence the intent to use a mobile game than a factor such as the "subjective norm" in the office or in class. In an analysis of mobile commerce early adopters Pedersen (2005) applied the theory of planned behavior (TPB model) with a modification to include the "perceived usefulness" and "user friendliness" factors of the TAM model. In survey measuring attitudes among early adopters, Pedersen (2005) found weak support for the importance of subjective norms in influencing early adopters. Pedersen (2005) suggests that there are conditions in which subjective norms take a secondary importance for adopters of new technology. Pedersen also found that user friendliness was not a major influence in early adoption, suggesting that user friendliness is more important for later adopters.

In her earlier research, Kaikkonen (2008) explores how full and tailored web content on mobile devices satisfies user information needs. She notes that in a context

where screen size is very small and a slow connection, tailored web content was very useful. However, as users have larger screens and faster access to web content users increasingly want access to full content websites (Kaikkonen 2008, 1). Following a survey, Kaikkonen (2008) interviewed a small sample of survey participants. She found that users tended to prefer tailored web sites for small, checking tasks. At the time of the survey, very few participants used or knew what a widget was.

In a later study on mobile Internet usage Kaikkonen (2011) looks at how mobile Internet browsing habits have changed since a 2007 study by collecting data during 2010, when touch screen smartphones have become more standard. The results find that users are browsing the Internet more frequently and accessing more content rich sites. Similar results regarding preferences for full web content is found. Survey respondents expressed annoyance at being directed to a mobile tailored site by default, and generally preferred to see the full site. This trend may have increased since 2008 since participants are using more widgets and applications to provide similar information that tailored web content provided in 2008 to mobile Internet users.

In the later study, Kaikkonen (2011) also compares mobile Internet usage to computer Internet usage. She notes that in the 2007 study, “there was no single activity more frequent on mobiles than on computers” (Kaikkonen, 2011, p.175). Since then, activities such as “reading emails and news, downloading applications, listening to music, finding contact information and using maps” (Kaikkonen, 2011, p.175) has increased to favor usage of the mobile Internet. Kaikkonen (2011) points out that at the time of data collection, tablets had not become as prevalent as they are today.

Chua et al. (2011) investigated factors affecting users’ perceptions and fulfillment

of information needs using mobile phones. In particular, they looked at how contextual factors and affordances of the device could trigger information needs and affect the fulfillment of that information need. Through a diary study of self-recorded activities, their research found that fulfillment of information needs tended to be hampered still by connectivity issues while on the go (for example, not being able to access GPS and map information while traveling on the subway or bus) as well as the ease of use of virtual keyboards. Like Kaikonen (2011) found, hardware keyboards are still preferable for typing-intensive tasks. Chua et al. (2011) also found that user perceptions of subjective norms influenced the use of mobile phones to fulfill information needs. Participants in the research noted that it would seem inappropriate to pull it out at work or school, because mobile phones can be perceived as devices that distract from work.

Many of the researchers found that perceived privacy could influence whether a mobile phone is used to address an information need. Also, the perceived ease of use had an affect on how users solved their mobile information problems. Difficulty typing queries encouraged users to simply call a friend or consult a nearby expert. Kaikkonen (2011) found that access to hardware QWERTY keyboards increased typing activities on mobile phones, such as writing emails. Poor network connectivity also limited the use of a mobile phone when an information need arose.

2.2 Tablets

As a more recent, emerging technology, there is not quite as much research on tablets as that done in the area of smartphone usage.

Kim and Sim (2012) look at how tablet PC's are adopted by non-users and what factors influence current users to have "positive behavioral intention" toward the devices (p 246). The research they present is in response to contradictory forecasts on how tablets (an emerging technology) will be integrated and used by adopters. The two views see tablets as either completely replacing all other mid-size mobile devices (such as PDA's, netbooks, mobile phones, etc.) or as occupying a limited, niche market between netbooks and smartphones, most likely for entertainment contexts. In order to assess the validity of these forecasts, Kim and Sim (2012) consider tablet PC acceptance in terms of acceptance and diffusion models of "new IT devices" (Kim & Sim, 2012, p.246). They administered two online surveys to outline a model of tablet PC acceptance and diffusion. The first survey was for current uses of tablet PC's and asked questions regarding their satisfaction with their current tablet PC. The second survey targeted non-users and introduced the concept of tablet PC's as well a variety of tablet designs, features and price ranges about which the participant answered a questionnaire about their acceptance of a tablet model.

The results indicated a couple of interesting themes for tablet PC acceptance and use. First, Kim and Sim (2012) found that "the more complex a product, the higher its PU [perceived usefulness]" (p.253). They suggest that because adopters of an emerging technology like tablets are already using a variety of mobile and IT devices, ease of use is less of a factor in deciding to adopt a device. Kim and Sim (2012) also found that:

"playability was the biggest influence on the acceptance-diffusion of tablet PCs.

This result is an indication that a tablet PC is perceived, at least thus far, as a fun device, rather than a device that is a necessity in every day life" (p.253).

This result corresponded with the finding that for current tablet users, the playability and user interface had the largest influence on user satisfaction. It also suggests that the opposing predictions for future tablet-use are still not resolved from Kim and Sim's (2012) research. It is clear that users perceive tablets as both an entertainment device as well as a device from which they would prefer some complexity of features in order to satisfy a variety of information needs.

3 METHODOLOGY

3.1 Research Goals

The goals of this study were to gain a better understanding of how users are switching between different mobile technologies available to them, such as smartphones, tablets and laptops. In particular, the study sought to answer:

- 1). How does context (location, task, time of day, affordances or subject norms) influence the intention to use a smartphone, tablet or laptop?

- 2). How do device cues or user habits influence the decision to use a smartphone, tablet or laptop for a particular context?

3.2 Description of Method

In order to discover how users are switching between mobile devices, semi-structured interviews were conducted at the Chapel Hill Public Library, located in the local mall. The interview technique was chosen to allow the researcher to gain a better understanding of the different factors that might influence the use of one device over another through conversation, while also eliciting specific choices based on a list of contexts, tasks and devices in order to compare consistently across participants.

3.3 Population and Sampling Technique

It was important for the validity of the results that the participants were representative of many different types of mobile device users. The only requirement for the study was that the participant must have access to a combination of at least two mobile devices (either a smartphone, tablet or laptop), in order to discuss how they choose between using one or the other. To have access to a diverse sample of the population, the researcher obtained permission to recruit participants outside of the Chapel Hill Public Library, which is located inside the local mall. As a result, the researcher had access to both library patrons as well as visitors to the mall. The Chapel Hill University Mall is a community-oriented facility, which currently houses the public library. The library and the mall afford a public meeting space where a broad cross-section of Chapel Hill residents come to shop, check out books or meet and hang out.

Participants were recruited by the researcher using a flyer (attached in Appendix B) that was displayed at a table visible to anyone passing by or through the library. The recruitment flyer also noted that participants would be compensated a \$2 gift card to a mall restaurant for their time. If a potential participant expressed interest, the researcher would determine if they met the eligibility criteria for the study by determining what devices they had access to. Acceptable devices were considered to be:

- 1). Any smartphone or device with a 2-5 inch screen size that can connect to the Internet. This definition would include an iPod touch. Even though it is technically not a phone, many users use such a device in exactly the same manner, even using voice-over-IP applications to make phone calls.

2). A tablet was accepted if it was a mobile PC that is larger than 7 inches, operates primarily through a touch screen and can connect to the Internet.

Dedicated e-readers such as the Kindle were not included, but would include a device such as the Kindle Fire.

3). A laptop (a less ambiguous category) was accepted if it was a mobile PC that includes a keyboard and mouse pad by default and does not support a touch screen.

No effort was made to control for gender, race, age or other demographic markers.

A total of 21 participants were recruited over a period of three days at the public library. Of the participants, 12 were female and 9 male. The age of participants was evenly distributed between age groups of 18-25, 26-30, 30-40 and 40-50. Only one participant over 60 and two between 50-60 were interviewed. Also, race distribution favored Caucasians, with only 5 participants identifying as African-American or another race. Interestingly, all but one participant owned or used a smartphone, while 10 had tablets and 19 had laptops. About half (11) owned both a smartphone and a laptop, 7 owned all three mobile categories (smartphone, tablet and laptop), 2 owned a smartphone and tablet and only one participant owned a tablet and laptop.

3.4 Study Procedures

After a respondent expressed interest in taking the survey and being interviewed, the researcher asked questions regarding the devices they use or own to determine if they met the study's eligibility criteria. At this time the researcher determined informally whether the potential participant owned at least 2 mobile devices and whether those

devices met the specifications for each mobile category. If the participant was eligible and available for 5-10 minutes, the researcher and the participant moved to a mall table located in front of the library.

At this point the participants were given background on the nature of the study and presented the consent form (attached in Appendix C) to review and sign. No personal identification was collected and no recordings were made of participant answers. Once the participant signed the consent form, the interview began. Participants were asked to fill out a survey matrix (attached in Appendix A) that required they mark how frequently they use a device depending on the task and context or location. A semi-structured interview protocol was used, so that the interviewer asked four follow-up questions, using the survey responses as a guide, to discover if any other contextual factors influence the choice to use one device over another. The interviewer took notes of each participant's response to the interview questions. No interviews exceeded 10 minutes. After the interview was completed, the participants were offered a \$2 gift card for their participation.

3.5 Survey and Interview Guide

The survey and interview guide used during the study is included in Appendix A. The questions were developed iteratively through a review of relevant literature and in consideration of the research questions behind the study. Three contextual settings were refined to 1). a "personal" context, 2). a "mobile" context and 3). an "away" context. The personal context could include home or work. This is a place where the participant spends a lot of time and has the opportunity to interact with their stationary information

technology, such as a desktop. While some literature considers the office a “public” place, the two locations were grouped due to this stationary and more private nature of both settings in contrast to a place like a coffee shop. The relative privacy of a home or office is really dependent on the environment; however, for the purposes of this study the personal environment is meant to capture the stationary and at least semi-private context.

The mobile context was determined to be the truly “on-the-go” context, when a potential participant is in transit to another location such as on the bus or walking around. Finally, an “away from home” context was included to capture the truly public setting at which a user may be stationary, but are creating a temporary station for work or interaction such as at the coffee shop, in an airport or at the library.

Along with the contextual settings, nine tasks were broken out in the survey. These tasks were developed in consideration of the 2010 Nielsen Survey “What Americans Do Online” (nielsenwire, 2010) along with current literature reporting mobile phone usage categories. The Nielsen survey identified 10 sectors of dominant online activity for Americans. The top categories include: social networks, online games, e-mail, portals, instant messaging and search. The tasks selected for the survey were chosen for their representation of the categories the Nielsen report describes as well as for their ability to be performed across mobile device platforms.

3.6 Data Analysis

After completion of the interviews, the data was recorded and compiled into an excel spreadsheet. Responses to the survey were coded according frequency of use. A number “2” was assigned when a device was used for a task and setting “all the time”, a

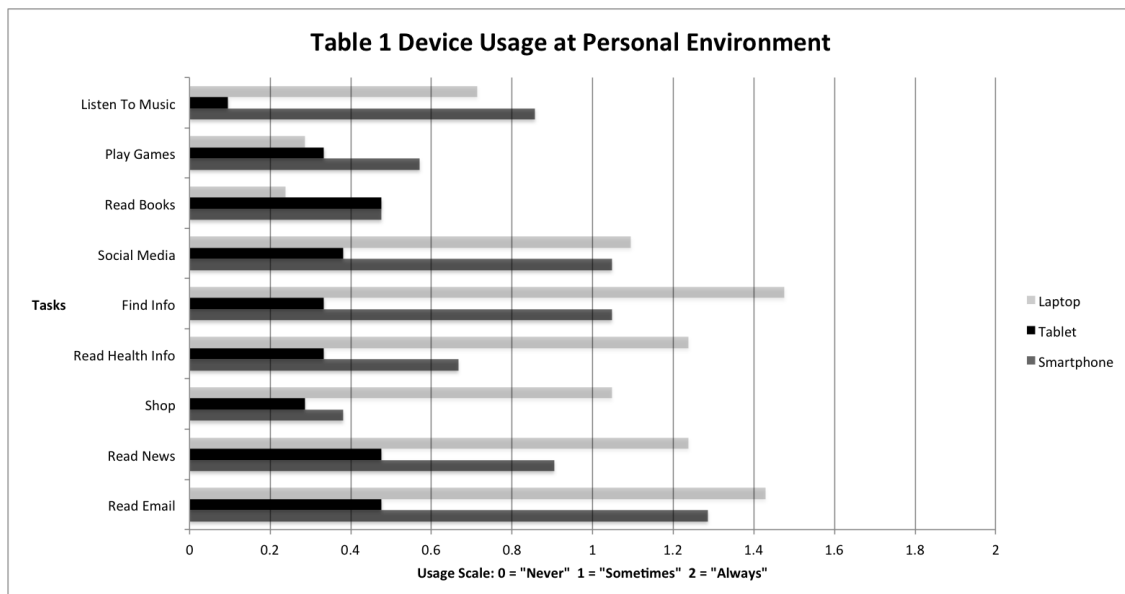
“1” assigned for sometimes and a “0” for never. The mean was calculated by device and context across participants. Because a majority of participants owned a laptop (19) and a smartphone (20), while only 10 owned a tablet, the mean frequency of use across device and context was calculated for tablet users versus non-tablet users to get a better sense of how tablets integrated into the user’s choice.

For the interview section, five themes about what influenced user preferences were found, which include: Ease of Use, Ease of Access, Perceived Usefulness, Subjective Norm and Cost. The category Ease of Use includes perceived affordances of one device over another, such as screen size or a keyboard. Ease of Access is used to describe the mobility of a device as well as its ability to begin interaction quickly. The Perceived Usefulness is used to describe what the user believes they can do with the device most efficiently. Subjective Norm includes user perceptions about what they should be using the device for, based on social standards. The Cost captures how device usage is influenced by financial considerations.

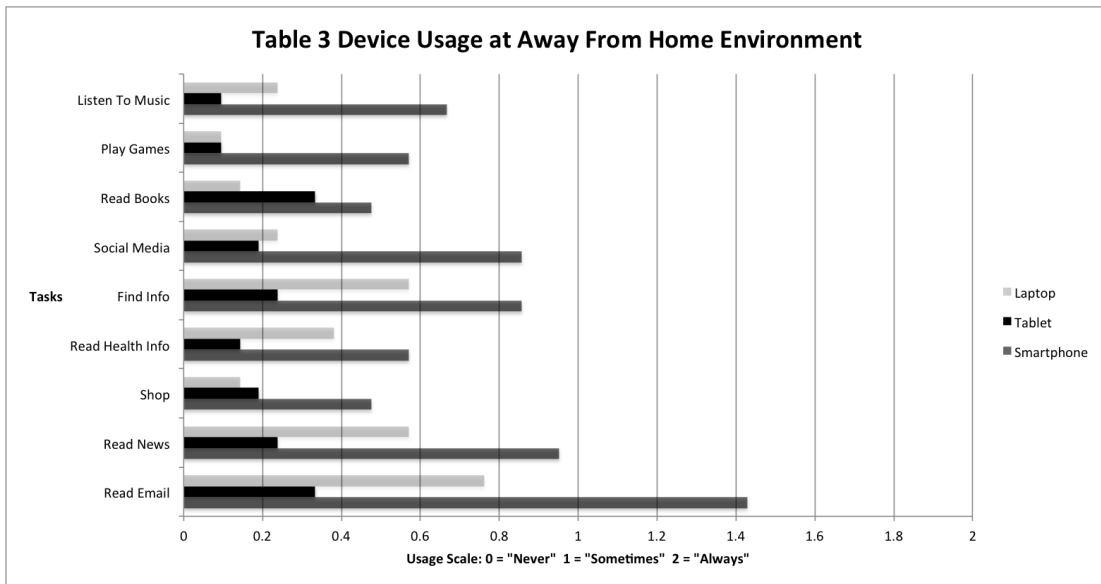
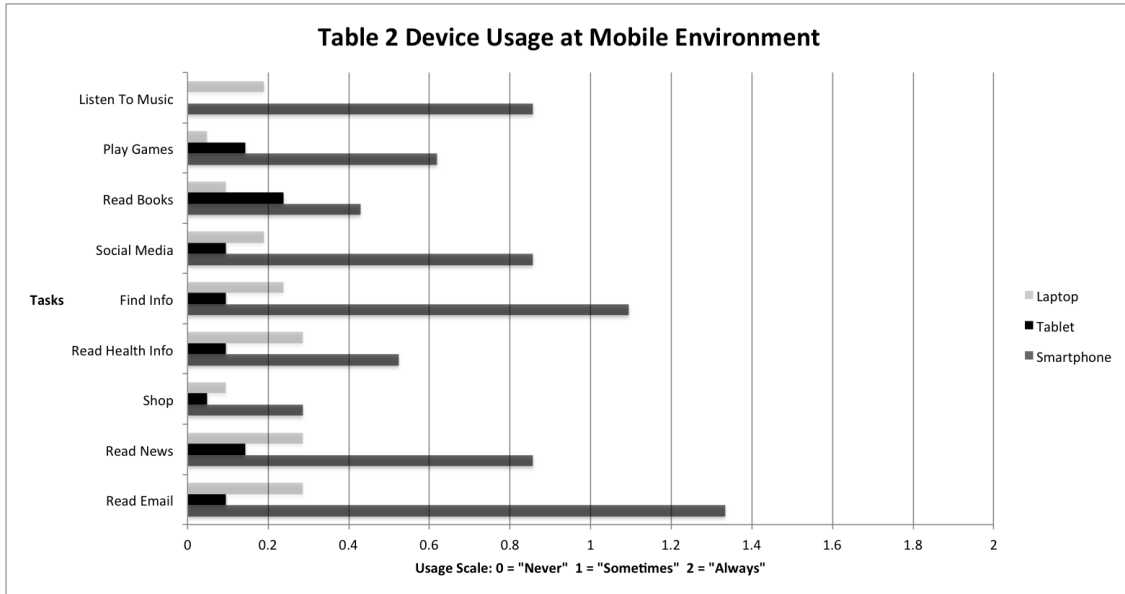
4 RESULTS

4.1 Effect Of Context On Usage

Looking at device preference in terms of context across all participants indicates that users still prefer the affordances of a laptop when it is easy to access. Table 1 shows how laptops still are used more frequently in the “Personal Environment” for most tasks. The only exception is for media consumption, where smartphones or tablets (if owned) are preferred for reading books, playing games and listening to music. However, smartphones are still used frequently while at home or work. For example, users are just as likely to use their smartphone to check their email or engage in social media as their laptop in this context.



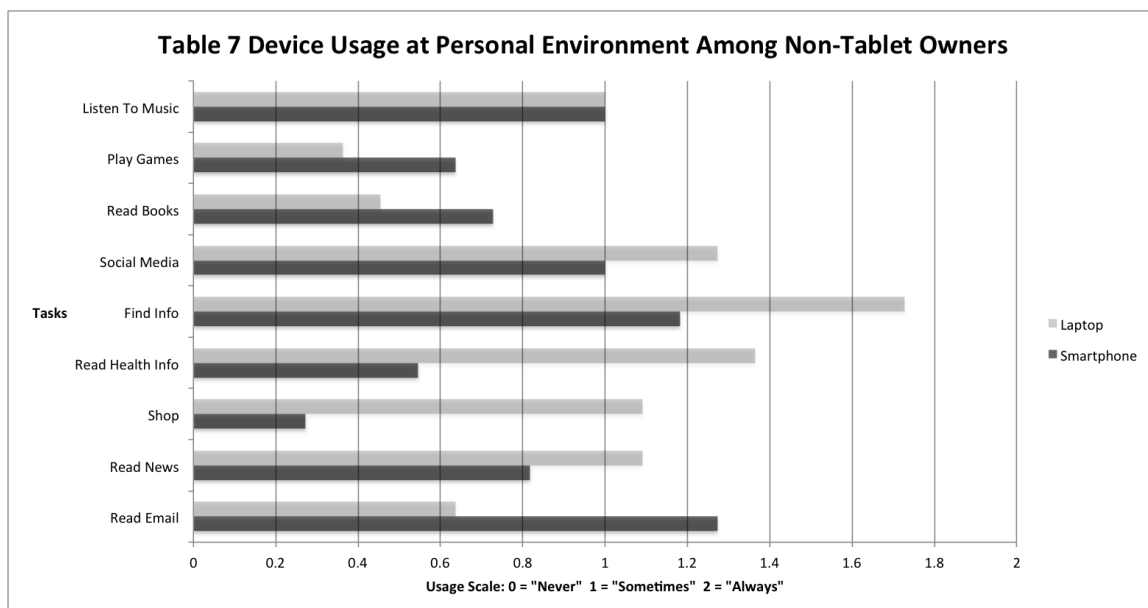
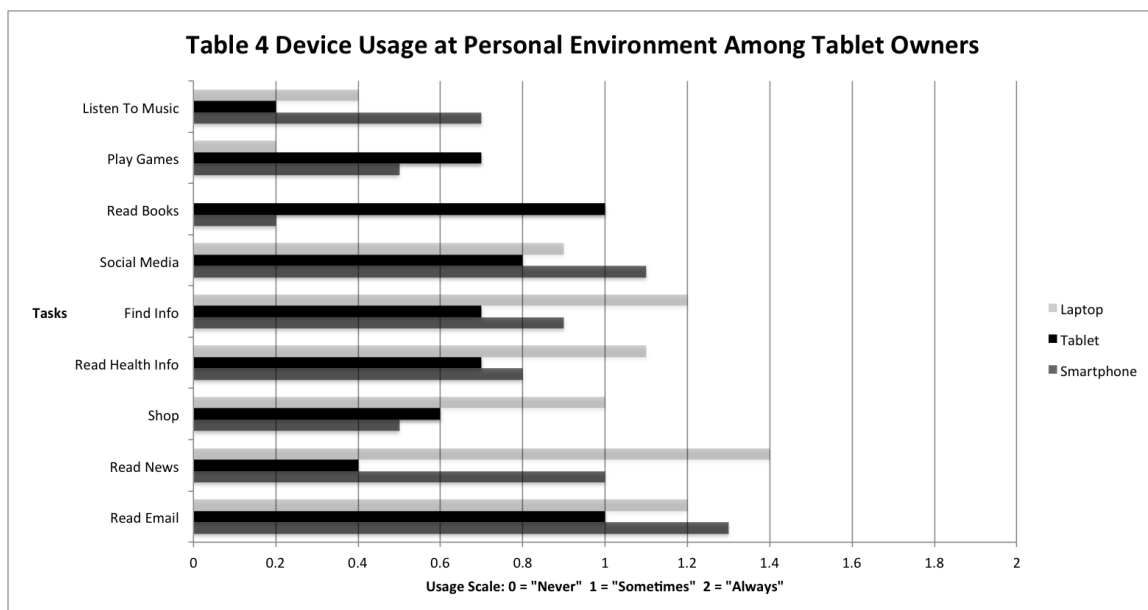
The data (Table 1, 2 and 3) also shows that, like laptops, tablets are used more frequently in a personal environment or in an away from home setting than a mobile setting, where smartphones are by far the most popular choice.



4.2 Tablet vs. Non-Tablet Owners

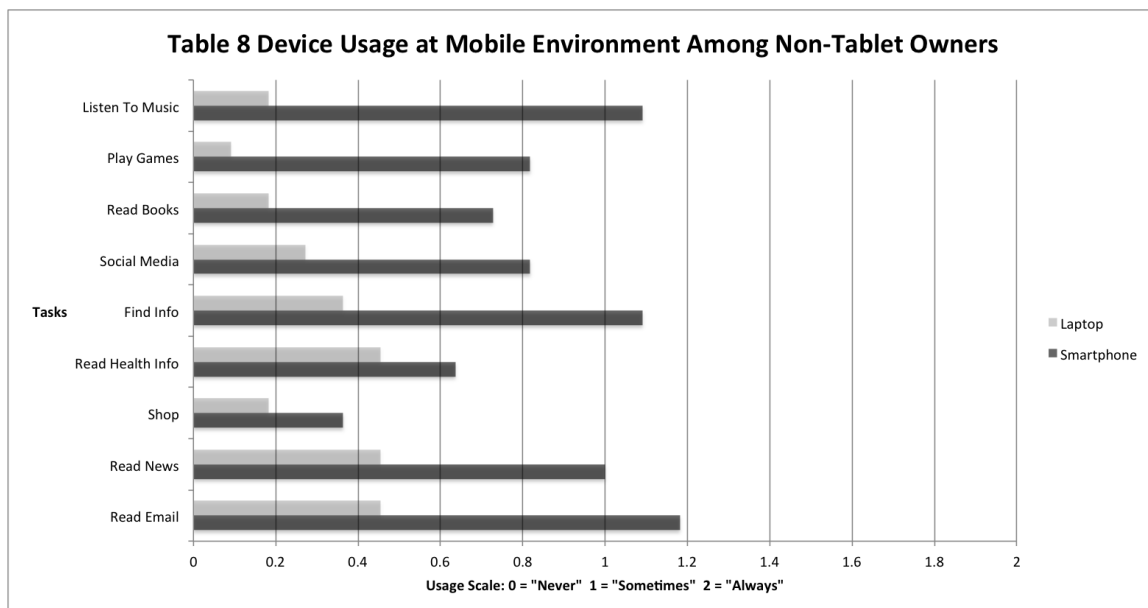
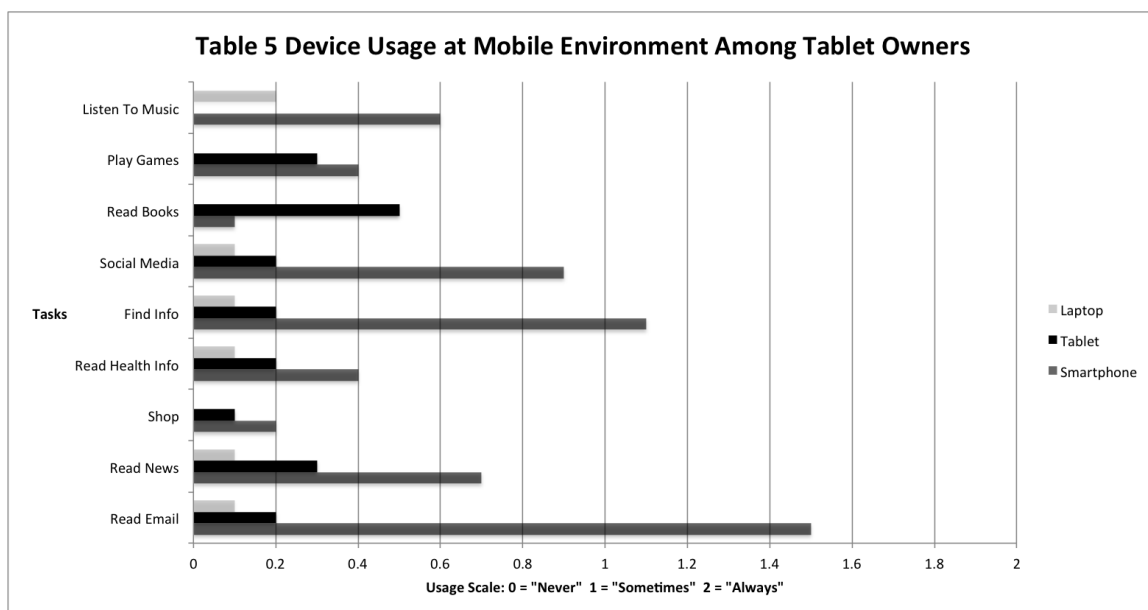
The data also shows a significant difference in usage patterns for tablet and non-tablet users for some contexts and tasks. Tables 4 and 7 compare usage at a personal

environment. Tablets are only preferred over any other device for media-centered activities such as playing games and reading books. However, tablets are also just as likely to be chosen to find information, shop or read email as a smartphone in this context.



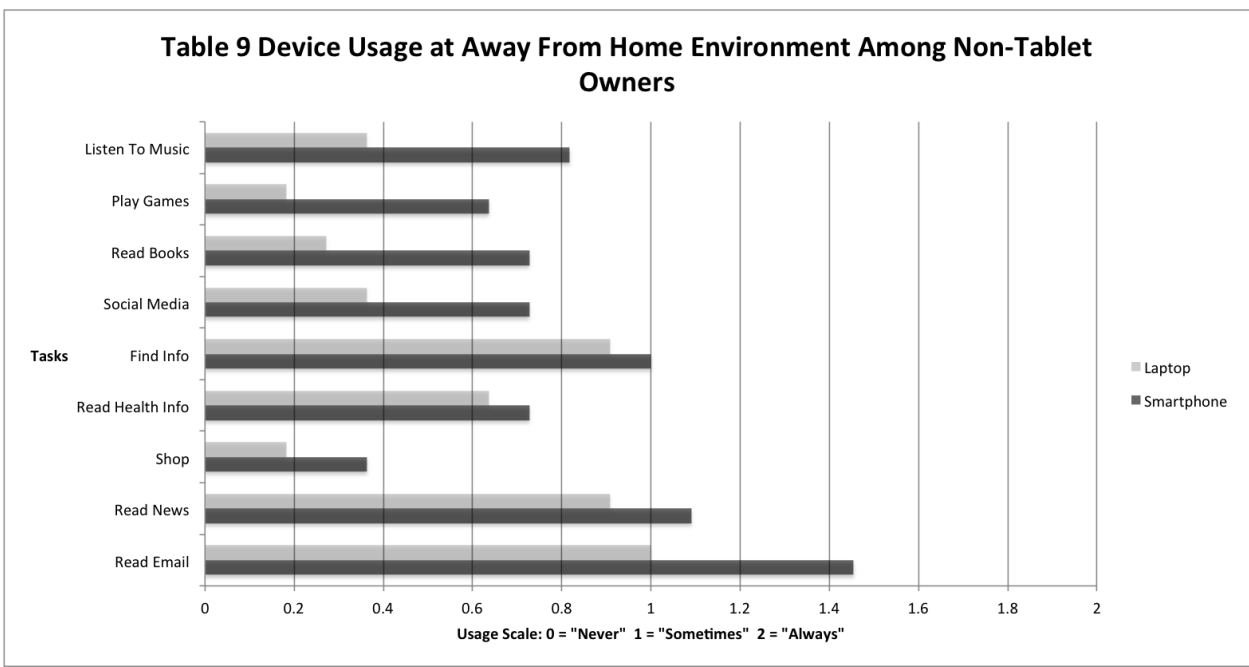
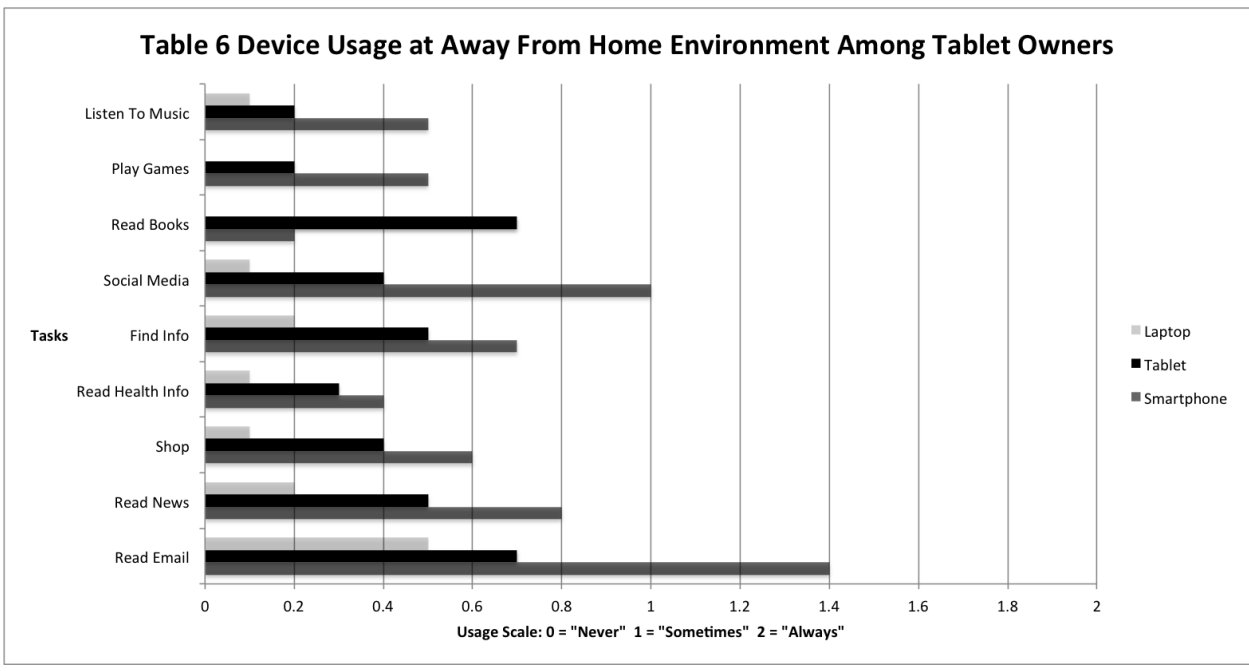
In a mobile environment, Tables 5 and 8 show that users still largely prefer to use their smartphone like non-tablet users, except in the case of media-oriented activities

such as reading books where the preference for tablets still remains for the tablet owner group in the mobile context.



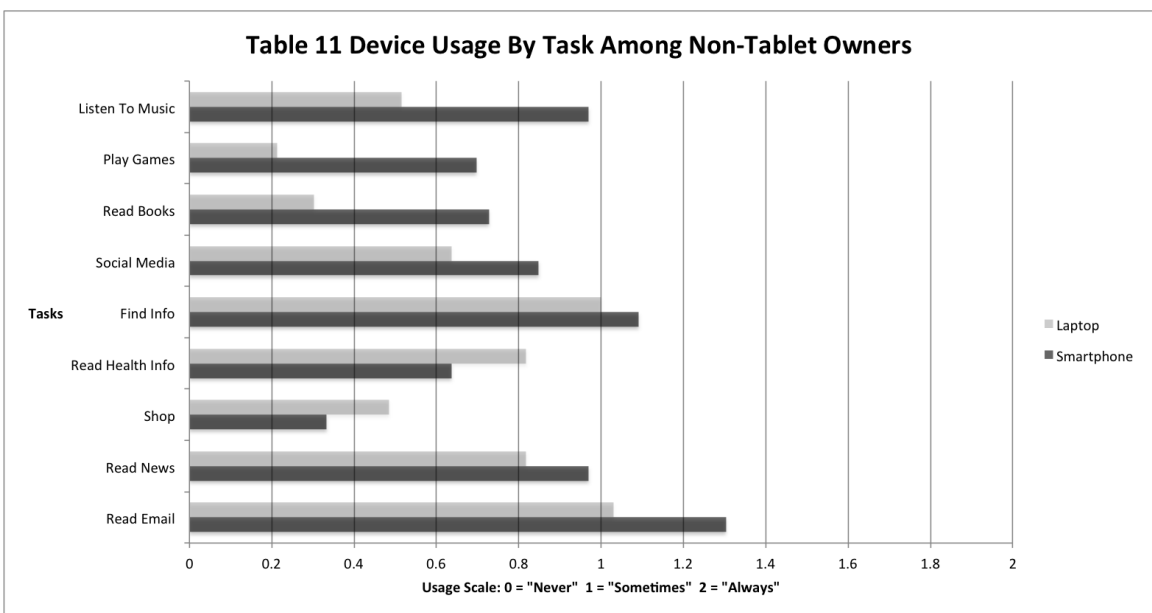
As previously noted, tablet usage increases again for tablet users in an away from home setting. Table 6 shows that while users still prefer the tablet to read books, the preference for using the smartphone to play games becomes more pronounced in this

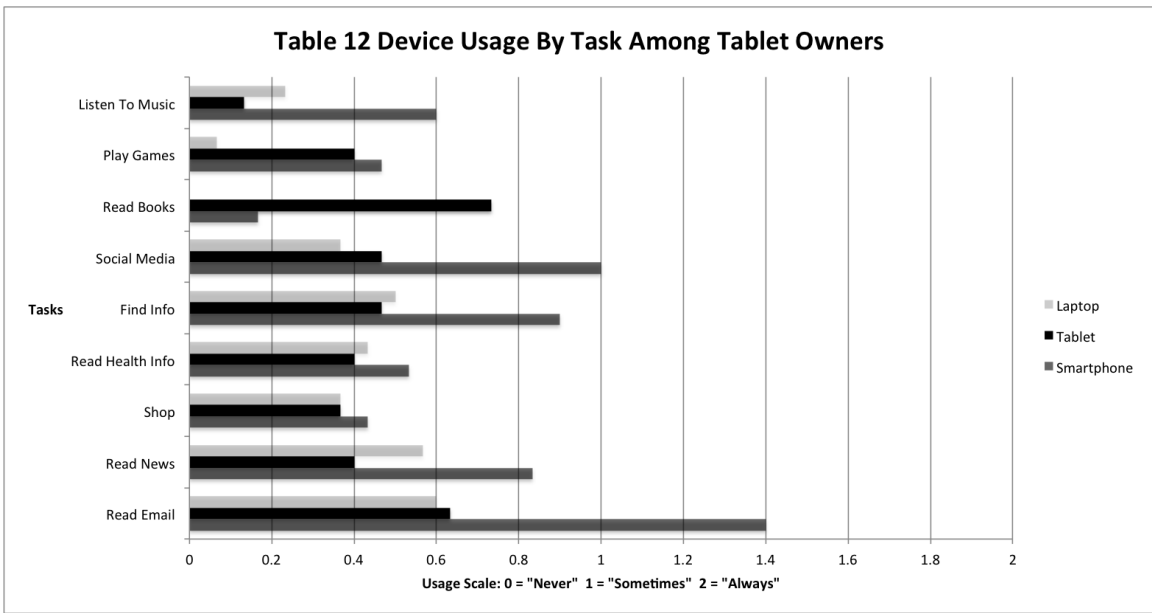
context. Otherwise, Tables 6 and 9 show that the preference for a smartphone over tablet or laptop is about equal for both groups in this setting across tasks.



4.3 Effect Of Task On Usage

Some user preferences for devices appear to maintain consistency across contexts for certain tasks. For example, even though laptops are slightly more popular in the personal environment (Table 1), users have an overall strong preference for using their smartphone to read email, find information, engage in social media, read books, play games and listen to music. Tables 11 and 12 show device usage grouped by task across contexts for tablet and non-tablet users. The data shows that users rely on their smartphones heavily for the tasks listed, with just one exception for reading books and playing games among tablet users.

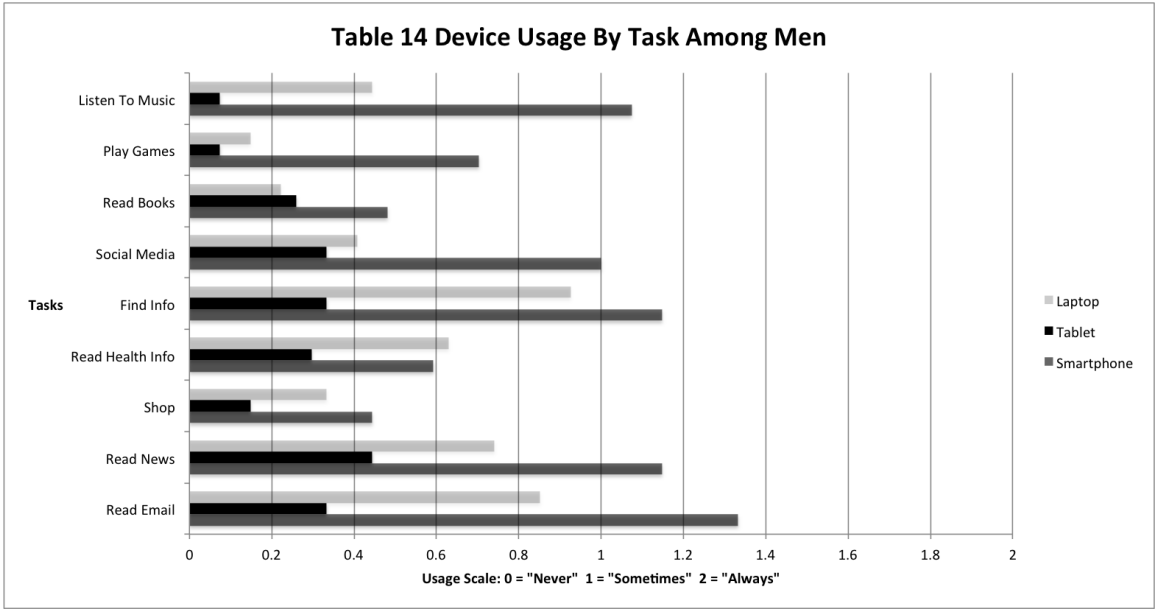
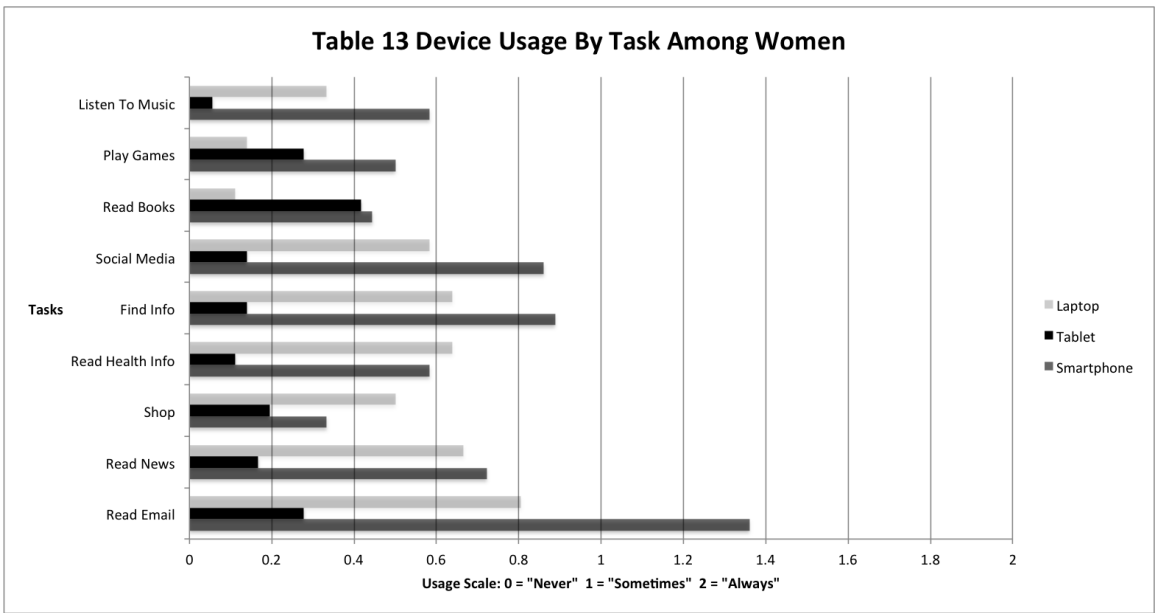




4.4 Effect Of Gender On Usage

Looking at device preferences by gender, a couple of trends become apparent. Overall, the usage patterns are consistent except for a couple of areas. First, as shown in Table 14, men tend to use their tablets more frequently for activities such as social media, finding information, reading health information, reading the news and reading email. However, Table 13 shows that women tend to use their tablets much more frequently for reading books. They also use it only slightly more frequently to shop.

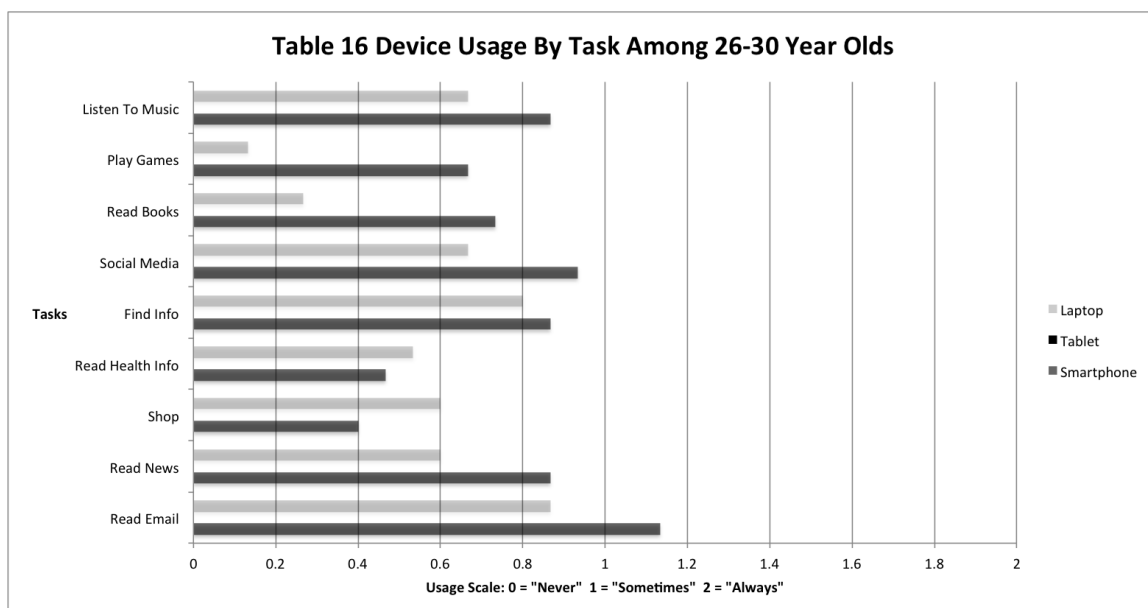
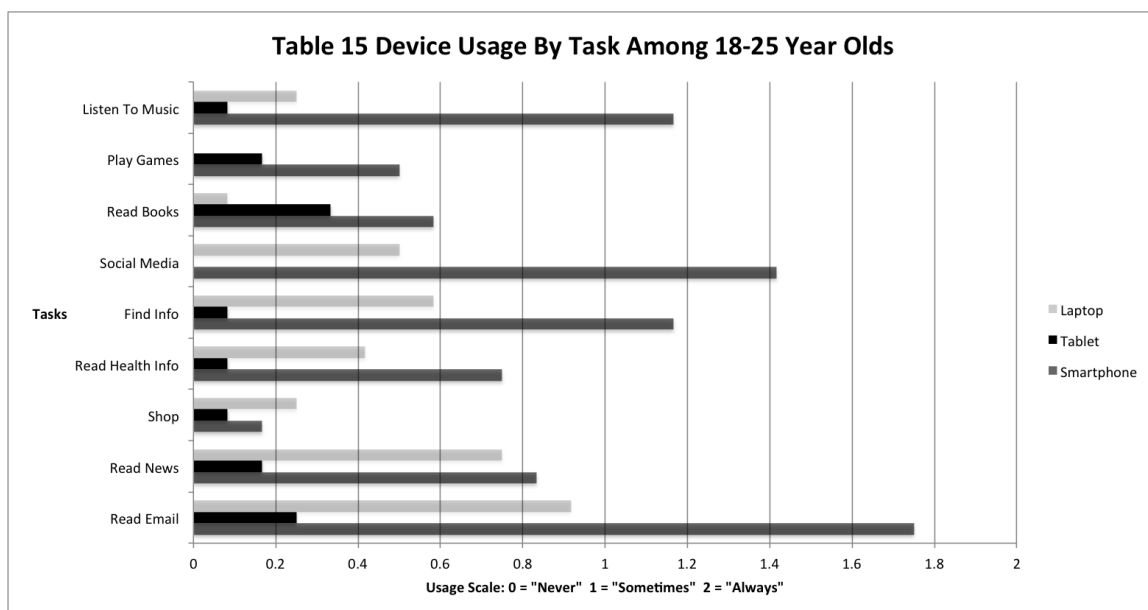
Another trend that becomes apparent is how much more frequently men use their smartphones. Table 14 shows that men use their smartphone to listen to music almost twice as much as women do. They also rely on their smartphones more often to read the news, find information and do social media.



4.5 Effect Of Age On Usage

Interesting trends were discovered after breaking down usage by age. Table 16 shows how among 26-30 year olds there are no tablet users. This age group also had the least pronounced preference for a smartphone and frequently used their laptops for many tasks. Table 15 shows that 18-25 year olds use their smartphones far more than any other

device, especially for listening to music, doing social media, finding information and reading email. However, for both age groups, shopping is primarily done on the laptop.



On the other hand, Table 17 shows that for 30-40 year olds, the smartphone is preferred for shopping, followed by the tablet. This age group relies heavily on their smartphones to read email, find information and do social media. Stronger preferences

for the tablet emerge for reading books, doing social media, reading news and reading email.

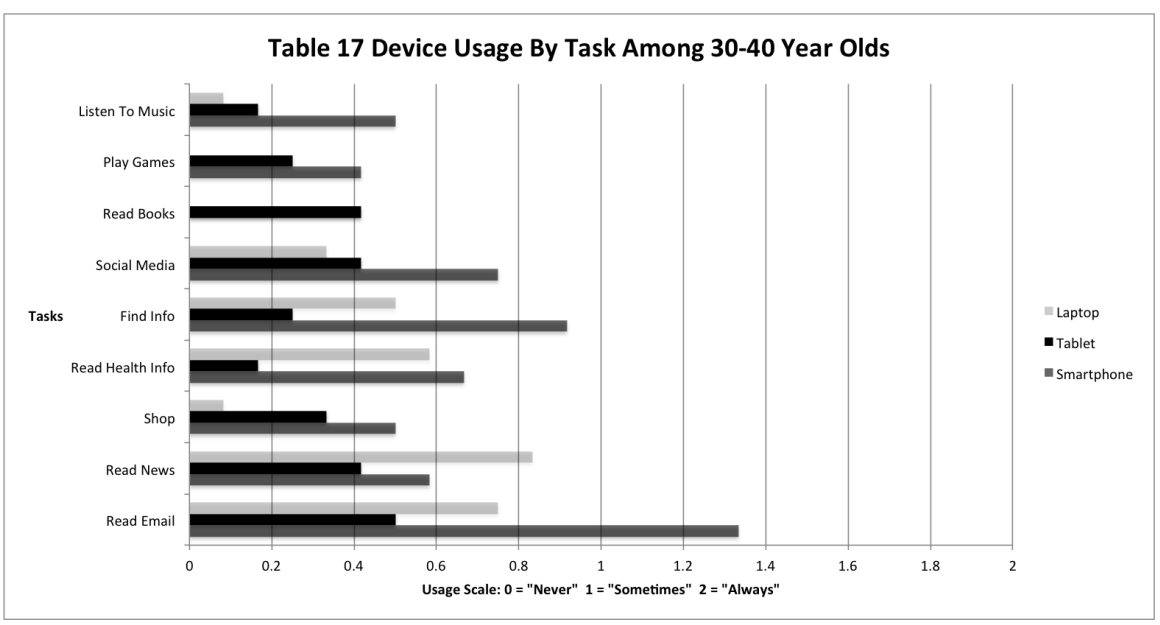
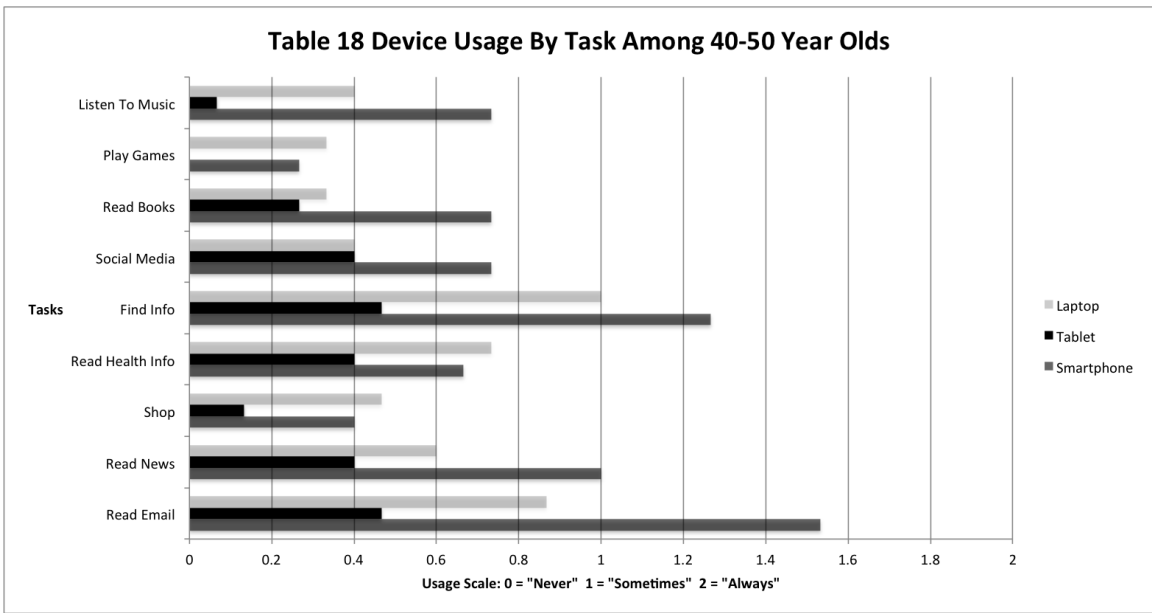
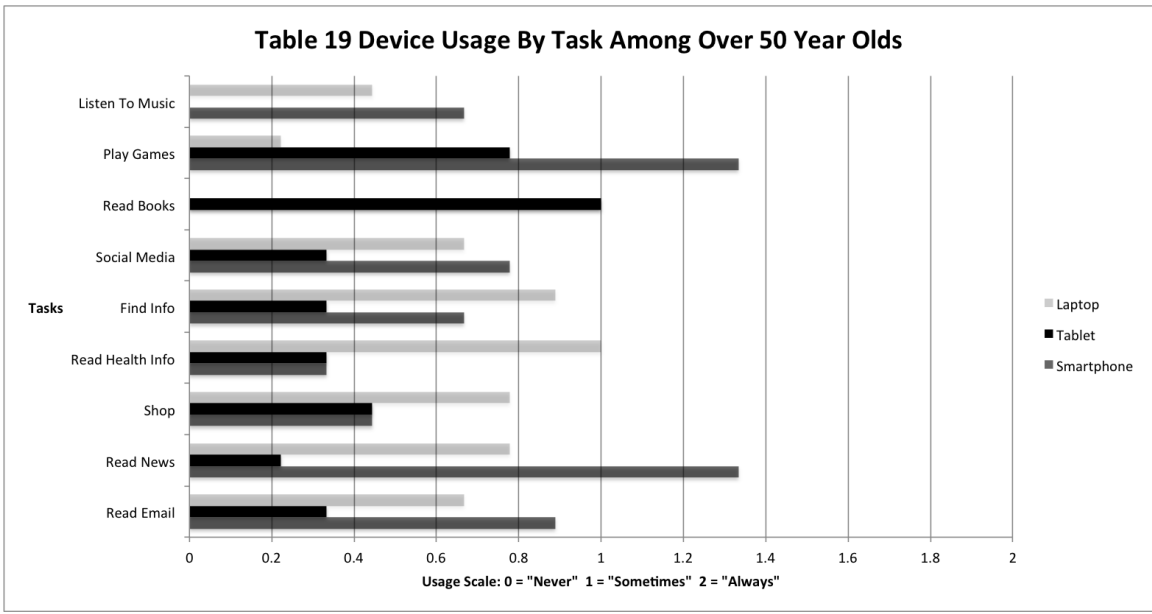


Table 18 demonstrates an interesting contrast to the preferences of 30-40 year olds. Like the 18-25 and 26-30 year olds, the 40-50 age group also prefers using a laptop to shop. For this group, smartphone usage is very pronounced to read email and find information. This group is also more likely to use their tablet to find information, but they do not play games on the tablet.



Like most of the participants, the over 50 bracket largely prefers using a laptop to shop; however, Table 19 shows that they are equally as likely to shop on a tablet as smartphone. Smartphone and tablet usage is also very high among this group for playing games. Also, the data shows that this group shows a very distinct preference for reading news on their smartphone over other devices.



4.6 Interview Questions

Five themes were found to describe user responses to four follow-up questions during the interview. The first question asked the participant to describe what their reasons were for purchasing the devices they owned. Most responses tended to fall under Ease of Access (EA) or Perceived Usefulness (PU). For example, many participants wanted to be mobile and have access to the Internet at all times. Participants also tended to list specific applications or activities they wanted to do on the device. Many purchased laptops to be able to work or write, while others wanted to be able to play specific games or use navigation applications. A minority of responses cited Cost as a reason, with the emphasis being on what was cheaper or free. Though not as frequent as EA or PU, Subjective Norm (SN) was typically only used as a reason for this question. For example, a couple participants stated their reason for buying a laptop or mobile phone was simply “to function.”

The second question asked participants to describe whether their behavior has deviated from what they expected to be doing with each of their devices. A majority of participants cited that they use their phone more often than they expected, citing EA or EU as a reason. Participants also suggested that as they used their phones, the PU of increased through the availability and discovery of new applications. A few participants had different experiences, especially if a tablet was involved. For example, one participant thought she would use the tablet a lot for work, but came to describe it as a device primarily for “entertaining the kids” instead. She found the EU to not be sufficient for her work tasks. She noted that it is difficult to do work tasks that are simple on the laptop, such as attaching a file. Another participant stated that: “I use my laptop more than my tablet because that’s what I like [to do more things on].”

The third question asked participants to describe any multi-tasking they do: where it is, doing what and with what devices. Two participants said they did not multi-task at all. For the rest, the majority of multi-tasking occurred on their phone while doing other activities such as walking around, watching TV, at social events or lectures, etc. A few listed using their laptop to multi-task while at home. Several described multi-tasking with two of their devices at once. For example, one participant said he would “use the phone to look up something while using the tablet.”

Finally, the fourth question asked participants to summarize the primary purpose or uses of each device they use. Several participants responded that they use their phones for “everything.” One stated that his phone is “my go-to thing.” Another participant made a similar claim, saying: “If I realize I forgot to do something, I typically grab my phone first because it is right there.” A minority of participants stated that their laptop was used for everything. For example, one participant said that they “use [the laptop] for most everything except for phone calls.” Other participants tended to list specific applications for each of their devices. Smartphones are used for a variety of tasks: communication, email, music, games, working, etc. Tablet users tended to list “fun stuff” (as one participant put it): games, books, pictures and surfing the Internet. Only one said they used their tablet “mostly for work,” however they preferred using a laptop because of the availability of MS Office applications.

5 DISCUSSION

The purpose of the study was to determine what factors affect a user's choice to use one mobile device over another. Previous research has considered adoption and usage of a mobile technology (such as a smartphone or tablet PC) on its own, but has not looked at how adoption and use is done in context of other mobile devices that offer relatively similar affordances. In addition to this, recent literature has suggested that users are increasing their usage of smartphones, creating a shift from the laptop as the primary channel for information access. Understanding how users interact between their mobile devices will be helpful in mobile application design, especially for applications that will be used across mobile platforms.

5.1 Quantitative Results

Overall, survey respondents demonstrated a tendency to prefer a smartphone across contexts for the tasks listed. Laptops only outpaced smartphone usage in the Personal Environment context. However, one limitation of the survey is that it was limited to tasks that are commonly done online and could likely be performed across mobile platforms. As a result, it did not consider more intensive tasks that might favor a laptop or tablet, such as word processing.

Another limitation is that participants may not have understood the distinction between "always," "sometimes" and "never" when it comes to using a device for a particular task. For example, if a participant rarely does a task, but always does it on that

device, they were instructed to mark that they “always” use that device for that particular task. However, it is likely that some participants interpreted the frequency question to be about the frequency of the task. And the survey did not control for how frequently the different participants do a task. For example, during the survey, one participant stated that she never reads the news, lowering the total score in that category.

In addition, the survey relied entirely on self-reporting, which has its limitations and relies on what participants want to project about themselves. In fact, a few participants made comments about their usage as they filled out the survey, interpreting their selection of “always” in certain categories as negative. One participant chided herself, saying, “I need to change” after looking at her responses. Despite many of their responses being typical usage, these participants clearly find what they perceive as “excessive” technology use to be outside of the norm. In contrast, other participants were proud of their technology use. One participant noted that all he needed was a pocket-able keyboard to be using his smartphone all the time and thus increase his overall productivity. Given the strong attitude of the different respondents, it is clear that how an individual incorporates technology into their everyday life is a reflection of their values and is still being negotiated for many.

One interesting result found in the survey is the preference that men have for using their laptop and smartphone for listening to music. Tables 13 and 14 show that men use both their smartphone and laptop much more frequently to listen to music than women do. The results suggest that either men simply listen to music more often, or women are relying on another device to listen to music. Since the latter explanation is

most likely the case, it would be interesting to investigate further trends into accessing and listening to music.

Another interesting trend found in the results is that men tend to use their smartphones more than women do. A couple reasons may contribute to this finding. First is the issue of portability. Men can easily carry a smartphone at all times in a pants pocket, whereas women can possibly fit a tablet or small laptop into a purse to carry around. However, this explanation does not seem satisfactory because most participants reported using a smartphone or tablet in a mobile context. In addition, both men and women highly valued the portability of the smartphone during their responses to the survey. Another possibility is that of the participants recruited, there may have been several stay-at-home moms who spend more time at home, or at least less time travelling to and from work, where other devices are available. Unfortunately the survey did not collect information about an occupation to verify how much time a participant spends at or away from home. A third possibility is that the men interviewed perceive their smartphones to be more useful than women do. This may have several causes, one of which might include the higher rate of marketing new phones and gadgets to men.

Finally, the qualitative data analysis showed some interesting preferences for device based on age groups. Not too surprising is the 18-25 year olds heavy use of the smartphone for many of the activities. However, one surprising result showed that among the 26-30 group, no participants owned a tablet and their usage tended to be equally distributed between both their smartphone and their laptops. While the sampling for the age groups is small (only 4-5 participants per group), this finding suggests that the cost of a tablet may be skewing adoption of tablets to either older and more affluent

users, or younger adopters that have not invested in a laptop already. As for the laptop usage among this age group, most respondents stated that they used their laptop primarily at home or for work and their smartphone for everything else. As a result, high usage of the laptop suggests that this age group is most likely already spending a lot of time on their laptop for other purposes, making it just as easy to do a task on either device.

Finally, the results of the survey matrix found that among all the users, playing games on their mobile device is most popular among over 50 year olds. One explanation for this is the extra free time among this group. Several in this group described using either their smartphone or tablet to play games while TV or during advertisements. Another possibility is that the other age groups prefer to downplay game playing as a behavior, if it is viewed negatively as wasting time.

5.2 Qualitative Results

Responses to the survey found several interesting reasons why smartphone usage is increasing for users. One reason matches up with the “checking habit” discussed by Oulasvirta et al. (2012). Several participants stated that they check their phone all the time. One said she is a “phone and internet junkie,” while another participant stated: “anytime I’m bored I use my smartphone, get on Hotmail and chat with friends.” This behavior can be described by Oulasvirta et al.’s (2012) observation of information rewards available with phone usage as well as the visual cue of seeing the phone that acts as reminder and reinforces the reward of use. However, other participants described an increase in their usage as they found that the smartphone could efficiently resolve a variety of information needs not anticipated beforehand. For example, one participant

said she got her smartphone to access email, Facebook and GPS applications, while she purchased her laptop to do schoolwork. Yet she observed that she uses her phone a lot more now, because she can use it check on schoolwork too. Other participants also noted that they use their phone more because they don't have to worry about battery life as often and it doesn't have to be turned on or opened up to access it.

Also of interest for tablet design is the difference between expectation and reality described by tablet owners during the survey. Several of the tablet owners anticipated using their tablet for work, but found that the affordances of the tablet did not satisfy their needs completely. As noted previously, one participant explained that things like attaching a file are difficult, while another wished they could use laptop-type applications such as MS Word. It is interesting to find that the tension described by Kim and Sim (2012) regarding whether tablets will replace all mid-size mobile devices or occupy a niche market in media consumption are reflected among users. Currently there seems to be a desire among users to find a device that can act as a replacement for their other mid-size mobile devices. One participant noted that she bought the tablet instead of a laptop for mobility. However, all of the tablet users reported using the tablets almost exclusively for media consumption, a finding that is corroborated by the results of the survey matrix that find playing games and reading books to be the top activities for tablet usage across contexts.

As mentioned previously, the participants expressed strong attitudes about appropriate use of a device. A concern with excessive use of technology became most apparent with the third interview question regarding multi-tasking. All but two participants responded that they did multi-tasking. The two participants that said they did

not multi-task responded emphatically and clearly saw multi-tasking as a negative behavior. Several responded that it was something they did all the time, even though they preferred not to. In addition, participants showed variation in their interpretation of multi-tasking. Of the participants that responded positively to multi-tasking, five described scenarios where they used two devices at once to look-up information and enhance their ability to resolve an information need. For example, one participant noted that she frequently would use the smartphone to “look up something while using the tablet.” On the other hand, eight described scenarios where multi-tasking was done as a distraction from their current task. Several described using their laptop, tablet or smartphone while watching TV. Others noted that they frequently checked email while walking or driving. Most claimed that their most frequent multi-tasking device was their smartphone.

6 CONCLUSION

The purpose of this study was to discover what factors influence the choice to use one mobile device over another. A survey was administered and participants were asked to fill out a survey matrix to list how frequently they used a device given the context and task. Four follow-up questions were asked about participant habits, including reasons why they purchased their devices, what they do with them most frequently, if their habits have changed and how often they multi-task. Responses showed that users rely heavily on their smartphones for a variety of reasons, including the ease of access and its efficiency for solving a variety of information needs both at home and in other contexts. Responses also showed that for tablet users the device is still primarily used for entertainment and leisure activities. Some tablet users reported a desire to do more work with the tablet. Future design for the tablet might consider how to integrate applications for productivity so that users can expand the contexts of use.

Smartphones were also more frequently used because of the EA. Participants noted that they liked using their smartphone because they didn't have to turn it on or off and the screen "just pops up," becoming immediately available. Future design considerations for the laptop might consider how to increase the EA and decrease the time to interaction for these devices.

The result that men are using their laptop and smartphones more frequently than women to listen to music suggests an area for future research that might prove useful for cloud music services such as iTunes, Amazon and Spotify.

Furthermore, one weakness of this survey was its reliance on self-reported usage. A more thorough follow-up study might compare reported usage with actual usage to determine what and how user attitudes towards technology affect how they self-report usage. Such a comparison would help determine whether the trends found in this survey are a result of actual usage or what users believe their usage should be.

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APPENDIX A Interview Questions

Choosing Between Mobile Devices Survey

Age:

Gender:

Race:

What devices do you own or have frequent access to?

Smartphone / iPod Device

Tablet

Laptop

Desktop

Rate your interest in using technology to manage or improve your life on a scale of 1-5
(1-no interest, 3-neutral, 5-high interest)

Indicate how frequently you use each device for the listed activity, considering the location or setting.

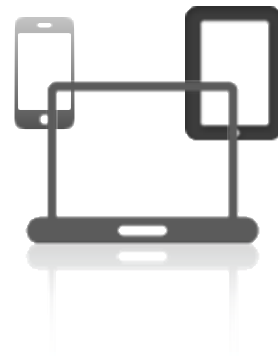
(All the time) (Sometimes) (Never)

	 Personal Environment (at home/work)	 Mobile (on the bus, walking around)	 Away From Home (coffee shop, airport)
	   	   	   
Read email	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>
Read news	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>
Shop	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>
Read health information	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>
Find information	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>
Social Media	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>
Read books	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>
Play games	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>
Listen to music	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>

1. What influenced your decision to purchase or use the device(s) you have access to?
2. Do you do the things you thought you would do with it, or do you think your behavior has changed as you use it? Has it changed as you acquired other devices?
3. How often do you multi-task with any of these devices? (For example, watching TV while shopping or checking Facebook). Indicate the tasks you do while multitasking, and which devices you use for which tasks during multitasking? Why?
4. What are the main things you like to use your phone for? How about on your tablet? How about on your laptop and desktop?

APPENDIX B Study Flyer

Do you use a
Smartphone?
Tablet?
Laptop?



Ask me about a brief
survey for a **\$2 gift card**
to **Village Burger!**

APPENDIX C Informed Consent

Informed Consent Form for the Choosing Between Mobile Devices Survey

Purpose of the project:

The researcher Paula Rigoli is conducting a survey to evaluate how people choose between using a smartphone, tablet or a laptop in different settings and locations. The results will be used to help contribute guidelines for future application designs and to contribute knowledge to improved user experiences.

Procedures:

As a subject you will be asked to spend 20-25 minutes doing the following:

- 1.) Answer questions about your background with technology and your demographics
- 2.) Fill out a survey about your use of a smartphone, tablet, laptop or desktop in different situations and settings.
- 3.) Answer follow-up interview questions about your responses to the survey.

Confidentiality:

Participation in this survey is voluntary. No personal identifying information will be collected and all information will remain strictly confidential. The descriptions and findings will be used to compile an academic report about the results of the survey. However, at no time will your name or any other identification be used. You are at liberty to withdraw your consent to the survey and discontinue participation at any time without prejudice.

If you have any questions after today, please contact Paula Rigoli by email at rigoli@email.unc.edu.

I have read and understood the information on this form and had all of my questions answered.

Participant's signature

Date

Researcher's signature

Date