2013

How do You Choose What to Use? Technology Choice When You Have So Much

Tamilla Mavlanova
American University in Bulgaria, tmavlanova@aubg.bg

Sidne Ward
University of Missouri - Kansas City, wards@umkc.edu

Mark Silver
Fordham University, silver@fordham.edu

How do You Choose What to Use? Technology Choice When You Have So Much

Tamilla Mavlanova
American University in Bulgaria
tmavlanova@aubg.bg

Sidne G. Ward
University of Missouri - Kansas City
wards@umkc.edu

Mark S. Silver
Fordham University
silver@fordham.edu

ABSTRACT

This research-in-progress provides a fresh insight into technology choice in our daily activities. As opposed to prior studies that focus on technology in the work environment, this research is centered on individual technology choice while performing daily tasks: searching for information, executing transactions, consuming entertainment, and communicating. As hardware has become more affordable, more varied in size, and more diverse in features, individuals have access to a plethora of different devices - smartphones, tablets, laptops, and desktop computers. Individuals also have a choice of software: apps versus web browsers. Our research focuses on understanding why individuals choose specific combinations of hardware and software to perform their tasks. By studying this phenomenon, our proposed research program can contribute to understanding individuals' technology choices and inform organizations providing applications to consumers.

Keywords

Human-Computer Interaction, Technology Choice, Apps, Websites, Browsers, Mobile Computing

INTRODUCTION

Due to the technological advancements of the last few decades, individuals now rely on personal IT devices on an almost constant basis for retrieving and capturing information, executing transactions, consuming entertainment, and communicating with others (Lipsman et al. 2013). As devices have become more affordable, more varied in size, more mobile, and more diverse in their features and functions, it is now common for a person to have several different devices available - smartphone, tablet, laptop, and desktop computer - any one of which could be used to accomplish the task at hand. Moreover, any given device may offer multiple software applications for accomplishing the task - for instance, specialized apps as well as web browsers. The technology landscape is further diversified by the proliferation of platform providers such as Apple, Google, Microsoft, Amazon, and others. In today's IT-laden society, someone may be checking the local weather forecast on an iPad tablet using a third-party app while scanning the news via a web browser on a Windows-based computer, all while simultaneously chatting on an Android-based smartphone using a Google app.

As opposed to the workplace, where employees may be required to use a given system, individuals have great freedom of choice of technology devices, platforms, and applications in their personal lives. The variety of choices gives a new context and a new urgency to studying technological choice. Yet few studies investigate personal behavior when an individual possesses more than one device. For instance, a recent meta-analysis of research on mobile devices (Coursaris and Kim 2011) identified limited studies of multiple devices or of device choice in a non-work domain.

As consumers and providers confront the current state of affairs and look toward the future, an important research question becomes the following:

When confronted with a choice of hardware and software technologies to support such activities as personal information processing, entertainment consumption, performing transactions, communicating, and socializing, what do people choose and why?

Note that the issue we are raising is not which technologies an individual acquires nor is it the matter of "use vs. non-use" or even "extent of use" that characterizes most IS adoption research (for instance, Venkatesh et al. 2012) but rather, given the technologies someone already possesses, which hardware and software combination he or she chooses to use in a given instance. Put differently, "What is an individual's pattern of use for the personal IT technologies he or she possesses and what explains this behavior?" And this question leads to another:

What are the utilitarian and hedonic consequences of those technological choices? For instance, how does the technology employed contribute to the time and effort required for an individual to complete the task, to the substance and quality of what he or she accomplishes,

and to his or her enjoyment of and satisfaction with the process and its outcomes?

These questions are interesting because personal technology choices are something we all confront in modern society. They are important because technology features can make a difference and, since we depend on these technologies for so many facets of our lives, our technology choices can be highly consequential. Moreover, understanding these choices and their consequences is essential for informing the design of future hardware and software technologies.

This paper proposes a research program for studying personal technological choice and its consequences in the age of ubiquitous tools whose expanding capabilities overlap. The program considers the technical design features of the tools, the tasks to which they are applied, the characteristics and behavior of the people who use them, and the consequences of their use in light of several possible theoretical explanations of user behavior and its outcomes.

UNDERSTANDING FEATURES OF HARDWARE DEVICES AND SOFTWARE APPLICATIONS

The technological choices available to individuals for gathering information, consuming entertainment, executing transactions, and communicating with others as they go about their daily lives can be characterized by four components: (1) the hardware device they use, (2) the device's software platform (for instance, its operating system), (3) the applications software they use to perform their tasks, (4) and the provider of network access. While all four of these choices are likely consequential for people, we initially focus on two: the hardware device and the software applications (and, of course, their interactions).

In terms of specific hardware devices, the most prevalent today (from physically smallest to largest) are touch-sensitive smartphones, tablets, various types of laptop computers (including notebooks and ultrabooks), and desktop PCs. Smaller devices impose greater limitations on input and output (due to more limited screen size) and make navigation more difficult (Nah, Siau, and Sheng, 2005). Smaller keyboards negatively impact both typing speed and error rates (Sears et al. 1993). And the limited screen size also constrains output, either making screen contents more difficult to read or limiting how much can be displayed (Darroch et al. 2005). Offsetting these liabilities, however, are the increased ease of transporting the devices (since they are less bulky) and the associated availability (as people carry them about). In short, there is a trade-off between ease-of-use and availability.

Turning to software, the web browser, despite some limitations (Silver 2006), was for more than a decade the primary vehicle for interactive Internet-based personal activities. But shoehorning browsers and websites to fit the limitations of small, portable devices has been challenging and using browsers on smartphones is often difficult, degrading usability (Venkatesh et al. 2003).

The development and proliferation of small, touch-based, mobile, handheld devices, as popularized by Apple's iPhone, has brought about a new applications software paradigm, wherein people employ apps, small, stand-alone applications dedicated to a single purpose and downloaded over the Internet, to perform various tasks. These apps typically exhibit high usability by taking advantage of the touch interface and by restricting functionality, which accommodates the input and display limitations of smartphones while offering their users simplicity. And integrating the app with other features of smartphones - such as the built-in camera or someone's personal phone book - adds useful functionality. Tablets are also natural devices for such apps and some apps can now be found on laptop and desktop computers. So we are now at a point in time where apps and browsers providing the same basic functions co-exist on smartphones, tablets, and sometimes even PCs.

We see that there are trade-offs between apps and browsers for accomplishing tasks and these trade-offs may depend on the hardware device in question. Moreover, the balance between usability and functionality is often key, with the simplicity of the app generally offering greater usability but the complexity of the browser affording greater functionality. Smartphones tend to favor the app, since browsers are both cumbersome and unable to offer their full set of benefits on such a small device. In contrast, laptop and desktop PCs tend to favor the browser, since neither the browser's functionality nor its usability is limited by the size of the device.

Those who use even a single device such as a smartphone or a tablet may have a choice between the app and the browser. And those possessing multiple hardware devices have wider choices still. We will refer to the combination of a hardware device and a given app or website as a "tool." Table 1 shows a popular (but non-exhaustive) set of tool choices currently available. Other devices worthy of mention are e-readers and desktop PCs. And newer technologies, such as Google Glass, are on the way.

	Smartphone	Tablet	Laptop
App			
Website(via Browser)			

Table 1. Illustrative Technology Choices: Popular Tools (Combinations of Hardware and Software)

Table 2 summarizes our discussion of the various considerations raised by a tool's design features (such as physical size) that may distinguish tools from each other in a way that explains why a user would favor one tool over another.

Usability	The ease of invoking and employing the tool's functionality. Usability is often impaired by reduced physical size.
Functionality	The range of capabilities afforded to the tool's users. Functionality is often reduced

	to accommodate reduced physical size.
Availability	The extent to which the device and its functionality are accessible, especially when mobile and when dependent on network access.
Seamlessness/ Integration	The extent to which one can move easily from one application to another and to which those applications can access the device's functionality (for instance, a built-in camera)
Platform Dependence	The extent to which different versions of software applications are required for different hardware or software platforms. This issue tends to be greater for apps than for websites accessed via browsers.
Application Management	The ease of downloading and installing applications (if necessary), updating them, and locating apps and websites.

Table 2. Technological Considerations that Distinguish Tools

The various possibilities depicted in Table 1, illustrative of the tools that many people have at their disposal, raise the questions of which tool a given individual will use for a given task and with what result. The considerations listed in Table 2 may help provide answers, contributing to understanding both the choices that people make and the utilitarian and hedonic outcomes that follow from those choices. Such an understanding has implications for technology design as well as for guiding individual behavior in employing technologies.

UNDERSTANDING TECHNOLOGY CHOICE

The question of which combination of hardware and software a given individual will use for a given task is reminiscent of one studied in the early days of email adoption under the rubric, Media Choice. Media Richness Theory (Daft and Lengel 1986) offered an explanation, ordering media along a richness continuum and suggesting that more equivocal tasks are better suited to richer media. Other researchers proposed additional factors that play a role, such as the social processes around technology that define specific choices as appropriate (Markus 1994).

Media Richness Theory can be seen as an instance of Task-Technology Fit (Goodhue and Thompson 1995), which posits that the combination of task characteristics and technology characteristics impacts individual performance. And as with Media Choice, understanding which personal IT tool someone will use in a given situation likely depends, along with other factors, on comprehending the fit between the task and the technology. Our focus on understanding technology choice by individuals in the course of their daily lives is substantially more complex than that of Media Choice. The tasks involved here are much more varied - see Table 3. Similarly, the technological possibilities here, reflecting combinations of hardware devices and software applications, are also more varied than the communication media. Nonetheless, Task-Technology Fit provides a potentially useful avenue for understanding user behavior and its consequences in selecting a tool for a given task at a given moment. Indeed, Gebauer, et al. (2010) have analyzed such fit involving some of the same technologies in the context of mobile use of corporate information.

Retrieving and Consuming Information	The search for information (for instance, by entering search terms or by navigating through menus or links and scanning for relevant results). The consumption of information in the form of static documents, tables, graphs, consumer-driven analysis, and so forth.
Transacting	The execution of transactions such as purchasing products and services, paying bills, trading stocks, or signing up for email newsletters.
Communicating	The exchange of information with others through e-mail, instant messaging, video chat, or social media.
Consuming Entertainment	The use of tools to pass time or for enjoyment such as listening to music, watching videos, gaming, or reading for pleasure.

Table 3. Illustrative Tasks

A key element of the fit between task and tool is how the tool may satisfy the task requirements (Table 4). For example, gaming, conducting transactions, and information processing require different tool capabilities (Fang et al. 2005-6). A focus on analytical tasks versus those requiring mere consumption of information may influence preference for different tool capabilities (Mayer 2013). Certain tools may not provide sufficient functionality to support more complex tasks (Dishaw and Strong 1999).

Time-criticality	The urgency of a task. Time-criticality is typically influenced by events external to the consumer.
Non-routineness	The extent to which the task is novel.
Interdependence	The extent to which a task requires exchanging output and coordinating with others.
Spontaneity	The extent to which a task is unplanned. Spontaneous tasks are often the result of consumers' sudden impulses.
Complexity	The difficulty of the task as reflected in the number of steps necessary to complete the task or the amount of information that must be considered.
Support for Mobility	The extent to which task execution requires support for consumers on the move (for instance, location-based tasks such as requesting directions and finding nearby services).
Efficiency	The extent to which task execution is driven by productivity and time saving goals.
Enjoyment	The extent to which task execution is driven by hedonic goals and emotions.
Effectiveness	The extent to which task execution is driven by utilitarian goals and practical considerations.

Table 4. Common Task Requirements

Given the breadth of personal tasks supported by IT the focus of Task-Technology Fit (Goodhue and Thompson, 1995) on performance outcomes can be limiting. Xu et al. (2012) suggest extending the Task-Technology Fit model to include the technology's hedonic and utilitarian values to provide a more holistic evaluation of the use of devices and applications. Tool choice that is driven by the fit between task and technology in a given instance might reflect a user's desire for utilitarian outcomes, hedonic outcomes, or both. Task-Technology Fit recognizes the role of individuals in affecting outcomes. Individual and demographic characteristics likely also play a role in technology choice. Differences in the use of mobile devices among different demographic groups suggest that there may also be differences in technology choice patterns among these groups.

The fit between the task and the technology is not likely to be the only factor that contributes to tool choice in the personal domain. Habitual behavior is another. Habits are formed when a person uses the same medium multiple times and is able to achieve his or her goal successfully (Hartmann, 2009). More comprehensive, satisfactory, and frequent use of a system may strengthen the effects of habit (Limayem et al. 2007).

Network effects may influence technology choice as well. Consumers often derive more benefit from tools or services that are used by a number of other people purchasing compatible products (Katz and Shapiro 1986). For example, to make free calls over WiFi, consumers may opt to install an app that the majority of people in their contact list uses, since the more contacts that use the service, the more free calls a person can make. These individuals might therefore choose the app over a browser-based service that offers better functionality or usability. Network effects are likely to be most prominent in tasks involving communication and social media.

Social influence and herding behavior may also play a role. Since consumers are known to be influenced by positive reviews (Huang and Chen 2006), consumers selecting a tool to read a book may use the app on their tablet if they have read positive reviews of that app even though their dedicated e-reader may provide a better fit through superior formatting of the content. Similarly, the technology-related behavior of one's friends and peers may influence one's choice of tools.

Studies on Multichannel Choice in a consumer context can also shed light on tool choice, especially if the technology is being used for online shopping. For instance, spillover effects influence consumers to stay with a given channel from one stage of the shopping process to the next (Gensler et al. 2012). In our context of technology choice, if a given individual is using a smartphone to research product information and then decides to complete the transaction, he or she might continue using the smartphone even if a desktop computer might be a better fit for the second stage.

Our observations about technology choice, summarized in Table 5, indicate that the technology choice phenomenon is complex and in need of systematic study. A collection of very different forces (some task dependent and some not) may combine - in fact, interact - to influence tool selection. For instance, habitual behavior may counter the spillover effect. And if users' tool choices are indeed influenced by spillover effects, then we see that one cannot study tool selection for a given task in isolation.

Task-Technology Fit	Network Effects
Individual (Demographic) Characteristics	Social Influence
Habitual Behavior	Spillover Effects

Table 5. Factors Likely to Affect Tool Choice

RESEARCH PROGRAM

We propose a research program to study (1) how individuals choose among their hardware and software options for performing the various IT-related tasks that they engage in as they go about their lives as well as (2) the consequences of those choices for performance and satisfaction. Our objective is to inform (1) technology choices by individuals who employ the devices and applications, (2) technology choices by those organizations that provide apps and websites, and (3) the design of future technologies by the consumer IT industry. Given the complexity of the phenomenon, with multi-dimensional technology characteristics, a wide variety of tasks, and a diverse set of factors that may influence choices and consequences, we anticipate a research program incorporating a range of research methodologies, including laboratory and field studies, experiments, and surveys

Our initial exploration will entail an online survey designed to identify consumers' beliefs regarding the tools they would choose in a variety of situations. Findings should lead to a deeper understanding of the pattern of tool choices made by consumers. This improved understanding will inform the second stage of our research program - an experiment designed to measure tool choice directly in a controlled setting, followed by a field study to better understand the individual tool choices.

CONCLUSION

Our research-in-progress addresses a phenomenon of growing significance as individuals are becoming increasingly dependent on IT in their daily lives and as they possess a variety of tools which could be used to accomplish a given task. Given a diversity of hardware devices ranging from handheld devices to desktop computers, and given a range of apps and browsers, people are constantly making technology choices, selecting some combination of hardware device and software application for each task they perform. Our research focuses on understanding these tool choices and

their consequences. Our work is unique in a number of ways. The research focuses on technology choices by individuals in their private lives, rather than the use of technology mandated in the work environment. And, unlike most adoption studies, it focuses not on whether or not a system is used, and not on the extent of a system's use, but rather on the tool choices that people make on an ongoing basis among a collection of personal technologies that they have adopted. By studying this phenomenon, our proposed research program can contribute to better tool choices by individuals, by organizations providing applications to individuals, and by the consumer IT industry.

REFERENCES

Coursaris, C. K., and Kim, D. J. 2011. "A meta-analytical review of empirical mobile usability studies." Journal of Usability Studies (6:3), pp. 117-171.

Daft, R. L., and Lengel, R. H. 1986. "Organizational Information Requirements, Media Richness and Structural Design," Management Science (32:5), pp. 554-571.

Darroch, I., Goodman, J., Brewster, S., and Gray, P. 2005. "The Effect of Age and Font Size on Reading Text on Handheld Computers," Human-Computer Interaction-INTERACT (3585), pp. 253-266.

Dishaw, M.T., and Strong, D.M. 1999. "Extending the technology acceptance model with task-technology fit constructs," Information & Management (36), pp. 9-21.

Fang, X., Chan, S., Brzezinski, J., and Xu, S. 2005-6. "Moderating Effects of Task Type on Wireless Technology Acceptance," Journal of Management Information Systems (22:3), pp. 123-157.

Gebauer, J., Shaw, M. J., and Gribbins, M. L. 2010. "Task-Technology Fit for Mobile Information Systems." Journal of Information Technology (25:3), pp. 259-272.

Gensler, S., Verhoef, P.C., and Bohm, M. 2012. "Understanding Consumers' Multichannel Choices across the Different Stages of the Buying Process," Marketing Letters (23), pp. 987-1003.

Goodhue, D. L., and Thompson, R. L. 1995. "Task-Technology Fit and Individual Performance," MIS Quarterly (19:2), pp. 213-236.

Hartmann, T. 2009. Media Choice: a Theoretical and Empirical Overview. Routledge.

Huang, J.H., and Chen, Y.F. 2006. "Herding in Online Product Choice," Psychology & Marketing (23:5), pp. 413-428.

Katz, M. L., and Shapiro, C. 1986. "Technology Adoption in the Presence of Network Externalities". The Journal of Political Economy (94:4), pp. 822-841.

Limayem, M., Hirt, S.G., and Cheung, C.M.K. 2007. "How Habit Limits the Predictive Power of Intention: The Case of Information Systems Continuance," MIS Quarterly (31:4), pp. 705-737.

Lipsman, A., Aquino, C., and Flosi, S. 2013. "U.S. Digital Future in Focus 2013." comScore, Inc., http://www.comscore.com/Insights/Presentations_and_Whitepapers/2013/2013_US_ Digital_Future_in_Focus. Retrieved 2013-02-28.

Markus, M.L. 1994. "Electronic Mail as the Medium of Managerial Choice," Organization Science (5:4), pp. 502-527.

Mayer, J.H.H. 2013. "Improving Mobile IS Acceptance: A Business Perspective," ECIS 2013 Proceedings, Paper 197. http://aisel.aisnet.org/ecis2013/197. Retrieved 2013-08-20.

Nah, F. F., Siau, K., & Sheng, H. 2005. "The value of mobile applications: A utility company study". Communications of the ACM, (48:2), pp. 85-90.

Sears, A., Revis, D., Swatski, J., Crittenden, R., and Shneiderman, B. 1993. "Investigating Touchscreen Typing: The Effects of Keyboard Size on Typing Speed," Behavior & Information Technology (12:1), pp. 17-22.

Silver, M. S. 2006. "Browser-Based Applications: Popular but Flawed," Information Systems and e-Business Management (4), pp. 361-393.

Venkatesh, V., Ramesh, V., and Massey, A.P. 2003 "Understanding usability in mobile commerce," Communications of the ACM (46:12) pp. 53-56.

Venkatesh, V., Thong, J. Y. L., and Xu, X. 2012. "Consumer Acceptance and Use of Information Technology: Extending the Unified Theory of Acceptance and Use of Technology," MIS Quarterly (36:1), pp. 157-178.

Xu, L., Lin, J., and Chan, H. C. 2012. "The moderating effects of utilitarian and hedonic values on information technology continuance," ACM Transactions on Computer-Human Interaction (19:2), Article 12 (July 2012).