Understanding Tablet Use: A Multi-Method Exploration

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ABSTRACT

Tablet ownership has grown rapidly over the last year. While market research surveys have helped us understand the demographics of tablet ownership and provided early insights into usage, there is little comprehensive research available. This paper describes a multi-method research effort that employed written and video diaries, in-home interviews, and contextual inquiry observations to learn about tablet use across three locations in the US. Our research provides an in-depth picture of frequent tablet activities (e.g., checking emails, playing games, social networking), locations of use (e.g., couch, bed, table), and contextual factors (e.g., watching TV, eating, cooking). It also contributes an understanding of why and how people choose to use tablets. Popular activities for tablet use, such as media consumption, shopping, cooking, and productivity are also explored. The findings from our research provide design implications and opportunities for enriching the tablet experience, and agendas for future research.

Author Keywords

Tablet; mobile devices; diary study; video diary; contextual inquiry; field interviews; user requirements

ACM Classification Keywords

H.5.m. Information interfaces and presentation (e.g., HCI): Miscellaneous

INTRODUCTION

The emergence of tablet computers (tablets) have provided a new device format for users to enjoy access to a wide variety of digital experiences and information. People search the internet, they communicate with friends, they download mobile applications (apps) so that they can access everyday information, they watch videos, and they play games on their tablets. Existing insights into tablet ownership and use are available primarily through market research studies. Pew Internet has been measuring tablet ownership since May of 2010, when it recorded US ownership at 3% [26]. By August 2010, their survey showed that ownership had grown to 10% [28]. More recently tablet ownership has risen sharply, to 19% of the US population [31]. The prominence of tablet devices is also reflected in the level of app usage, with 75% of those (8% of all US adults) having downloaded an app to their device, and 38% reporting using six or more apps per week [28]. Aside from this body of market research, there is little other published research available on tablet use at this time.

Given this lack of information about tablet use, our goals were to provide a detailed picture of how people are using tablets today. We investigated when, where, why, and how people interact with content on their tablets. We explored activities including, but not limited to, media consumption, shopping, cooking, and productivity. Our research that employed a combination of diary study, interview, and observational methods took place in September and October of 2011, with 33 participants across three locations in the US.

RELATED WORK

While little has been published around how consumers use tablets, it is important to note that over the past few years there has been substantial research conducted around how consumers use smartphones. There have also been investigations into some specialized applications of tablet use. We will review these topics as a basis for approaching our research into understanding everyday tablet use.

Smartphones have been quickly adopted by consumers in the US. A 2011 Pew Internet study reports that one third of adults in the US own a smartphone [30]. Additionally, studies by Nielsen have shown that ownership is increasing across all age groups [24]. Studies on smartphone use have focused on search and mobility, location, and app use; and a variety of methodologies have been applied including exploratory methodologies [1, 7, 6], survey research [30, 33], and log analysis [8, 14, 3].

Amin et al. (2009) used a web-based diary tool to understand searches done on the go; they found that mobile searches are primarily conducted when people are with others [1]. More recently, online diaries and interviews have been used to explore the trend towards more people using their phones from stationary environments, primarily home and work. Church and Oliver (2011) found that mobile phones are primarily used for communication and that search behavior is shaped by location, social factors, and other aspects of context [7]. Similarly, Chau et al. (2011) found that location, context, and the social environment trigger information needs [6].

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Logging and tracking methodologies have also been applied to gain more insight into how people use their mobile phones. Early studies focused primarily on search behavior and more recently studies have started to track the use of apps. Church et al. (2008) examined six million search requests and characterized the differences between search behavior on desktop computers and mobile phones, finding mobile search queries to have shorter query length, be more focused, and centered around transactional content, navigational queries, and adult content. The authors anticipated mobile specific opportunities such as taking advantage of touch-based displays and localization, and making the mobile search experience more personalized [8]. A study by Kamvar et al. (2009) similarly found mobile searches to be more targeted than those on desktop [14]. Verkasalo et al. (2010), conducted both a tracking study and a survey that confirmed that perceived behavioral control is directly linked to perceived enjoyment and the usefulness of apps that people choose to use [33].

With the proliferation of apps, logging and tracking has been applied to uncover patterns of app usage. The types of apps used have been found to differ throughout the day, e.g., news apps are accessed in the morning, games apps at night, and communication apps are used throughout the day [3]. A Nielsen tracking study revealed that certain types of apps such as those related to shopping, games, and video viewing, are differentially accessed by age [21]. And while smartphones themselves provide a diversity of functionality, to which apps contribute, a recent study has illustrated that users can aptly, and happily, navigate the "seams" that are a current characteristic of smartphones [2]. The authors suggest that design and development priority be given to building systems that allow for "assemblability" so that users can build their own personal experiences with their phones, adapting the features and functionality to their own lifestyle needs.

Turning to examine tablet use, there has been little use of exploratory and in-depth research methods to uncover details and patterns of activities that characterize consumer-focused tablet use. There are however, different strands and bodies of research that detail tablet use in specific applied contexts. Use of tablet computers has been found to afford greater collaboration, creativity, and expressiveness in children with learning disabilities, including those with autism spectrum disorders [13]. Many of the opportunities envisioned for tablet use in general education and learning have focused on social, collaborative use as well as expressiveness, and indeed, have resulted in gains in these specific areas [32, 5, 34]. The use of tablets for increasing the efficiency and effectiveness in education environments has been examined widely [15, 4, 9], and the use of tablets in health and medical settings has been investigated [12, 11]. However, since we have seen such a rapid shift in tablet design and adoption over the last couple of years, tablet use in these contexts is likely going through some substantial change. We have reached the point now in the developed world, at which tablet computers are being designed for consumers en masse, and, in contrast to the niche areas of their application, we see tablets very rapidly gaining in adoption and use in several everyday contexts. Now is the time therefore, that we need to understand what the landscape looks like for tablet users that have adopted this new form-factor product so readily.

One major methodological approach has already been applied to understanding consumer tablet usage, and this is the survey method. Findings, such as those from Pew Internet, provide us with demographic information about tablet use [27]. Methodologically similar studies by Nielsen tell us that tablet ownership is changing, that it is becoming a popular device with older users now, as well as younger [22], and that for a significant proportion of people, tablet ownership reduces the amount that they use other devices [23] while aggregate device usage is generally increasing [22].

The goal of our work was to investigate how people are using their tablet devices, and apply exploratory methodologies to do so. We wanted to understand the activities people choose to do on their tablets and the places that they do them. We were interested in whether the activities done on tablet devices are self-contained, or required other devices, and we were interested in finding out about the extent to which the activities that people are conducting on tablets also bridge into the "real world", such as shops or restaurants. An additional goal was to collect rich examples of tablet use.

STUDY METHODOLOGY

To gather comprehensive insights about how tablets are used we employed a variety of research methods: 1) written diaries, 2) video diaries, 3) follow-up in-home interviews, and 4) contextual inquiry observations. We selected this set of methods to understand different aspects of tablet usage and triangulate varying insights. While the diary study portion allowed us to collect a large amount of self-reported data over a longer period of time, the follow-up interviews and contextual inquiries enabled us to gather rich data about specific use cases.

Participants

A total of 33 participants were recruited from three locations across the US: San Francisco (12), New York (11), and Milwaukee areas (10). This allowed us to draw participants from urban, suburban, and rural areas. Participants were recruited against several criteria, including gender, age, education, occupation, family situation, commuting habits, length of tablet ownership, and characteristics of their tablet. These criteria were guided by previous research by both Nielsen [17, 19, 18, 25] and Pew Internet [29], to target a sample of participants that was representative of the current US population of tablet users as possible. Participants were incentivised for their time investment with a gift cheque and could keep the small video cameras that were provided to complete the video diaries.

Of all 33 participants who took part in the diary study, 39% (13) were men and 61% (20) were women. They ranged in age from 18 to 70, with the following distribution across the different age ranges: 18-23 (18%), 24-30 (30%), 31-40 (39%), 41-70 (12%). All participants owned a tablet: 73% (24) owned an Apple iPad and 27% (9) owned an Android-based tablet. For 82% (27) of those participants, the tablet they used during the time of the study was the first tablet they had ever owned. While 39% (13) of all participants were still

new to using their tablets (they had owned it for less than three months), 61% (20) had owned their tablet for more than three months at the time of the study.

After the diary study had commenced, we selected a subset of 18 participants to participate in follow-up field visits, six from each location. They were again chosen to reflect the same participant requirements outlined above. Finally, we conducted contextual inquiries sessions with four of those participants, to gain further insights.

Procedure

In this section, details are provided about the four different research methods that were used.

Written Diaries

To uncover all of the activities that are carried out on tablets, participants were asked to complete a written diary entry whenever they used their tablet over the two-week study period. We used Google Forms to collect written diary entries, accessible to the participants through the browser of their desktop computer. The diary questions were designed to capture details about each activity, including an explanation of the activity itself, the time and length of the activity, the context in which that activity was conducted (e.g., location, secondary activity, other people), as well as information about transitions to and from other connected devices or the real world. The diary questions included a set of open-ended as well as several closed-ended questions. Each participant was called periodically to check on their involvement, and, as a reminder to them, to complete the question set every time they used their tablet. Participants were not able to review their previous diary submissions.

It is important to point out the limitations of this diary study research method, which are mainly a result of the self-reported nature of this data gathering technique. Participants may forget to record some activities, resulting in under-reported activity frequencies. Overall, the diary study methodology allowed us to collect rich information about each instance of tablet use, when it occurred naturally, without having to be present with the participant to observe them.

Video Diaries

In addition to the written diary entries, participants completed five video diary submissions, based on specific assignments that were requested on five different days, spread over the two-week period. We used a vendor that provided an online portal specifically created for collecting video diary data. Each video diary question was designed to capture information about the participant and their tablet use with greater richness beyond the textual diary entries. Participants were asked to record either their face or the tablet screen, depending on the question asked. Each participant was provided with a small video camera with a stand for simple recording, to enable them to easily complete the required video diaries.

Through five specific tasks, participants were asked to introduce themselves and describe their day, to provide background information about their tablet, to walk through their tablet apps, and to detail recent shopping and search related activities. They received an alternative assignment if they had not used their tablets for such activities recently.

Follow-up Interviews

Throughout the two-week diary study, we reviewed participants' responses. This helped us to select a subset of 18 participants to visit for follow-up interviews in their homes, six per location (New York, San Francisco, Milwaukee areas). The goal of the interviews was to broaden our understanding of the function of the tablet in the participants' lives, understand how it is used alongside other devices they own, learn about and observe the context they are using their tablet in, and follow up with questions about specific use cases described in their diary entries. Each interview lasted 90 minutes, for which we used a semi-structured interview guide.

Contextual Inquiry

Both when reviewing the diary submissions and when conducting the follow-up interviews, the researchers identified areas for which we would be able to collect richer data and gain unique insights through conducting contextual inquiries. We followed up with four participants we had previously interviewed and the contextual inquiries lasted two hours each. During each contextual inquiry, we observed the participants' activities, recorded their interactions with the tablet and other devices, and periodically asked follow-up questions for clarification. The activities that we observed included looking up recipes and cooking, family use before, during and after dinner, and productivity tasks in a workplace environment.

RESULTS

Once the research was completed, we had collected 774 written diary entries, 157 video diary answers, 18 detailed participant profile write-ups from the field visits, and observations from four contextual inquiries, together with the raw video recordings, transcriptions, and photos. We conducted the analysis in three stages: 1) quantitative analysis of the written diaries, 2) qualitative analysis of the field research and video diaries, and 3) triangulation of insights to develop a set of conclusions.

Over the course of the two-week period, our participants had reported 774 incidences of tablet use with an average of 23.5 per participants (min=1, max=72, standard deviation=17.2). As these numbers indicate, there was a range in the number of tablet use incidences reported by each participant, with 80% of all diary entries submitted by 17 out of the 33 participants. Note that due to limitations of the diary study approach, it is unlikely that these numbers reflect the exact volume of actual tablet use, but rather a lower bound on their true usage. All open-ended responses to diary questions were coded using a bottom-up approach; with similar activities being grouped to then turn those into frequency distributions. The data from the video diaries, field visits, and contextual inquiries were analyzed in a two-day workshop during which we followed a bottom-up affinity diagramming approach. Finally, we reviewed the diary study analysis to triangulate its findings with those from the insights from the generated affinity diagram. This analysis process resulted in a set of insights about the overall distribution of tablet activities, correlations of tablet activities to contextual factors, and learnings about specific

Activity	Incidences		Participants	
Email checking	146	18.9%	28	84.8%
Playing games	84	10.9%	17	51.5%
Social networking	51	6.6%	19	57.6%
Looking up information	45	5.8%	19	57.6%
Listening to music	39	5.0%	12	36.4%
Watching TV/videos	34	4.4%	16	48.5%
Shopping: Browsing	31	4.0%	19	57.6%
Reading a book	27	3.5%	10	30.3%
Lightweight creation	27	3.5%	7	21.2%
Checking the weather	25	3.2%	11	33.3%
Reading news	25	3.2%	15	45.5%
Surfing the Web	22	2.8%	15	45.5%
Shopping: Purchasing	22	2.8%	15	45.5%
Local search	22	2.8%	11	33.3%
Recipe search, cooking	21	2.7%	12	36.4%
Reading a blog	19	2.5%	6	18.2%
Finding, installing apps	17	2.2%	9	27.3%
Checking calendar	15	1.9%	6	18.2%
Managing finances	13	1.7%	8	24.2%
Viewing documents	10	1.3%	6	18.2%

Table 1. Top tablet activities (90% of all reported incidences listed).

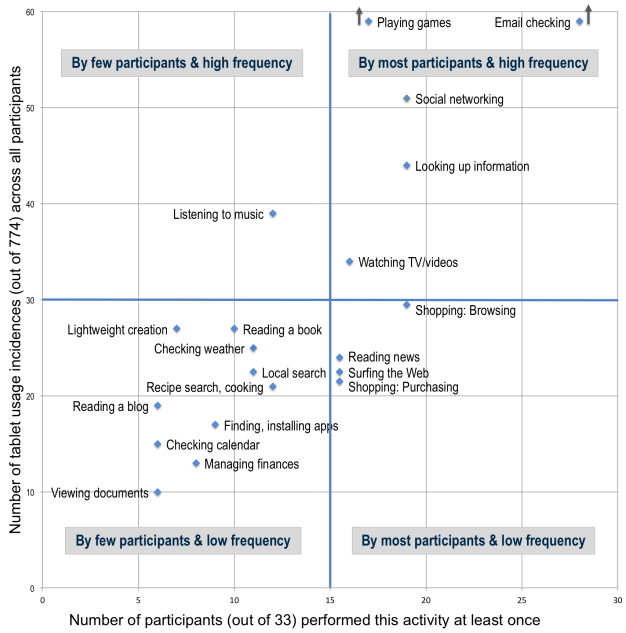

Figure 1. Top activities: Number of incidences vs. participants.

areas, including media consumption, shopping, cooking, and productivity. The remainder of this paper describes the details of our findings.

Overview of Tablet Activities

Across all reports of tablet use, the most frequent activities were found to be: Checking emails (with light responding), playing games, social networking, looking up and searching information, listening to music, shopping (browsing and purchasing), lightweight content creation (e.g., notes, lists, forms), reading a book, checking the weather, reading news, watching TV/movies/videos, and conducting a local search (refer to Table 1 for details). These results are similar to a Nielsen report which found that email, social networking, and watching videos were the top three activities [23], though we found that playing games, information seeking, and listening to music were more common than watching videos.

It is important to explore whether the reported tablet activities are common across participants or if they can be accounted for by just a few participants who do them frequently. We divided the activities into four distinct groups (see the quadrants in Figure 1): Activities reported 1) by few participants with low frequency, 2) by few participants with high frequency, 3) by a high number of participants with low frequency, and 4) by a high number of participants with high frequency. Hence, email checking, playing games, social networking, looking up information, watching TV or videos, shopping, reading news, and surfing the Web are distinct among activities, in being both common across participants and activities that are done frequently.

The structure of the diary questions allowed us to further dissect these activities. We first broke them down by personal vs. work. About 91% of reported tablet use was for personal purposes, while only 9% were related to work. Tablets were predominantly used for fun and relaxation. This was confirmed during the follow-up interviews in which many participants who described activities such as cooking, watching videos, and playing games were found to be particularly passionate about doing these on their tablet. Other personal tablet activities included those that were previously done on other devices, like checking email, social networking sites, their calendar, or the weather. Participants also enjoyed collaborating on activities with their kids and reading the news. For some families, tablets have become a central shared device that can be used by several family members, e.g., for playing games, reading a story book together, or for educational purposes. In such cases the tablet is not exclusively used in a collaborative setting, and members of the family may use it as a personal device as well. Only a small portion of participants used their tablets primarily for work-related tasks, which we will address in detail later.

Previous research has shown that use of computers and mobile phones differs depending on the day of the week [10], and so we evaluated if this also applies to tablet computers. Tablets were used for more activities (i.e., more unique instances of tablet use) during a typical weekday as compared to a typical weekend day: 61% of usage (1.86 incidences) occurred on a typical weekday and 39% (1.21 incidences) occurred during a typical weekend day. Besides the difference in the number of activities, tablets were also used overall for longer total duration during a typical weekday (an average participant spent about 48 minutes using their tablet) as compared to a typical weekend day (36 minutes). Weekdays showed more frequent email checking, managing of calendars, and checking the weather, but also included longer activities such as listening to music or social networking; however, activities such as watching videos, playing games, reading, and shopping were more frequently done on weekends.

Our findings show that tablets are being used repeatedly for the same activities, as has also been found to be the case for mobile phones [7].

We further asked participants to describe those activities that either involved another connected device or an action in the real world (i.e., without using the tablet). About 18% (138 incidences) of all reported tablet use involved another device besides the tablet, either before, during, or after using the tablet. The most frequent activities that included the use of another device were: checking emails (e.g., writing longer replies from their laptop/computer), looking up and searching information (e.g., conducting intensive research), and shopping (e.g., making the purchase after having browsed through options). Furthermore, about 12% (90 incidences) of all reported tablet use was started or continued in the real world. The most frequent of these activities included: checking emails (e.g., discussing or answering the email in person), looking up and searching information (e.g., providing the answer to a question they encountered in the real world), reading a book (e.g., a discussion of the book content), local search (e.g., going to the found store or restaurant), and shopping (e.g., making a purchase in a store).

Context of Tablet Use

To guide future product development, it is important to fully understand the contexts of tablet use. In the diary study, we asked participants to explain the place and situation they were in each time they used their tablet. We then coded their responses by the location and the secondary activity mentioned. In this section, we will discuss tablet activities regarding the participants' locations and other activities participants were engaged in while using their tablet. Examples of how participants described their contexts of use included:

> I was sitting on my couch having a cup of coffee.
>
> I was sitting on my bed and I had just woken up.
>
> I was sitting in my car waiting for the street to be cleaned and save myself a parking spot.
>
> I was at my home office desk while doing work emails with my laptop.
>
> Outside in my backyard, sitting on my patio relaxing.
>
> I was on the train going back home from work.
>
> I was home in my apartment and I just carried the iPad around with me when I changed rooms.

Common Locations

The most common locations for using tablets included those within their home (living room, couch, table, kitchen), at work (office, desk, meeting), while on the go (car, train, subway), and in other places (restaurant, gym, classroom). See Table 2 for details. Note that we developed the location codes based on the greatest specificity provided by the participants' diary submissions, e.g., while some participants may have only referenced their bedroom, others were more specific and called out that the specific location was their bed. As a result of this, the categories are of varying levels of granularity.

Location	Incidences		Participants	
Couch	182	23.51%	23	69.7%
Bed	128	16.54%	22	66.7%
Home	97	12.53%	18	54.6%
Table	70	9.04%	13	39.4%
Kitchen	67	8.66%	15	45.5%
Office	46	5.94%	11	33.3%
Desk	28	3.62%	9	27.3%
Bedroom	26	3.36%	7	21.2%
Car	25	3.23%	6	18.2%
Restaurant/café	21	2.71%	6	18.2%
Gym	12	1.55%	6	18.2%
Classroom	10	1.29%	4	12.1%
Commuting	10	1.29%	5	15.2%

Table 2. Top tablet use locations (90% of all incidences listed).

The data also provides a picture of the most common locations for the different activities (see Figure 2 for details):

- Email checking: Mostly on the couch and in bed.
- Playing games: Mostly on the couch, at home, in the car.
- Looking up info: Mostly in the kitchen, on couch, in bed.
- Listening to music: Mostly in the kitchen and in the office.
- Shopping: Mostly in bed, on the couch, in the kitchen.
- Light-weight content creation: Mostly while at a table.
- Reading: Happens quite evenly in any location.
- Checking weather: Mostly in the bedroom or in bed.
- Watching TV/videos: Mostly in bed, on couch, at the gym.
- Recipe search, cooking: Mostly in the kitchen.

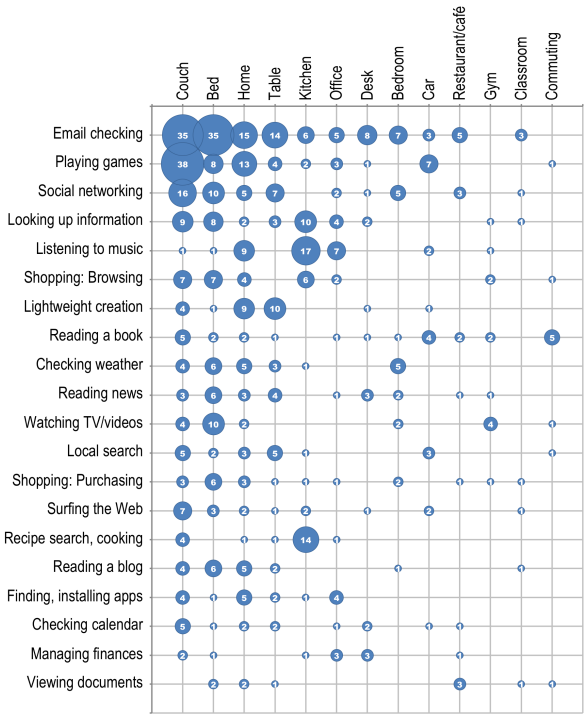

Figure 2. Frequency of top tablet activities by top locations.

Secondary activity	Incidences		Participants	
Watching TV	99	31.33%	20	60.6%
Eating/drinking	80	25.32%	13	39.4%
Cooking	32	10.13%	9	27.3%
Waiting somewhere	20	6.33%	9	27.3%
Getting dressed	15	4.75%	2	6.1%
Talking with others	14	4.43%	8	24.2%
Watching child/dog	10	3.16%	5	15.2%
Reading	10	3.16%	2	6.1%
Working	7	2.22%	5	15.2%
Exercising	6	1.9%	6	18.2%

Table 3. Top secondary activities (90% of all reported sec. activities).

During our follow-up interviews, we gathered more insights about the locations where tablets are used today. Seven interview participants said they used the tablet while in bed because the form factor fits the relaxed setting of being in bed. As the tablet was often placed close to their bed, they were likely to use it last thing before they went to sleep as well as the first thing after waking up.

This data also showed that tablets are more likely to stay at home as compared to being fully mobile devices; 82% of all incidences of tablet use occurred at home. Given the findings of a study by Church and Oliver (2011) [7] on the location of smartphones, we had already anticipated that a significant proportion of tablet activities would occur at a stationary location; however, tablets turned out to be even less mobile than smartphones. For most participants, their tablet stayed at home and was used in many rooms within the house from living room, to kitchen, to bedroom, to bathroom. The only exception to tablets remaining in the home was when people travelled, in which case the tablet tended to become a laptop replacement and was, hence, taken with them outside of their home. Fewer participants took their tablets everywhere (such as to work, school, the gym, cafes, or the park) as compared those who used it mainly at home.

Secondary Activities

We further classified tablet use by the participant's level of engagement, differentiating between partially and fully engaged use. We categorized an activity as fully engaged when the participant did not describe any other activity besides using the tablet; hence, partial engagement was defined as using the tablet while doing something else. Of all reported tablet incidence, 41% (316 out of 774) showed partial engagement. Note that this number is to be considered as a lower bound as it is possible that participants under-reported or forgot to explain those activities they were engaged in outside their tablet use.

The most frequently reported non-tablet activities that participants were doing at the same time they were using their tablet were: Watching TV, eating or drinking, cooking, waiting somewhere, getting dressed, talking with others, and exercising, among others (see Table 3 for more details for each). Those tablet activities that included secondary activities were: Listening to music, checking the weather, checking and light responding to emails, recipe search and cooking, social networking, and looking up information. Further relating tablet activities to secondary activities away from the tablet highlighted, for example, that playing games occurs frequently while waiting, that checking of emails and social networks is done often while eating, and that recipe searches happen mostly while cooking (refer to Figure 3 for more details).

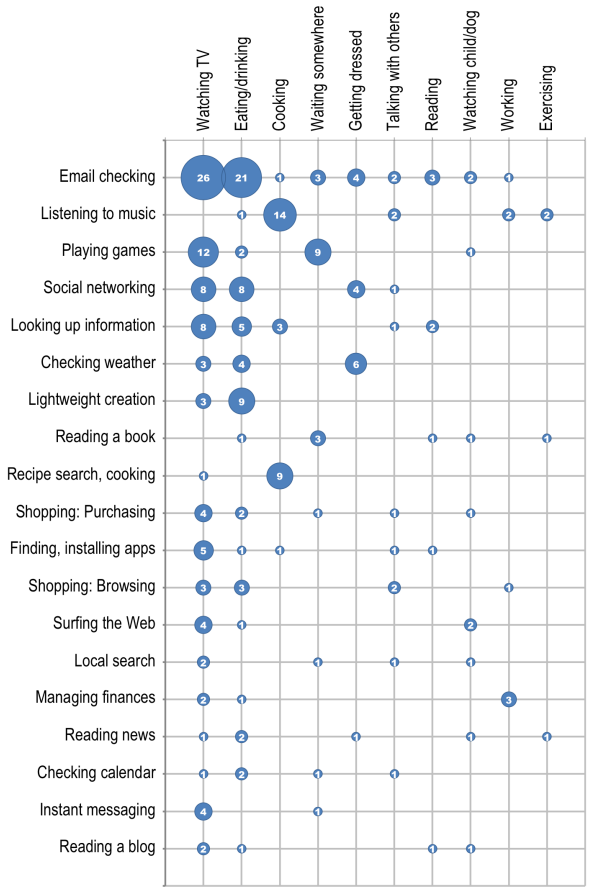

Figure 3. Frequency of top tablet activities by top secondary activities.

The most frequent secondary activity performed while using the tablet was watching TV (by 61% of all participants, 31% of all secondary activities), as our diary study analysis as well as other research that has since been conducted [16, 25, 20] showed. Participants explained that their tablets can enhance the TV experience by extending that activity, through for example, looking up related information about the program that they were watching. An example of this would be searching a movie database for the names of movie actors. However, the diary study data also showed that people sometimes do unrelated activities on their tablet at the same time as watching TV. Some were constantly switching their focus between the TV program and their tablet activity, while others were simply accompanying their partner engaged in watching TV by being in the same location. The tablet form factor affords lightweight interaction that compliments TV watching better than a laptop, and having a bigger screen than a smartphone makes it easier to divide attention between the TV and the tablet screen.

Insights about Specific Areas

Our research revealed that certain activities on the tablet warrant a fuller exploration and description. They are compelling either because people are particularly passionate about them, because they are very engaged in the activity while carrying it out, or because it requires sustained effort and interaction. We will look at these areas of shopping, media consumption, cooking, and productivity, in this section.

Shopping

We found that many participants like to do shopping research through browsing (window shopping) on the tablet but then often made the actual purchases either on their computer or in person at a physical store. During the two-week diary study, 58% of all participants (19) did some form of product browsing activities on their tablet (31 out of 774 incidences), while 42% of all made an actual purchase on their tablet during the time of the diary study (22 out of total 774 incidences). This differentiation between browsing and purchasing is also highlighted by shopping-related activities having a higher percentage of transitions from or to other devices (30%) or the real world (17%), than many other activities.

> It's always just a bit more effortless on the laptop [shopping] but every now and then when I'm sitting in front of a movie I'll purchase items through my iPad. – iPad user

There were several reasons why purchases tended not to be made on tablets. During our follow-up interviews, most participants said they were often not signed into their accounts on shopping sites. These participants explained that they did not have their account information stored in the tablets' browser and they couldn't always remember their username and/or password. It was therefore more convenient to switch to the desktop or laptop computer, where this information was already stored. Participants also described how it is often difficult to enter payment information and "checkout" on the tablet with the attempt sometimes failing because the site is not optimized for tablet interaction. We also heard from many iPad users that the lack of Flash support was a reason they would move from window shopping on their tablet to the computer. Other reasons included that the tablet form factor (especially the keyboard) can make purchasing more difficult in comparison to a computer with a full, tactile keyboard.

> It's too much pain to sign in on the tablet. By the time I do that, I have ordered it already on my computer. – iPad user

Through our in-depth interviews, we learned that many participants went directly to trusted shopping sites such as Amazon, Target, eBay, or Craigslist. We observed several participants as they went back and forth across such sites mentally comparing the products and prices that they saw. We observed that when shopping, most participants appeared not to be interested in finding additional stores to buy the item from if their favorite, known sources will do.

> Usually when I do any kind of shopping, my main app is Safari so I can jump through the sites that way. – iPad user

Lastly, most participants who shopped on their tablets explained they preferred to do so on full sites in the browser over apps or mobile sites. Reasons for this included having a larger number of products listed on full sites, product details can be expanded to a greater degree, and there is often additional filtering functionality available. We also observed that participants preferred the richer browsing experience afforded by the full sites (over apps) because it is familiar and consistent with their experience on a computer.

As more people continue to pursue shopping activities on tablets, it is important to find ways for creating a more seamless experience both on the tablet itself and across devices.

Media Consumption

Media consumption activities explored in our study included watching television, movies and videos, listening to music, and reading news, blogs, magazines and books. These media consumption activities were carried out by the majority of participants. 78% of all participants (26 out of 33) used media on their tablet at least once during the study. Media consumption was also among the most frequent activities accounting for 19% of all 774 incidences.

Watching television, movies, and videos was reported by 16 out of 33 participants (34 out of a total 774 incidences) in the diary study. During the subsequent interviews, participants told us how they liked that the tablet provided a bigger form factor compared to their phone for consuming media. They also said that since their tablets were more portable, cool (temperature) and lighter than a laptop it made it easier to watch television, movies, and videos in bed. They also used the tablet for media consumption in other locations including the living room, at the kitchen table, or at the gym. Participants reported that they had migrated some activities they previously performed on laptops and smartphones to the tablet. The types of activities that they had transitioned tended to be leisurely activities such as media consumption that better fit the fun and leisurely experience that participants associate with their tablets. We also found that participants were surprised at how much they were using their tablets to watch television, movies and video. They reported accessing this media primarily through specific apps, e.g., Netflix, iTunes, YouTube, Facebook, PBS, ABC, and HBO.

> I didn't think I was going to use this [iPad] to be a TV to watch HBO. The resolution on it is really, really good so I feel like I have a little personal TV to myself. – iPad user

One of the key areas of media consumption reported by participants was reading content, with 61% of participants (20 out of 33) reporting reading either a book, news, blog, or a magazine on their tablet. Of the 33 participants in the diary study, 15 reported reading news (24 out of 774 incidences), 10 reading a book (27), 6 reading a blog (18), and 4 reading a magazine (7).

> After work today, I decided to do some reading on my tablet to relax. Reading on my tablet is so easy and it actually can be more fun. I also think that it is easier on my eyes as well. – Android tablet user

Reading a book occurred primarily at home (on the couch or in bed) and when commuting. Participants reported finding it easy and convenient to download and read books on their tablet. They were reading in the evening in bed before going to sleep and also when they had some free time during the day, typically in sessions lasting less than one hour. Participants primarily used native apps (e.g., Slate, Wall Street Journal, Fox News) and aggregators (e.g., Flipboard, Pulse) to access news content, though several reported using the browser to surf across favorite news sites (e.g., CNN, NYTimes, and local news providers). While the majority of participants did their reading of magazine, blog, and news content at home, a few reported doing so at work, while commuting and at other locations such as a gym or cafe.

Participants also reported that *listening to music* was a key activity they did with their tablet. During the diary study, 36% of participants (12 out of 33) used their tablet for listening to music. Interestingly, the top location for listening to music via the tablet was in the kitchen while cooking a meal. Tablets were also used for listening to music while at work. Participants reported accessing the music with apps, or streaming via the browser, via services such as Pandora and Spotify.

> I accessed Pandora on my iPad to play some low key music while cooking breakfast for my child. I like having music on while I am cooking or baking especially with my child around. We sing and dance to the music together and it makes for a nice, mellow bonding time while eating. – iPad user

Our research showed that many activities are migrating from participants TVs, computers, and phones to the tablet and of particular interest are some of the activities around media consumption that have high levels of engagement. We expect to see more of these activities happening on tablets as more content and delivery channels become available.

Cooking

The extent to which participants used their tablets for recipes and cooking was surprising. During the diary portion of the study, 36% of all participants (12 out of 33) described using their tablets for finding recipes and for following instructions while cooking. When we only look at female participants, 45% of all (9 out of 20) used their tablet for such activities. Many did this fairly regularly, often a couple of times a week. In comparison to other activities (such as accessing the news, emailing, or social networking) it is a less frequent activity, but has a higher average sustained length. Also of particular note, some participants were very passionate about using their tablet for recipes and cooking, particularly enjoying the experience, and citing it as a good benefit to owning a tablet computer. The form factor of the tablet resonated in terms of being an ideal cooking companion for some people.

The benefits that participants saw to using the tablet as a cookery resource included not having to print recipes to take them to the kitchen, not having to plug the tablet in, and being able to put the tablet close to the cooking area. The issues included knowing to change the settings to disable the dimming function of the tablet. If the user did not do this, they regularly needed to touch the tablet to reactivate the light. Also, a number of recipe websites were not mobile optimized for tablet devices, resulting in a less satisfying experience. Some users also spoke about being concerned about getting food on to their tablet during the cooking process, and keeping it at a suitable distance within the cooking vicinity can be somewhat frustrating.

We found that the recipes that participants accessed came from four sources: 1) directly accessing favorite recipe websites (e.g., `allrecipies.com`, `foodnetwork.com`, `cooks.com`, `bettycrocker.com`), 2) searching and finding recipes via search results, 3) directly accessing favorite apps (e.g., Epicurious, Jamie Oliver's 20-minute meals), and 4) directly accessing favorite cooking video shows (e.g., Netflix, YouTube). It seemed to be that participants typically stuck to their preferred source for their recipes, whether a particular show, a favorite app or website, or whether they always searched in a browser, since they talked to us about the primary way they access recipes. However, not all sources were created equal, and using recipes accessible through videos proved quite problematic. While we were observing one participant, it was clear that the pace of the video was too fast to easily follow. She had to rewind it a lot, and found that difficult to control. She had to watch the whole episode from the beginning a few times, because the instructions went by so quickly.

We also discovered that online solutions that create a shopping list are beneficial. For example, the Epicurious app has a shopping list function, and three participants described taking their phone to the store with a shopping list, and switching to their tablet at home to follow the recipe.

> I used Epicurious to build my shopping list, snapshot the list and emailed it to my iPhone. – iPad user.

As we have seen, there are a variety of ways to find recipes using a tablet; and our study has also revealed a diversity of ways that users are saving recipes. These include: 1) bookmarking recipes in the browser, 2) using a tagging service, 3) storing the recipe using Evernote, 4) copying and pasting recipes into the Notes app on the tablet, and 5) "favoriting," "liking," or using similar marking mechanisms in cookery apps. Through our contextual inquiries, we found that the time while the recipe is cooking is "down-time" during which the tablet was used for media consumption (as described previously), and we also observed participants using their tablet as an entertainment device while cooking.

While finding recipes and cooking with tablets is understandably not a frequent activity, in comparison to checking email or playing games, this study revealed that using tablets for recipes and cookery is an important activity for many tablet owners, and should be considered as a key use case for their development and design.

Productivity

The diary study revealed that 39% of all participants (13 out of 33) performed at least one productivity-focused task with their tablet. Such activities included document creation, document editing, file management, and file transfer. When in-

cluding "email checking with light responding", 88% of all participants (29 out of 33) did a productivity-related activity with their tablet.

Participants used a wide variety of tools on the tablet for productivity tasks including 1) Evernote for syncing notes across multiple devices and for collecting recipes, 2) QuickOffice to view documents, 3) Google Docs to view and edit documents, 4) Notes for shopping and task lists, 5) Cosi for syncing lists, 6) AutoCad for reviewing drawings, and 7) email apps for reminders and file management. One participant who was a student used her iPad for reading PDFs, note-taking during class, and sending files through email for subsequent use on her laptop. Another participant, also a student, used her tablet as a laptop replacement for activities such as reviewing and taking notes in class, editing documents and sending emails to herself for future reference.

> I was studying in my office today and used QuickOffice on my iPad to take notes as I read. Not having a keyboard always makes this process a little less fluid and easy than using my laptop, but it's worth it to have the smaller device to carry around. It also takes up less space on my desk or table when I work, which is nice too. – iPad user

Document and content creation related activities included: email checking with light responding (146 incidences), lightweight content creation (27), creating and editing of documents (4), and creating notes and shopping lists (3). Participants reported that typing on the tablet was a major pain point which they found frustrating and it often limited the amount of data entry they were willing to do before moving to another device such as a laptop or desktop computer. Other productivity related activities included: checking the calendar with light managing (15), viewing documents (10), and transferring data (2).

Managing files and transferring data from the computer to the tablet (and visa versa) proved difficult for participants (e.g., difficulty opening zip files and working with large spreadsheets). Several participants complained about the lack of printing capability with their tablet. These participants had workarounds such as emailing items to themselves and switching devices (for example, one participant switched to a laptop to print coupons). Another participant described how she successfully emailed attached files from her laptop and opened them on the tablet with QuickOffice.

> I was trying to access a document through my email in order to view it on the iPad. I was able to access the email and download the document in order to study it later on in the day. – iPad user

Other productivity related insights included participants creating shopping lists and reminders on their tablets using the Notes app, email and other apps.

While in many cases productivity tasks were not easy to perform on the tablet, a number of participants were willing to put up with many of these issues for the convenience afforded by the form factor of the device (e.g., lightweight, small).

CONCLUSION

In this paper, we have presented results from a multi-method study conducted during September and October 2011, which explored in detail how tablets are being used today. Thirty-three participants from across three locations in the U.S. took part in a diary study, 18 were visited for follow-up interviews, and with 4 we conducted contextual inquiries. Our results include a detailed breakdown of tablet activities, with the most frequent activities being checking emails, playing games, social networking, and looking up information. We found that tablets are primarily used for personal purposes, and that users are very passionate about certain activities, particularly those for which the tablet form factor provides unique interactions or usability affordances. Our data also showed that tablets are used more during weekdays and that a portion of tablet activities include a transition from or to other devices or actions in the real world. We also found that tablet use mostly occurs in the home (e.g., couch, bed, table, kitchen) and often while doing other activities away from the tablet (e.g., watching TV, eating, cooking, waiting). Finally, we discussed qualitative insights about some of the most engaging activities, including media consumption, shopping, cooking, and productivity.

By better understanding current tablet activities and their context, these findings may serve as a basis for anyone designing and developing applications and sites for tablets. Especially for highly engaging tablet activities, we need to consider the constraints and opportunities of the context of use; for example, using tablets while lying in bed may require a tailored user experience and a particular interaction technique. It is also important to take better advantage of the disposition of tablet users by providing more opportunities for playful interactions and explorations in terms of how content is presented and revealed. Furthermore, website designers need to ensure their sites offer the full feature set while being tailored towards tablets. They should make a concerted effort to optimize their existing sites to "just work" on tablets, using responsive design. This will result in reduced effort of developing separate sites for each device, but it also encourages cross-device consistency and a unified user experience. At the same time, sites need to take advantage of the unique affordances of tablet devices to support gestures like touch and swipe.

As people continue to migrate many of their media consumption activities to tablet devices, website designers should optimize their entertainment content to make it more accessible on these devices (of varying screen sizes), as well as offer easy transitions between the actual media content and related material. In particular for shopping and productivity-related activities, it is important to provide a seamless experience across all of the user's devices, so that activities started on one of their devices can easily be continued on another. It is worth exploring how tablets can be integrated into the real-world shopping experience as well as making online shopping easier, so that tablets can provide great user experiences for purchasing in-store as well as on the tablet itself. The tablet also has the potential to become a state-of-the-art device to support the end-to-end cooking experience, including support

for recipe selection, ingredients shopping, step-by-step cooking help, healthy eating, gathering friends, and so forth.

Finally, our findings also point to several unexplored areas of research. It is important to understand more about how tablet use differs from that of other computing devices (especially laptops, netbooks, and smartphones), including understanding how and why people transition between those devices. We would also like to explore how tablets are used with other people or in the proximity of other people, to better understand the impact of different social situations. We intend to repeat this combination of quantitative and qualitative research on tablet usage periodically to uncover how motivations and behavior changes in relation to tablets over time.

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