
Mobile Phones and Information Capture in the Workplace

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Abstract

Smartphones (mobile phones with downloadable applications) are being used for far more than making calls and reading email. We investigated the use of phones for information capture for work purposes through interviews, multiple free response surveys, and two multiple choice surveys. While we expected and found taking pictures to be useful for work, we were surprised at the extent of audio, video, and note taking done on the phone, and the impact on other devices. Our work also suggests future mobile information capture for work will increase more due to cultural changes than technological improvements.

Keywords

Mobile, Smartphone, Image Communication

ACM Classification Keywords

H.5.m. Information Systems: Miscellaneous.

Introduction

Phone cameras have long been used for quick pictures of friends and places and because phones are typically nearby people are now using them for many other reasons. For example, employees might prove they have done a job by taking a picture. Consumers now take pictures of product barcodes or send images while shopping to help make decisions. Recently mobile phone cameras have increased in quality to the point

that it is possible to capture an image of a piece of paper with a camera and produce a print that is similar to the quality obtained with a scanner.

Our company has used the slogan "Image Communication" for many years, and revenue has been derived from activities associated with printing and copying. Copiers and printers are not particularly portable, and mobile phones explicitly are. Furthermore, we believe that there is a growing tendency for consumer based technologies to move into business, and this seems especially true in the mobile phone industry. Fifteen years ago mobile phones were designed for and purchased by businesses. Now many phones are clearly targeted at consumers, but then are used for business purposes. This trend has been called the "consumerization of IT."

Thus we are interested in information capture by mobile phones, business tasks done on the phone, and limitations of phones. Ultimately we want to detect trends in usage, and build applications to serve the mobile worker, and perhaps provide capabilities the mobile phone does not or cannot provide. This work-in-progress reports only on the current state of phone usage for business information capture.

One of our goals is to identify whether or not people are using their camera phones for information capture and communication in the workspace. Quite often "information scraps" are scribbled in notebooks, on post-it notes, on documents, on whiteboards, captured using cameras, stored digitally on blogs, and social networks [1]. There are a large number of information management tools available in the market, however not all of our information is transferred to a digital domain,

and even if it is, we do not have a unified way to share and collaborate using this information.

Most users also have a tendency to capture and share information visually [4], and we believe image communication is an important part of office work. Even knowledge workers still depend on static image-based representations of information such as pdf, paper, screenshots and jpeg images.

In prior studies, Brown et al looked into information capture in working life by studying a wide variety of multimedia capture devices to understand the purpose of capture activity [2]. Kindberg et al also did an in-depth study to see how people use camera phones and examine people's intentions at the time of capture and subsequent patterns of use [6]. Both these studies resulted in taxonomy frameworks describing possible reasons why people capture information and how the information captured can be categorized.

Smartphone User Interviews and Surveys

We conducted semi-structured interviews of known smartphone "power users" gathered from personal contacts. We wanted to understand the variety of ways people used their phones, especially for work purposes. This helped us compose several brief surveys consisting mostly of free response questions. In the free response surveys we asked about the type of phone used, the tasks it was used for, specific applications that were used, limitations on usage, places people didn't take their smartphone, tasks that were still done with the computer rather than the smartphone, etc. Each of these surveys was given to at least 50 people. The answers from these surveys were used to decide what

further questions to ask, and to provide options for a larger multiple choice survey.

For example, we asked what capabilities the smartphone had in a free response survey and the answers to that question became a list of capabilities to ask about in the fixed response survey, e.g. "Does your phone support taking videos?" Likewise the answers to "What applications do you use?" were categorized, and later respondents were asked how frequently an application was used in that category.

We gathered responses to the multiple choice survey from two sources: a database of corporate customers that have indicated willingness to participate in surveys and Amazon Mechanical Turk (AMT) (www.mturk.com), an online crowdsourcing system[3].

There is obviously some concern about using remote workers selected at random from a crowdsourcing system and we followed suggestions from [7] for our surveys. AMT workers do have an incentive to do a good job, because bad work can be rejected, payment rescinded and the worker's approval rating will decrease making it harder to gain more work. We limited our survey to workers in the US that claimed to own a smartphone and had an approval rating on previous jobs of greater than 96%. Never-the-less it was necessary to remove some of the responses based on inconsistent responses and check questions we had included in the survey.

We paid both AMT workers and those who participated from our customer database, but the cost of a response from the customer database was 20 times the cost of a useable response from AMT. Results below are from the

larger sample of AMT respondents unless otherwise indicated. We will report on a comparison between databases elsewhere.

Respondents

In the end we had a set of 406 smartphone users with age, income, education, and phone type described in Figure 1. Ninety-eight percent of our users confirmed that their smartphones had cameras, while 91% said that their smartphone had a note taking application, an audio recorder, and a video recorder.

Age	Percent	Education	Percent
18-24	33	Less than highschool	1
25-34	48	Highschool - GED	7
35-44	12	Some College	33
45-55	5	4 year degree	38
55-64	1.5	Post Graduate	19
Decline	1	Decline	2

Income	Percent	Phone	Percent
<=\$20K	31	iPhone	37
<\$40K	31	Android	15
<\$50K	22	RIM	18
<\$100K	22	Symbian	15
>=\$100K	5	Windows	9
Decline	11	Other	6

Figure 1. Demographics for main survey respondents

Smartphone Usage

Information Capture at Work

Our quantitative study asked about how users normally capture information not necessarily using a smartphone. A summary of all these responses appears in Figure 2. The results show that close to 80% of users take notes on the computer at least once a month, which was the most commonly reported form of information capture. Computer note taking was closely followed by post-it note taking and notebook note taking. So even among our smartphone owners, using a phone was not in the top three methods of capturing

information. However, use of the phone for note taking was higher than we expected with almost 75% of users capturing information by taking notes on their phone or at least once a month, and capturing information by taking pictures was not far behind. Perhaps more surprising was the high level of video recording. Several professions routinely make audio recordings, but with most phones it is often easier to make video recordings than audio only recordings. While this question did not specifically ask about audio, video, and pictures taken with a phone, later questions focused on phones indicated that most of the recording in Figure 2, must be from phones.

Functional Image Capture

Ninety percent of our users said that they take pictures using their phones at least once a week (not necessarily for work). We asked users to tell us how many pictures they had stored on their mobile phone. Some users take pictures and quickly transfer them, but 45% have more than 100 pictures stored on their phone, and 3% have more than 1000. Obviously, the phone is being used as both a capture device and an information storage device by some people.

We also used Kindberg et al's taxonomy to ask users to categorize their images in their smartphone gallery as affective or functional [6]. Figure 3 shows the percentage of respondents with different fractions of functional image content stored on their phone. Significantly 65% of people have at least 5% of images for functional tasks.

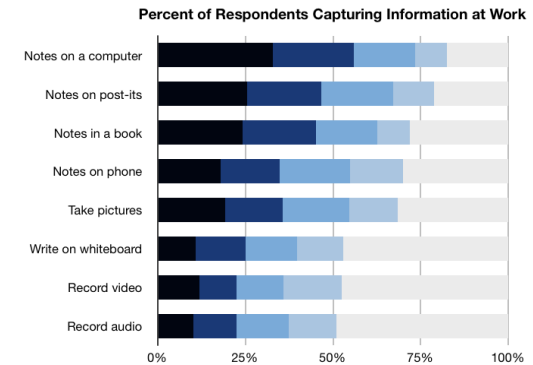


Figure 2. "What are some ways in which you capture information at work? (not necessarily using a smartphone)." Bar shading is: multiple times per day (darkest), daily, weekly, monthly, and less than once a month or never (lightest).

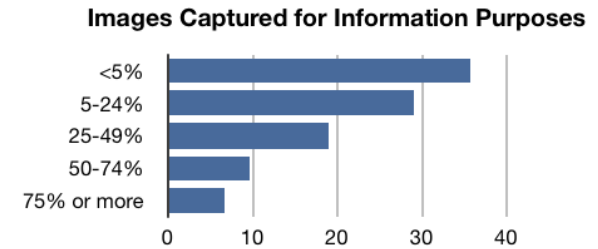


Figure 3. Fraction of images taken for functional reasons. Horizontal axis is the percentage of users with that fraction of functional images indicated on the left hand side.

Figure 4 shows the percent of images on users' phones with text content. Here there is a real dichotomy of use, with 54% of smartphone users not storing text based images, but 7% have more than half their images containing text information.

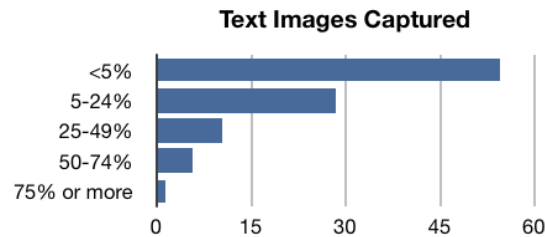


Figure 4. Fraction of images containing text information. Horizontal axis is the percent of users with that fraction of text indicated on the left hand side.

Smartphones and Other Devices

Karlson et al. [5] indicates the phone is emerging as a primary computing devices and we expected smartphones to replace or reduce the usage of other devices like personal computers. Our interviews indicated a surprising amount of use of a smartphone with a computer. Of course people talked on the phone while using a computer, but people also took pictures of their screen, made videos of programs running, listened to music, and even browsed the web with the phone rather than the computer. In some cases the phone was ideal because of personal control e.g. access to own music, or having web bookmarks with them in the future. In other cases the phone was useful because it was a second device that was independent of the PC. The smart phone clearly replaced carrying a separate phone and digital camera.

Although many used a phone with a computer, of those respondents who regularly carry a laptop computer 74% report carrying it less often because of their smartphone. More importantly for our company: more than half of the respondents believe they have reduced their printer usage because of their smartphone.

Printer and copier usage reduction due to smartphones

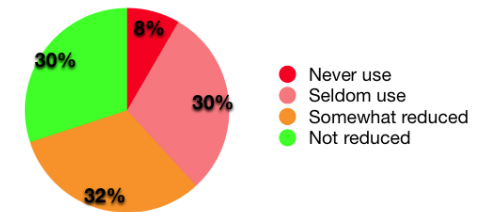


Figure 5. Do you use the printer or copier less now that you are able to capture information with your smartphone?

Smartphone Limitations and desires

When asked about explicit limitations of the phone the top four responses were small screen size, slow internet speeds, low processing power, and difficult to type. All of these had 40-45% of the respondents indicating it was a limitation. However, when asked about what discouraged them from using their phone for work information capture, respondents were much less likely to blame hardware limitations. In free response surveys users indicated time and again that privacy, confidentiality, or potentially improper access to information was a concern that limited the use of their phone for information capture. Fear of superiors, project complexity, and time and effort were also listed as reasons phones were not used. When asked what would cause them to author more content on the phone, the three top items listed were ease of creation, ease of publishing, and rewards. We posit that official rewards for content creation would not only assuage fear of superiors, but also indicate that the appropriate level of access/privacy was being maintained.

We asked about output formats users would like after creating content on the phone and the ranked list appears in Figure 6. A text document tops the list,

presumably because it can be edited and easily included elsewhere.

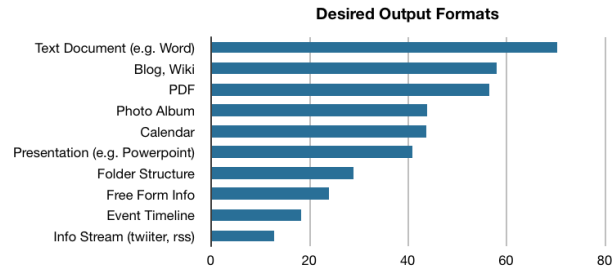


Figure 6. "What are some output formats you would like to see this information in?" Multiple answers possible.

CONCLUSION

We believe that the use of smartphones for information capture and authoring for work purposes is just getting started. We found prevalent note taking, moderate capture of functional and text information, significant video recording for work, and reduced usage of printers and laptops. From our initial surveys and interviews we see many creative uses of phones and a surprising amount of data being stored in pictures. We believe there are opportunities to increase the use of smartphones outside of physical device changes, not only by improving ease of capture, conversion, and sharing, but also by establishing corporate use guidelines. We still intend to look at the data segmented by age and by phone type. But we are most interested in accelerating the use of mobile devices for work purposes by providing the needed services and corporate culture.

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