

Electronic Communication for Professionals—Challenges and Opportunities

by

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A Dissertation Presented in Partial Fulfillment
of the Requirements for the Degree
Doctor of Philosophy

Approved April 2018 by the
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ARIZONA STATE UNIVERSITY

May 2018

ABSTRACT

The 21st-century professional or knowledge worker spends much of the working day engaging others through electronic communication. The modes of communication available to knowledge workers have rapidly increased due to computerized technology advances: conference and video calls, instant messaging, e-mail, social media, podcasts, audio books, webinars, and much more. Professionals who think for a living express feelings of stress about their ability to respond and fear missing critical tasks or information as they attempt to wade through all the electronic communication that floods their inboxes. Although many electronic communication tools compete for the attention of the contemporary knowledge worker, most professionals use an electronic personal information management (PIM) system, more commonly known as an e-mail application and often the ubiquitous Microsoft Outlook program. The aim of this research was to provide knowledge workers with solutions to manage the influx of electronic communication that arrives daily by studying the workers in their working environment. This dissertation represents a quest to understand the current strategies knowledge workers use to manage their e-mail, and if modification of e-mail management strategies can have an impact on productivity and stress levels for these professionals. Today's knowledge workers rarely work entirely alone, justifying the importance of also exploring methods to improve electronic communications within teams.

I credit much of the success in my life to my parents, Doris and Conrad Berry, so it is with tremendous gratitude that I dedicate this current endeavor to them.

My mother started teaching me industrial engineering through principles of lean manufacturing at a very early age by showing me how to arrange a kitchen around a dishwasher and how running errands in a circular pattern was more time efficient. Our conversations frequently centered on what I could do as a career; thus, attending college after high school was the only option I considered. She told me that I could do anything I chose to do and that she would always be there to support me. She is such a wonderful mother that, on occasion, I have loaned her out to friends whose fortunes do not include a person like her in their life.

Conrad entered my life when I was a teenager. I have no idea how he tolerated me during those years, but he stuck with me and I am better for his influence. He has the patience of a saint and empathizes with me on those occasions when my mother cannot appreciate my struggle. He taught me many practical skills for living, such as how to wire a light switch and how to drive a manual transmission vehicle. Those practical lessons were my first glimpses of engineering in real life. He taught me to be independent, self-reliant, and confident in my abilities. I recognized early on that he was much smarter than I was, and I grew to appreciate his great wisdom.

Through their love, support, and encouragement, I have been able to pursue this dream. I dedicate this dissertation to you—Mom and Pops.

ACKNOWLEDGMENTS

Everyone knows that a Ph.D. candidate is supported, coached, and enriched by several people, and I have many to thank for guiding me through this process. First and foremost are my co-chairs Dr. Braden Allenby and Dr. Kristen Parrish.

Dr. Allenby believed in my research and expressed an interest in learning about it early in my scholarly journey. When he was at AT&T, developers were working on virtual offices and Dr. Allenby was interested in how the work had progressed and where Arizona State University (ASU) might fit in and contribute to its advancement. Dr. Allenby is probably one of the biggest thinkers I will ever know. He said to me years ago, “Taking classes is easy; you should think about getting a master’s in law while you’re here.” Now that I have waged the battle of writing the dissertation, I agree: taking classes is easy. Dr. Parrish was the person behind the scenes, encouraging me and reminding me of the shining light at the end of the tunnel. She answered all the questions I was too embarrassed to ask anyone else, connected me with Dr. Allenby, and did the heavy lifting of administrative work to support me as a student. Drs. Amy Landis and Nancy Cooke rounded out my committee. Both provided invaluable input into my research and helped me stay on course.

Drs. Sarah Tracy, Michael Crow, and Daniel Sarewitz were the group of professors who made me question my long-held belief that a positivist’s view of pure science was the complete truth. They broadened my perspective and helped me to understand that other lenses can tell a different story and still be valid. The hard science I thought was superior and more complex was really the easy science. The messy sciences require more rigor to accomplish and are far more interesting.

Last, but not least, to all those who contributed in ways big and small to the success of this research. I acknowledge Dr. Sarah Tracy and the students of her class for their critique and feedback of the study inspiring Chapters 3 and 4 of this dissertation. I thank Dr. Eric Hekler for sharing his enthusiasm for customizing solutions to suit individual needs; the study of Chapter 5 emerged from this concept. Hunter Middleton, Silvia Neretti, and Theora Tiffney, I acknowledge your research assistance and willingness to partner with someone closer to your parents' age than your own. Additionally, my virtual cohort, Sanaz Saeidi and Sunshine Littlecreek, thanks for our twice-monthly calls. I am grateful that my alma matter provided the right place for me to continue learning; ASU's innovative environment embraced this interdisciplinary work and enabled my unique program of study. Dr. Mary Anderson-Roland served as a role model, mentor, and advocate from the beginning of my engineering education and into my career. Bill Ballot, my employer and the longest running boss in my career, I acknowledge your constant support. Without the research participants who shared their methods for using e-mail, my studies would not have advanced, I thank all of them for sharing their usually private experiences of how they manage their work. I humbly acknowledge my dear friends and coworkers who served as beta-testers, proofreaders and editors, listened to my struggles, and kept me sane, healthy, and laughing; Anna, Lisa, Cathy, Fariha, JoAnn, Jim, Jodi, Betty, Nancy, Fran, Timothy, Diana, Doris, Conrad and many more. Lastly to my dog, Sofia, who never judged me or complained when I could barely step away from my computer long enough to feed her, it's time for a well-deserved walk. My sincere thanks to all of you.

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CHAPTER 1

INTRODUCTION

In Bush's (1945) call to facilitate scientists' transition from supporting the business of war, the suggestion was made to shift research from bomb building (i.e., "strange destructive gadgets") to inventions that extend the powers of the human mind by developing ways to quickly and easily share, review, and grasp knowledge (p. 101). Bush eerily predicted many contemporary devices, including the modern-day office and computer, with his description of the memex:

A memex is a device in which some individual stores all his books, records, and communications, which is mechanized so that it may be consulted with exceeding speed and flexibility. It is an enlarged intimate supplement to his memory. It consists of a desk, and while it can presumably be operated from a distance, it is primarily the piece of furniture at which he works. On the top are slanting translucent screens, on which material can be projected for convenient reading. There is a keyboard, . . . Otherwise it looks like an ordinary desk. (Bush, 1945, p. 106)

"As We May Think" (Bush, 1945, p. 101) expanded the ever-growing body of knowledge on approaches and tools to help the "thinking man," scientists, professionals, and humankind as a whole to access and understand the vast sum of human knowledge. Almost all of the tools Bush predicted are represented among contemporary technology, but these tools have done little to unburden the thinking person from the enormous amount of knowledge available and the daunting task of understanding it. Although the 21st-century "thinking worker" has access to considerably more information than his or her counterparts did in 1945, the human ability to deal with that information has not changed nearly as much.

Bush's (1945) thinking men align with Drucker's (1959) knowledge workers, those who "think for a living" and use expertise in the primary pursuit of creation or application of knowledge (Davenport, 2005, p. 23). Ascribing Drucker's understanding of staff skills and responsibilities to the contemporary office context, knowledge workers use their expertise in

Knowledge worker:

Drucker coined the term "knowledge worker" in 1959. Davenport (2005) expanded the definition of knowledge workers to include those who "have high degrees of expertise, education, or experience, and the primary purpose of their jobs involves the creation, distribution, or application of knowledge" (p. 10).

the primary pursuit of creation or application of knowledge (Davenport, 2005) and must now develop skills and strategies to manage electronic communication. Knowledge workers, then, are similar to professionals (Professional, n.d.): they engage in specific activities that require some level of education. Other terms for knowledge workers are "office workers" and "white collar worker[s]" (Sinclair, 1919, p. 12) —people who wear white-collared shirts and work in an office, some of whom might serve in the role of boss. These terms are used interchangeably in this paper because all of these individuals work in an office setting, use a computer to perform the majority of their job, and likely receive a substantial volume of e-mail while also using the output of thinking to create value through innovation.

There are more than 66 million such workers in the United States (U.S. Census Bureau, 2015) and more than 330 million worldwide (Dobbs et al., 2012). These numbers are increasing as organizations encourage their workers and those in the employment pipeline to achieve higher levels of education to fill skill gaps. Given these swelling

numbers of workers receiving increasing volumes of e-mail, a method to reduce stress or improve productivity among this population of workers could be helpful.

In the 1940s, when Bush (1945) wrote about how people think, the daily business of receiving and sharing information involved a few simple communications methods and mediums: paper-based (typed memorandums, books, telegraphs) material, face-to-face communication, telephone calls, radio, and perhaps a rare television show. Knowledge workers in the 21st century have many more modes of communication due to computerized technological advances: conference and video calls, instant messaging, e-mail, social media, podcasts, audio books, webinars, and many more. Although electronic communications have been exchanged since the mid-1960s (Van Vleck, 2012), early Internet connections through DARPA occurred in the same time frame (Hurdeman, 2003), and the first personal computer, the MITS Altair 8080, was released in 1974 (Reimer, 2005), it was not until the mid-1990s that electronic communications as we know it began its steep growth and widespread adoption in the business environment (Reimer, 2005). According to Pew Research (Purcell & Rainie, 2014, para. 1), for today's knowledge worker, "life on the job means life online": 87% of working adults in the United States report using e-mail or the web daily, and e-mail is deemed the most important communication tool for these workers. Although the newest entries to this workforce, members of Gen Z, those born after the mid 1990's, see using e-mail as the digital equivalent of putting on a shirt and a tie; they willingly adopt e-mail upon entering the workforce, recognizing e-mail as the communication tool of working adults (Mims, 2016). Despite many challenges and threats to this communication method (e.g., hacking,

spam), e-mail remains the “main digital artery” for knowledge workers (Purcell & Rainie, 2014, para. 7). As such, developing tactics and strategies to manage e-mail could be beneficial to those who spend their working hours using e-mail applications. Many electronic communications methods are available and in use by 21st-century knowledge workers, but this work focuses on e-mail communication because it is the most widely used method.

In 1996, the number of e-mails sent surpassed the volume of “snail mail” items delivered by the U.S. Postal Service (USPS) annually (Stephens, 2007). As of late 2017, the USPS began offering to e-mail images of a person’s snail mail to him or her, and so Informed Delivery was introduced (USPS.com, n.d.). Using data from 2015, Global Data Point determined that the average “office worker,” similar to knowledge workers, received 121 e-mails per day (KnowBe4, 2017, para. 7). Some researchers projected that, by the end of 2018, more than 281 billion e-mails would be exchanged daily (Radicati, 2018). Professionals—individuals who think for a living—report getting more e-mail than ever, leading them to express feelings of stress about their ability to respond, and being overwhelmed due to this volume of e-mail (Dabbish & Kraut, 2006; Jerejian, Reid, & Rees, 2013; Kushlev & Dunn, 2015; Sumecki, Chipulu, & Ojiako, 2011).

Motivation and Research Goals

Knowledge workers who struggle to manage all the e-mail they receive experience the conundrum of having to choose to do e-mail or do work, and often have difficulty finding a way to do both simultaneously. Although many may seriously consider committing “e-mail bankruptcy,” the term coined by Turkle, a professor at MIT,

and implemented by Lessig, a professor at Stanford, as a solution that involves deleting all of one's e-mail and starting over, most respect that this is not an option (Musgrove, 2007). E-mail bankruptcy would yield immediate success but not be sustainable in the long term (Musgrove, 2007). Many books, blogs, and articles provide options of how to work "better" or "smarter." Some of these approaches, including Allen's (2008) "getting things done" five-step method, Lifestacker (Pash & Trapani, 2011), and Ferriss's (2011) 4-hour workweek, have cult-like followings.

What work is being set aside to allow these knowledge workers to pursue practices to achieve the elusive empty inbox? Are workers missing out on the opportunity to do truly innovative work, the work by which knowledge workers bring or add value with the "thinking" that they do, the work that can really help make the world a better place, such as solving one of the National Academy of Engineering grand challenges? Newport (2016) pointed out that answering e-mail resembles "shallow work," sometimes effectively done without full focus, whereas "deep work" contributes *the* critical aspect of knowledge work, resulting in innovation. Knowledge workers must choose their own answer to a difficult problem—do their e-mail, which helps retain their professional reputations, or do the "real" work they trained for and long to do by contributing to help make the world a better place.

The overall aim of this research is to provide knowledge workers with research-based solutions to manage the daily influx of e-mail that seems to arrive nonstop. Although authors of popular literature (Allen, 2008; Ferriss, 2011; Pash & Trapani, 2011) offer many practical, logical solutions, they rarely provide scholarly references to

reinforce their recommendations. The solutions they propose fail to take into account different preferences or working conditions, and some of the solutions become quickly outdated as technology changes. Some of these authors consult in this field and can offer the observational “proof” of their clients who report success following the recommendations, but many of them provide an unconvincing sample size of one (themselves) as the foundation for the proposals. Thus, the intent of this work is to provide a more scientific, research-based set of solutions that can provide knowledge workers with a focus on different activities they might be or could be employing, and solutions that can be used as technology changes. Although this work will be published in scholarly literature to provide new, original knowledge for the “academy,” the biggest impact of this work may be realized in the guidance it offers knowledge workers through publication in accessible outlets, written in straightforward, easily understandable language. This work seeks to understand what e-mail management practices are currently in use, if modifications of e-mail reading frequency and use of notifications can help improve productivity, and if teams can improve electronic communication with the following research questions:

1. What e-mail management practices are currently in use and what do knowledge workers express as the joys, challenges, failures, and successes of using and managing e-mail? What emotions inform this discussion?
2. Could aligning e-mail management practices of reading frequency and use of e-mail notifications have an impact on productivity and stress levels for knowledge workers? Would the type of work tasks in which the

knowledge workers engage—strategic versus tactical—influence any impact on productivity or stress levels?

3. How can team electronic communications be improved to increase perceived team productivity and reduce the stress perceived by team members?

Organization of the Dissertation

This dissertation is organized into seven chapters. Chapter 1 provides an introduction with the history of e-mail use, the current situation for knowledge workers, and the motivation and goals for the research. Chapter 2 includes a review of the relevant literature and points out the gaps or opportunities. Chapters 3-6 are presented in a format suitable for journal publication. As such each of these chapters includes an introduction, literature review, method, result and conclusion section. Chapter 3 examines the e-mail management strategies currently in use by knowledge workers, with a focus on the details of how they process (or do not process) their e-mail. Chapter 3 has been published, and the citation is: Counts, V. (2017). De-clutter your inbox: Transform your perspective to see email as a tool. *Proceedings of the Human Factors and Ergonomics Society Annual Meeting*, 61, 135–139. <https://doi.org/10.1177/1541931213601517>. Chapter 4 assesses the emotions these knowledge workers express about their management strategies and the impact of those strategies on their perspective. Chapter 5 investigates how e-mail checking frequency and the use of e-mail notifications affect knowledge workers through self-reported measures of stress and productivity. Chapter 6 explores electronic communication in teams through case study research. The need to focus on teams became

clear through the progressive elaboration of the research, thus Chapter 6 includes some additional literature relevant to teams as well as case study research methods. Chapter 7 summarizes the work, presents conclusions, and offers recommendations for future work.

CHAPTER 2

LITERATURE REVIEW

More than 35 years ago, Denning (1982) described the “receiver’s plight” (p. 164) that most 21st-century professionals experience as they attempt to process the volumes of e-mail that fill their inboxes daily at little or no cost to the sender. Denning’s (2006) follow-up letter, published more than 20 years later, suggests that some workers might be spending an hour a day merely deleting unwanted e-mails. Further supported with the logical finding that *sending* e-mail is perceived as better than *receiving* it (Renaud, Ramsay, & Hair, 2006) and that associating a cost with sending of e-mail could result in different reading and sending behavior (Kraut, Sunder, Telang, & Morris, 2005), the literature clearly calls for change.

Literature Review Process

The articles summarized in this review were collected primarily through keyword searches in Google Scholar. Search terms for e-mail-related topics (e.g., *email*, *e-mail*, *electronic mail*, *online mail*, *electronic communication*, *e-mail management strategies*) provided the initial seeds for searches. These terms were combined with other terms that imply efficiency, such as *work smarter*, *productivity*, *efficiency*, *output*, *yield*, *production*, *improvement*, and *capacity*. Furthermore, various words and phrases to find articles for knowledge workers (e.g., *knowledge workers*, *professionals*, *office workers*, *white-collar workers*) provided a variety of audiences. Seven mentor articles most closely aligned with the research questions and topic areas were identified through this process. Then, each of these seven articles was retrieved using Arizona State University (ASU) Library’s

One Search; the articles from “citing this” and “cited in this” provided a forward and backward trace of references. Any new relevant references were included in the review. In some cases, search terms for specific research methods provided references such as *qualitative data analysis* and *case study analysis*. The top 20 books from Amazon.com resulting from search terms of *e-mail management* and *productivity* offered the perspective of popular literature. More than 275 references were collected in an EndNote management system for review.

Summary of Reviewed Literature

When the business world transitioned from reliance on paper-based systems to those involving electrons, clever developers recycled key terms and functional concepts from common language, such as *inbox*, *folders*, and *trash* (Malone, 1983; Mander, Salomon, & Wong, 1992; Whittaker & Hirschberg, 2001), but failed to ensure those paper handling processes actually worked well and achieved the best productivity in the electronic environment. In the 21st century, e-mail applications serve the purpose of personal information management (PIM) tools that include added features such as tasks, calendars, and contact management, well beyond the original intent as an electronic memorandum delivery tool (Bellotti, Ducheneaut, Howard, & Smith, 2003; Whittaker, Bellotti, & Gwizdka, 2006; Zhang, 2015). These e-mail applications provide the foundational workspace for knowledge workers, incorporating many, if not all, of the tools used by professionals on a daily basis (Whittaker, Bellotti, & Moody, 2005).

Over time, scholarly research has recommended new tools and/or features to the software industry that could help users manage electronic communications better

(Ducheneaut & Bellotti, 2001; Gwizdka & Chignell, 2004; Takkinen & Shahmehri, 1998; Venolia, Dabbish, Cadiz, & Gupta, 2001; Whittaker, 2005) many of which have been adopted, although recent work suggests that more functionality might not help reduce stress (Hanrahan, Pérez-Quñones, & Martin, 2016). The ease with which e-mail can be sent increases the volume sent and places the burden of a response or action on those receiving the e-mail, which equates to higher levels of stress. With no clear, efficient process to deal with all the e-mail, this process is not sustainable. To move down the path to identify the “best” strategy to manage e-mail, first we must understand the current proposed solutions.

Many have argued that working more hours could be the solution to manage the increased volume of e-mail, but this approach does not appear to reduce the stress associated with the e-mail (Barley, Meyerson, & Grodal, 2011). Organizational policies designed with good intentions to reduce workers’ expressed frustrations with the e-mail problem have done little to resolve the situation (Ramsay & Renaud, 2012). For workers with high tendencies for procrastination, one of the coping patterns identified by the conflict theory of decision making, working on e-mail is sometimes used as a tool (or crutch) for avoiding other work tasks by providing an interruption to what they perceive as boring or challenging tasks (Phillips & Reddie, 2007). Interruptions of work due to e-mail negatively affect productivity (Renaud et al., 2006; Siu, Iverson, & Tang, 2006) and cause some to “get lost in e-mail” (Hanrahan & Pérez-Quñones, 2015, p. 3981).

Although originally an “asynchronous” communication tool, some have suggested e-mail might more appropriately be called “e-synchronous” because of an increased expectation

for an immediate reply, often to preserve one's professional image (Hanrahan & Pérez-Quiñones, 2015; Ramsay & Renaud, 2012; Renaud et al., 2006; Teichmann, Ilvest, Lõhmus, Murdvee, & Dondon, 2013; Tyler & Tang, 2003). Some workers respond to a new e-mail as quickly as they would answer the phone (Jackson, Dawson, & Wilson, 2003).

Thus, as knowledge workers, we have more e-mail than ever, we feel the need to reply immediately, and stress levels continue to rise. The industry has already incorporated many of the potential improvements suggested by research, and the volume of e-mail that must be managed each day increases. What action can we take to improve our situations? In a rare, paradoxical study conducted by Mark, Volda, and Cardello (2012), participants who gave up e-mail for one workweek experienced less stress (as measured via heart rate variability), switched tasks less frequently, reported the ability to focus more on specific tasks, and experienced a slower pace of work life without e-mail. Although many of us might want to quit using e-mail in the hope of reducing stress, it is not a likely option for most knowledge workers because e-mail has become a standard tool of business (Derks & Bakker, 2015; Purcell & Rainie, 2014; Whittaker et al., 2006).

Popular literature has provided many suggestions (Allen, 2008; Belsky, 2010; Bennett, 2014; Ferriss, 2011), but scholarly work contradicts some of the "seemingly logical" suggestions in the popular literature. For example, little evidence exists to show good usage of the idealistic "one touch" model, a "touch items once" philosophy aligned with principles of scientific management (Taylor, 1914), can be implemented in practice because few people can execute to this level of perfection (Bergman & Whittaker, 2016).

Popular media also often suggests extensive folder usage as a panacea for e-mail overload, but research shows that this approach often fails (Bälter, 2000; Ducheneaut & Bellotti, 2001; Venolia et al., 2001). There are several reasons for folder usage failure: difficulty creating meaningful folder categories results in incorrect folder sizing and makes retrieving messages problematic; too many files in a folder, too few files in a folder, or folder names too difficult to remember; and if e-mails containing tasks are filed, the “reminder” of the task goes away (Whittaker, 2011). Additionally, using large numbers of folders correlates to increased feelings of overload (Dabbish & Kraut, 2006). The search features available in most contemporary e-mail systems may obviate the need for extensive folder usage (Narang, Dumais, Craswell, Liebling, & Ai, 2017).

The scholarly literature represents an attempt to find a solution with theoretical models that predict e-mail overload¹ based on the number of interruptions and volume of e-mail (Sobotta & Hummel, 2015). Some participant studies have found e-mail overload is significantly correlated with Core Self-Evaluation scores (Reinke & Chamorro-Premuzic, 2014) and indicate e-mail volume is linked with great stress (Shirren & Phillips, 2011). Other participant-based studies have shown that those who report the highest feelings of overload do not always have the highest volume of e-mail (Pignata, Lushington, Sloan, & Buchanan, 2015). One study found no correlation between e-mail overload and e-mail antecedents (e.g., e-mail volume; Reinke & Chamorro-Premuzic,

¹ “E-mail overload,” as originally defined by Whittaker and Sidner (1996), refers to e-mail applications doing much more than just delivering electronic memorandums. In Whittaker and Sidner’s definition, the development of e-mail applications as PIM tools that include calendar, task, and contact management “overloads” the e-mail application. Some authors do not use “e-mail overload” in this sense, but rather as a way to say users are overwhelmed with managing and dealing with e-mails.

2014). Yet another study found that organizational actions such as training on how to manage e-mail can help reduce feelings of being overwhelmed, even if the volume of e-mail does not change (Soucek & Moser, 2010), all suggesting that reducing volume alone will not solve the problem for professionals drowning in e-mail.

Perhaps the answer might lie more in how often we “do” e-mail. Models suggest that checking e-mail less frequently and suppressing the urge for immediate reaction reduces work interruptions and improves productivity (Gupta, Sharda, & Greve, 2011; Kanungo & Jain, 2008). Participant-based studies support this strategy, finding that checking e-mail less frequently (limited to periodic checking versus all-day/continuous checking) positively affected the well-being of users, and those with lower stress had higher productivity (Kushlev & Dunn, 2015). This finding has received even stronger support through studies with contemporary wearable technology devices, using heart rate monitors, directly measuring the physiological impact of e-mail stress indicating that those who spend more time on e-mail and check e-mail more frequently have lower productivity and higher stress (Mark et al., 2016). Checking e-mails less frequently requires high levels of trust between managers and employees, with lowered expectations of speedy responses resulting in better employee job satisfaction and organizational commitment (Paczkowski & Kuruzovich, 2016).

Although modifications to how often we do e-mail show promise, many professionals with more tactical and operational roles (e.g., manufacturing managers, supply chain planners) who need to respond quickly to e-mails might find the strategy of checking e-mail less often impractical or impossible. The broader audience of knowledge

workers might benefit from also examining *how* they do e-mail, meaning the strategies and tactics they employ to work through their e-mail. Studies have revealed that many of us use our inboxes as task management tools, leaving e-mails in the inbox until the particular issue or task content of the e-mail is resolved, allowing the e-mail in the inbox to serve as “reminders” of some action or follow-up needed (Dabbish & Kraut, 2006; Siu et al., 2006; Whittaker & Sidner, 1996). Users also consistently use their e-mail system for storage of the e-mails themselves, either through development of folders and a filing process, or by leaving the e-mails in the inbox (Whittaker & Sidner, 1996). Multiple strategies could be implemented to deal with the different item types because e-mails come as distinctly different items: *to dos* (tasks), *to reads* (long messages that need to be read but likely have no action needed), *indeterminate status* (e-mails where it is not clear what—if any—action needed), or *ongoing correspondence* (part of an ongoing but incomplete conversation; Whittaker & Sidner, 1996).

Whereas many studies have categorized e-mail management techniques, uses of e-mail, or categorization of tasks that arrive via e-mail (prioritizers and archivers: Mackay, 1988; flow, triage, task management, archive, and retrieve: Venolia et al., 2001; cleaners and keepers: Gwizdka, 2004; immediate processing, limiting, encoding, and accumulation: Gwizdka, 2004; rapid response, extended response, and interdependent: Bellotti, Ducheneaut, Howard, Smith, & Grinter, 2005; relaxed, driven, and stressed: Hair, Renaud, & Ramsay, 2006; glance, scan and defer: Siu et al., 2006; adding “few folder filer” to Whittaker and Sidner’s (1996) approach: D. Fisher, Brush, Gleave, & Smith, 2006; delete, move, and mark: Narang et al., 2017), most rest on the foundational

work of Whittaker and Sidner (1996). Whittaker and Sidner found three distinct categories: no filers (those who leave their e-mail—unsorted—in their inbox), frequent filers (those who vigorously strive to limit the number of messages in their inbox by using copious folders), and spring cleaners (those who perform inbox clean-ups every 1 to 3 months). These categorizations examine how users “process” (or not) the e-mail that arrives in their inboxes. All of these examples except for that of Narang et al. (2017) are from studies that occurred more than a decade ago, and all but Narang et al. utilized some type of qualitative data, usually as part of a mixed methods study. Narang et al.’s (2017) study was entirely quantitative and anonymous (i.e., analysis of one week of Microsoft’s log data of their web mail service).

Given that e-mail applications have incorporated new features over the last decade, it seems reasonable that these strategies may have shifted to use those new features. The most recent qualitative studies are more than 10 years old, and e-mail applications have evolved dramatically since then. Current research can add to the knowledge base by examining the specific strategies users have developed and employed and how users incorporated new features in contemporary e-mail applications (Ducheneaut & Watts, 2005). An up-to-date empirical study can provide designers with direction for future improvements to e-mail software, as well as professionals with methods to manage their e-mail in a way that provides work/life balance and minimizes e-mail induced stress.

Lastly, many of the studies mentioned above revealed strong emotional feelings and reactions to the state of participants’ inboxes. Participants described their feelings

relative to e-mail as “disgust” (referring to the size of the inbox) and “seizures” (referring to the motivation to clean out the inbox; Whittaker & Sidner, 1996). As mentioned earlier, feelings of being overloaded with e-mail correlate to reductions in productivity, work engagement, and increases in burnout, “a psychological syndrome in response to chronic interpersonal stressors on the job” (Maslach, Schaufeli, & Leiter, as cited in Reinke & Chamorro-Premuzic, 2014, p. 503). More women than men have reported higher feelings of pressure to check e-mail frequently and reported believing checking e-mail frequently was disruptive to their work (Renaud et al., 2006).

Literature Summary and Gap Analysis

The low cost of sending an e-mail versus the high cost of e-mail to the recipient (e.g., need for action, or just reading) creates an imbalance of power between the sender and recipient and leaves the recipient with a higher burden of work without the benefit of a discussion of priority or exacting definition of work output needed (Denning, 1982; Renaud et al., 2006). E-mail applications of the 21st century include functions well beyond the original intent of message delivery, and these applications have become the platform for managing much of how knowledge workers perform their jobs (Bellotti et al., 2003; Mander et al., 1992; Siu et al., 2006; Venolia et al., 2001). Modern e-mail applications allow coworkers to exchange tasks, but the applications do not help us perform, manage, or track those tasks. As the rate of exchange continues to rise, the sheer volume alone can contribute to making e-mail unmanageable, which could lead to challenges in accomplishing work and maintaining professional relationships and reputations.

Paper-based handling processes formed the foundation for electronic processes through the use of metaphors and workflow, without any certainty that those original paper-based processes created optimal work practices (Malone, 1983; Mander et al., 1992; Whittaker & Hirschberg, 2001). Previous scholarly research provides guidance through three broad research approaches, as summarized in Table 1: mathematical models to predict or model some aspect of e-mail usage, custom prototype applications to address difficulties previously identified, or observational studies that include asking the participants to use their e-mail differently. Many of these studies provide crucial recommendations to industry (e.g., aimed at application developers such as Microsoft or Google; Bellotti et al., 2003; Denning, 1982; Mackay, 1988; Siu et al., 2006; Whittaker & Sidner, 1996) or organizations (e.g., policy suggestions on e-mail usage, such as no e-mail after standard working hours; Hansen, Shneiderman, & Smith, 2010; Ramsay & Renaud, 2012); many of these recommendations have been incorporated into the most popular e-mail tools in use today. Whereas journal publishers reward these industry recommendations because the aim and scope of many journals outline this service, a focus on the actual knowledge worker is long overdue. Only a few papers include recommendations for the working professional, such as changing one's e-mail checking process (i.e., do not use notifications, go through e-mail in a one-pass process) to reduce e-mail overload (Hogan & Fisher, 2006), use of short "vacations" from e-mail may be beneficial to well-being (Mark et al., 2012), and checking e-mail less often can result in less stress (Kushlev & Dunn, 2015).

Table 1. Summary of Research Approaches

Research approach	Example studies
Mathematical models to predict or model some aspect of e-mail usage	Bälter, 2000; Dabbish & Kraut, 2006; Dabbish, Kraut, Fussell, & Kiesler, 2005; Gupta et al., 2011; Kanungo & Jain, 2008; Mano & Mesch, 2010; Pignata et al., 2015; Sumecki et al., 2011
Custom prototype applications to address difficulties previously identified	Bellotti et al., 2003; Bellotti et al., 2005; D. Fisher et al., 2006; Gwizdka, 2002; Gwizdka & Chignell, 2004; Hogan & Fisher, 2006; Mackay, 1988; Szóstek, 2011; Takkinen & Shahmehri, 2016; Venolia et al., 2001; Whittaker, 2005
Observational studies	Barley et al., 2011; Ducheneaut & Bellotti, 2001; Gwizdka, 2004; Hair et al., 2006; Hanrahan & Pérez-Quiñones, 2015; Hanrahan et al., 2016; Jackson et al., 2003; Jerejian et al., 2013; Mander et al., 1992; Mark et al., 2016; Narang et al., 2017; Phillips & Reddie, 2007; Ramsay & Renaud, 2012; Reinke & Chamorro-Premuzic, 2014; Renaud et al., 2006; Shirren & Phillips, 2011; Siu et al., 2006; Tyler & Tang, 2003; Whittaker & Sidner, 1996; Wilson, 2002
Observational studies with process change	Huang, Lin, & Lin, 2011; Kushlev & Dunn, 2015 (with restricted timing of e-mail checking); Mark et al., 2012 (via abstaining from e-mail usage altogether); Soucek & Moser, 2010 (via training)

Much of the literature uses benchmark tasks (Gwizdka & Chignell, 2004), allowing comparison of the data on a participant-to-participant basis to measure differences between one process and another. The most inventive of these comparison studies has participants perform the same tasks with their own data (Whittaker, 2005). For example, using this type of study measure each participant was asked to take the last e-mail he or she wrote and perform the same task with the content of the e-mail. In contrast, evaluation in the field and involving data of real-world application usage can be most powerful for improving actual users' processes; there is little in the literature on studies that used real participant conditions. Although these studies focus on the individual's usage of e-mail, the literature clearly points out that e-mail management is not a single-person sport; completing the tasks that arrive via e-mail often requires

information and/or input from others (Bellotti et al., 2003; Gwizdka, 2002; Markus, 1994; Tyler & Tang, 2003; Whittaker et al., 2006).

Studies often refer to the interdependence on others or the “interleaving” of task management (Bellotti et al., 2005), meaning that a response must be received to complete a task, and now the user must simultaneously keep track of these outstanding tasks while waiting for the reply. Furthermore, knowledge workers indicate there is pressure to respond quickly (Ramsay & Renaud, 2012); the need to be visible for quick responses (Teichmann et al., 2013) is part of the process to develop and preserve a positive “responsiveness image” (Tyler & Tang, 2003) and thereby maintain a favorable professional reputation. This urgency for immediate responses creates a new night shift of expected after-hours work (Butts, Becker, & Boswell, 2015) and negatively affects work/life balance (Turville, 2016). Only high levels of trust among coworkers has been shown to reduce this urgency (Paczkowski & Kuruzovich, 2016). Lastly, because the sender does not expect a response to 79% of the e-mail sent (Hössjer & Eklundh, 2008), but the typical knowledge worker perceives urgency for a quick response, is the majority of this stress and effort all for nothing?

In summary, e-mail has become the platform through which knowledge workers do their work, but the tools could be improved to help accomplish this work, and the quantity of e-mail arriving continues to rise because the cost to send it is low—remarkably close to \$0.00. Many studies have illustrated opportunities for enhancements, some of which have been adopted, but these studies rarely focus on the knowledge workers themselves. Instead, these studies focus on the application developers or

organizational policies. Only a few previous interventional studies have asked knowledge workers to modify their e-mail management strategies with their own work. Finally, the interdependence of knowledge workers on each other to complete tasks and the potential lack of alignment of needed response timing between receivers and senders is prominently displayed in the literature, pointing to the need to improve e-mail management within work teams as an opportunity. Hence, this research aimed to study the knowledge worker in situ, with a focus on providing recommendations for the knowledge workers themselves, as well as within natural working teams.

CHAPTER 3

DE-CLUTTER YOUR INBOX: TRANSFORM YOUR PERSPECTIVE TO SEE E-MAIL AS A TOOL

This chapter was published in the conference proceedings of the Human Factors and Ergonomics Society Annual Meeting 61 and it appears as published with the exception of the text, reference, table, and figure formatting. The citation for this article is: Counts, V. (2017). De-clutter your inbox: Transform your perspective to see email as a tool. *Proceedings of the Human Factors and Ergonomics Society Annual Meeting, 61*, 135–139. <https://doi.org/10.1177/1541931213601517>

What would you do with an additional 15 minutes every day? Could improved techniques for managing electronic communications wisely add hours to your workweek, allowing a more sustainable, enjoyable life and provide time for innovation? Perhaps you might use that extra time to meet one of the grand challenges head on? Qualitative data collection and analysis techniques utilized in this mixed methods study show that having a purposefully developed, individualized e-mail and task management strategy used consistently may have a positive outcome on attitudes concerning the use of e-mail, suggesting that how we work can change our perspective of e-mail. The qualitative techniques employed this study, including carefully crafted questions to elicit emotions and stories, revealed the gem in this study: there is a connection between commitment to a management strategy and participant perspective of e-mail. This study contributes by showing this link between the participants' view of e-mail aligned with management strategy, supports adding the “few filer” category of e-mail folder management aligned

with use of contemporary improved search capabilities, and shows no support for enactment of the elusive “one touch” model.

Introduction

Knowledge workers (Drucker, 1959), those who “think for a living” and use expertise in the primary pursuit of creation or application of knowledge (Davenport, 2005, p. 23), have doubled their e-mail usage and connection to the Internet since 2000; 87% of US working adults report using e-mail or the web daily (Purcell & Rainie, 2014). In 1996, the number of e-mails sent electronically surpassed the number of snail mail deliveries by the U.S. Postal Service annually (Stephens, 2007), and by the end of 2017, over 200 billion e-mails were projected to be exchanged daily (Radicati & Levenstein, 2013). These professionals report getting more e-mail than ever, express doubt that they can respond in a timely manner, and feel overwhelmed or stressed due to this volume of e-mail (Dabbish & Kraut, 2006; Jerejian et al., 2013; Kushlev & Dunn, 2015; Sumecki et al., 2011).

Nearly 35 years ago, Denning (1982) aptly described the receiver’s plight most professional experience today as they attempt to process the volume of e-mail that easily arrives to inboxes daily, at little or no cost to the sender. Many think working more hours can be the solution to deal with the increase of volume, but additional time working does not appear to reduce the stress associated with the e-mail (Barley et al., 2011). Interruptions of work due to e-mail negatively affect productivity (Renaud et al., 2006; Siu et al., 2006) and cause some to “get lost in e-mail” (Hanrahan & Pérez-Quñones, 2015, p. 3981).

Background

Contemporary e-mail applications serve the purpose of complete PIM tools, with the inclusion of additional features such as tasks, calendars, and contact management in the applications, well beyond the original intent for electronic memorandum delivery tool (Bellotti et al., 2003; Whittaker et al., 2006; Zhang, 2015). Academic research has recommended new tools and/or features to the software industry, many of which have been adopted, that can help users manage electronic communications better (Ducheneaut & Bellotti, 2001; Gwizdka & Chignell, 2004; Takkinen & Shahmehri, 1998; Venolia et al., 2001; Whittaker, 2005). However, as the volume of e-mails received continues to trend upward, these improvements merely allow knowledge workers to keep their heads just slightly above the water level of their e-mail inboxes.

As knowledge workers, we have more e-mail than ever, we feel the need to reply immediately, stress levels continue to rise, and the industry has already incorporated many of the improvements identified by research. What action can we take to improve our situations? Popular literature provides many suggestions with book titles such as, *Get it Done* (Bennett, 2014) and *Making Ideas Happen* (Belsky, 2010), some with cult-like followings, such as Allen's (2008) "getting things done" (GTD) five-step methodology. Some findings from scholarly work contradict some of the seemingly logical advice in the popular literature. For example, little evidence exists to show good usage of the idealistic one-touch model, a "touch items once" philosophy aligned with principles of scientific management (Taylor, 1914), often recommended by time management gurus (Bergman & Whittaker, 2016). Popular media also suggests extensive folder usage as a

panacea for e-mail overload; however, research shows that it often fails. Folder usage failure occurs for several reasons, such as difficulty creating meaningful folder categories that result in correct folder sizing to aid in future message retrieval, files too big, too small, or too hard to remember, and if the e-mail containing tasks are filed, the reminder of the task goes away (Whittaker, 2011). Additionally, usage of large numbers of folders correlates to increase feelings of overload (Dabbish & Kraut, 2006). The search features available today in most e-mail systems may make extensive folder usage no longer needed or reasonable (Narang et al., 2017).

Perhaps the answer might lie more in how often we do e-mail. Models suggest that checking e-mail less frequently, suppressing the urge for immediate reactions, reduces work interruptions and improve productivity (Gupta et al., 2011; Kanungo & Jain, 2008) and participant-based studies support this strategy, finding that a lower frequency of checking e-mail (limited versus all day) positively effected the well-being of users, resulting in higher productivity (Kushlev & Dunn, 2015). While modifications to how often we do e-mail show promise, many professionals with more tactical and operational roles (e.g., manufacturing managers, supply chain planners) who need to respond very quickly to e-mails might find the strategy of checking e-mail less often impractical or impossible. Studies reveal that many of us use our inboxes as task management tools, leaving e-mails in the inbox until the particular issue or task related to the content of the e-mail is resolved, allowing the e-mail in the inbox to serve as reminders of some action or follow-up needed (Dabbish & Kraut, 2006; Siu et al., 2006; Whittaker & Sidner, 1996). Users also consistently use their e-mail system for storage of

the e-mails themselves, either through development of folders and a filing process, or by leaving the e-mails in the inbox (Whittaker & Sidner, 1996).

While many studies have categorized e-mail management techniques, uses of e-mail, or categorization of tasks that arrive via e-mail (prioritizers and archivers: Mackay, 1988; flow, triage, task management, archive, and retrieve: Venolia et al., 2001; cleaners and keepers: Gwizdka, 2004; immediate processing, limiting, encoding, and accumulation: Gwizdka, 2004; rapid response, extended response, and interdependent: Bellotti et al., 2005; relaxed, driven, and stressed: Hair et al., 2006; glance, scan, and defer: Siu et al., 2006; adding “few folder filer” to Whittaker and Sidner’s (1996) approach: D. Fisher et al., 2006; delete, move, mark+: Narang et al., 2017), most rest on the foundational 1996 work of Whittaker and Sidner. Whittaker and Sidner found three distinct categories: no filers (those who do not file their e-mail—they leave it in the inbox), frequent filers (those who make strenuous attempts to limit the number of messages in their inbox with extensive use of folders), and spring cleaners (those who perform clean-ups of their inboxes every 1 to 3 months). These categorizations examine how users process (or not) the e-mail that arrives in their inboxes. All of these studies, except the last analysis from 2017, occurred more than a decade ago and all but the 2017 work utilized some type of qualitative data, usually as part of a mixed methods study, with the latter 2017 work being entirely quantitative and anonymous (i.e., analysis of one week of Microsoft’s log data of their web mail service). Lastly, many of these studies reveal strong emotional feelings to the state of participants’ inboxes, with descriptions

such as “disgust” (referring to the size of the inbox) and “seizures” (referring to the motivation to clean out the inbox; Whittaker & Sidner, 1996).

Current qualitative-based research can contribute by examining the actual specific strategies users have developed and they use in practice now to examine how users incorporate new features present in e-mail applications today (Ducheneaut & Watts, 2005). Thus, the following questions guided this project.

RQ1: What strategies do knowledge workers use to manage their e-mail? (the focus on this paper)

RQ2: What do knowledge workers express as the joys, challenges, failures, and successes of using and managing e-mail? What emotions mark this discussion? (discussed in another paper)

Method

One-on-one interviews, long used in computer-related investigations (Hammond, Jørgensen, MacLean, Barnard, & Long, 1983; Mander et al., 1992), formed the foundation of this study. Whittaker et al. (2005) suggested that these types of empirical studies allow the malleability of e-mail systems to be understood. The interviews for this study used semistructured questions (Tracy, 2012, p. 139) to gather “stories” about the participants’ e-mail management process as well as demographic and comparative data using Likert-like scales. The interview guide for this study included 25 questions; five general demographic questions, two grand tour questions (e.g., “Show me how you process your e-mail” and “How do you feel about using e-mail?”), and 18 other prompts to capture equivalent information from each participant.

Participants

Most historical guidance for qualitative study sample size merely states “until theoretical saturation,” a vague concept usually revealed through data analysis, too late to be informative. Fortunately, Guest, Bunce, and Johnson (2006) provided some direction in their study to determine when saturation does occur, finding meta-themes present after six interviews and saturation within 12 interviews. Thus, this study targeted 6–12 participants. With permission from business HR directors and the Arizona State University Institutional Review Board, 10 people volunteered to participate in this study. The participants volunteered through open calls for participation, and snowball sampling (Tracy, 2012, p. 136). Two of these snowball sample participants can also be considered to be extreme instance samples (Tracy, 2012, p. 136) or “super users” due to their known passion concerning their e-mail management strategies. All the colleagues who volunteered to participate in the interviews previously knew the primary author. The participants reside in the same division of a large multinational technology company with 85,000 employees and over \$20B in revenue (per the company website). All participants provided consent for audio recording, sharing of screenshots of their e-mail application, and agreed to follow-up questions. Data collection occurred during spring 2016.

These highly educated (70% with advanced degrees), predominately female (70%), experienced ($M = 19$ years, $SD = 9$) participants graciously shared their time for the study. Each interview, scheduled for an hour, included up to five unrecorded minutes of administrative explanation and rapport building. Predictably, every participant would add something more once they could clearly see that the voice recorder switched off at

the end of the interview, and these nuggets of information found their way into handwritten notes.

This homogeneous, convenience sample (Tracy, 2012, p. 134) of colleagues followed many other studies of workplaces of a primary author (Barley et al., 2011; Bellotti et al., 2003; Mackay, 1988; Mander et al., 1992; Venolia et al., 2001). While many human computer interaction (HCI) studies include a majority of male subjects, likely due to the overrepresentation of men in technology workspaces, the level of female participants in this study likely reflects the personal relationships with the primary author and her long-term support of efforts to encourage more women in STEM fields.

Procedure

Transcripts of the interviews varied in length, resulting in approximately 100 pages of single-spaced text, then imported into NVivo for Mac, a qualitative data analysis software tool, to aid in the analysis of these data using qualitative coding techniques. During coding of the interview transcripts, an Excel worksheet was populated and proved helpful to see comparisons between the participants' answers to the interview questions. As a self-reflective check, the primary author included her own style of e-mail management; however, the body of the paper does not include any of the primary author's data.

Results

RQ1, Strategies currently in use: Over three dozen aspects of how the participants process their e-mail provided an overview of each individual's strategy for managing e-mail, such as did they delete e-mails from the inbox, did they try to get their inbox to no

e-mails at all, when did they read e-mail (i.e., all through the day or at specific times), did they use e-mail notifications. These strategies are included in Table 2.

Table 2. Key E-Mail Management Indicators

Partici- pant #	Folder usage	Inbox deletion action	# Unread e-mails	Whittaker & Sidner classification
1	Low	No (stay in inbox)	40	No filer
2	Low	No (stay in inbox)	178	No filer
3	Low	No (stay in inbox)	10,431	No filer
4	Low	Move to archive	9	Frequent filer
5	High	Move to archive	8	Frequent filer
6	Medium	Mixed	1	No filer/spring cleaner
7	High	Move to archive	1	Frequent filer
8	High	Move to archive	2	Frequent filer
9	Medium	Mixed	10,137	No filer
10	High	Mixed	688	Frequent filer

The participants' folder usage technique rating (i.e., low, medium, or high) is aligned with a rubric reflecting approximate terciles of the data distribution: low < 6 folders, medium 6–20, high > 20. Popular media suggests users create extensive folder structure to aid in organization of e-mails (Standss, 2017) and at least one academic study joins this suggestion (Ducheneaut & Bellotti, 2001); however, research shows that extensive folder usage often fails, either by folders including a small number of e-mails stored in them or by taking too much time searching when retrieving an item (Mander et al., 1992; Venolia et al., 2001; Whittaker & Sidner, 1996), and this practice correlates to increase feelings of overload (Dabbish & Kraut, 2006). Dabbish and Kraut (2006) suggested that keeping a small inbox could result in lower feelings of overload; thus, Table 2 includes the state of the participants' inbox, whether they delete or move e-mails

out of the inbox or leave e-mails in the inbox, as well as the number of unread e-mails present in the participants' inbox at the time of the interview. Each participant's e-mail management style reflected in his or her own phrasing provides insight into his or her own perception of how each one works (not included here due to space limitations); four themes in these phrases proved interesting: never deleting e-mail, task management, descriptive works of "clutter" and "junk," and scanning some of the e-mail (potentially denoting the rate of speed the participants use when going through their e-mail).

Finally, during this analysis, the data provided insight as to which of Whittaker and Sidner's (1996) classic three categories (i.e., no filers, frequent filers, or spring cleaners) most closely resembled the participants' e-mail management strategy based on the interview and the review of screenshots of their inboxes, shown in Table 2. It is interesting to note that most of the participants keep almost all the e-mails they receive, either by routinely keeping e-mails in their inbox or archiving all their e-mail in some file structure. This worksite does have an e-mail retention policy that has varied over time, between 6 months and 2 years, and most participants do not know what the time limit of the current policy is, only to mention that whatever the value, it is too short.

As data analysis continued, two items added to the view of how these participants manage e-mail: (a) their commitment to their own self-created strategy, and (b) each participant's feelings and emotional answers about the place of e-mail in their work life: as a burden or a tool. Some of the participants reported perceiving e-mail to be an important, useful business tool; e-mail helps them do their job and get more done, while others who see e-mail as a burden reported many negative aspects of e-mail usage, do not

feel in control of their e-mail usage, and are overwhelmed with the quantity of e-mail needing their attention. Full development of the later aspect can be found in the paper on Research Question 2, though included here in this table due to the telling nature of the data. Table 3 shows these additional aspects, sorted in the order of the continuum of feelings, from seeing e-mail as a burden to seeing e-mail as a tool.

Interestingly, similar to many other studies, all participants left some e-mails in their inboxes, usually as a reminder to follow up on a task (Ducheneaut & Bellotti, 2001; Siu et al., 2006; Whittaker, 2005). All the participants have a smart phone, but only 30% have work e-mail accessible on the phone. Half of the participants have an iPad (or similar tablet device), but only 10% have work e-mail installed on the device. All participants have personal e-mail accounts and rarely use their work accounts for personal business; limited activity related to timely notifications about school-aged children (e.g., communication with the school). All participants expressed a time frame, from 1 to 15 minutes, in which they would take care of a question or task that came to them in e-mail immediately. All but two of the participants process e-mail last in first out (LIFO). Several explained why, usually using the word *burned*, and one participant was quite detailed in the reasoning:

One thing I have learned is that I've gotten burned in the past. If you start with the oldest ones, it may have already been resolved by the time you get to the top of your list. So, I always start at the top because usually half of them have already been resolved and don't need any action on my part.

Table 3. E-Mail Management Indicators, Sorted by View of E-Mail (From Burden to Tool)

View	Participant #	Folder usage	Inbox deletion	Unread e-mail	Level of commitment
E-mail as a burden	3	Low	No	10,431	Low
	9	Med.	Mixed	10,137	Low
	2	Low	No	178	Med
	6	Med.	Mixed	1	Low
	7	High	Move to archive	1	Med
	10	High	Mixed	688	High
	1	Low	No	40	High
	8	High	Move to archive	2	High
E-mail as a tool	5	High	Move to archive	8	High
	4	Low	Move to archive	9	High

Discussion

The study participants all have different processes for managing their e-mail and the ensuing tasks that arrive electronically; however, analysis of Research Question 1 suggests creating a system for processing or dispositioning e-mail out of the inbox can allow users to perceive e-mail as a tool rather than a burden.

Analysis of Table 3 shows that the participants in this study who exhibit a strong commitment to their own self-development e-mail management strategy (Participants 4, 5, 8, 1, and 10), those who see e-mail as a tool, and express less stress about managing e-mail have much in common. All of these participants use some method to disposition e-mail that arrives in their inbox, with most moving the e-mail out of the inbox and one marking the e-mail as read. Leaving only those unhandled tasks in the inbox, either physically or via read status, creates a clear visual indicator of the work remaining.

Perhaps this management technique helps these participants feel less stress about what work they need to accomplish, as they can clearly see what remains.

While the one-touch model (Bergman & Whittaker, 2016; Gwizdka, 2002), meaning touch an e-mail only once (either answer it or put it on a task list), is touted in the literature, both popular and scholarly, and seems logical, this study questioned if it can actually be implemented with its rigid structural requirements. None of these participants executed such a model, even though two of them said this was their strategy, though the captured screenshots revealed some read e-mails in the inbox.

One participant classified as a frequent filer, one of Whittaker and Sidner's (1996) classifications, uses very few folders, filing everything into either a reference archive or action folder, then using the search feature to find needed e-mails. This strategy supports the few filer category (D. Fisher et al., 2006), now feasible with the significantly improved search accuracy in contemporary e-mail applications (Narang et al., 2017). Usage of such a strategy might also be helpful for others.

Limitations and Future Work

This sample was quite homogeneous, with all participants working for the same organization with long employment, almost all educated as engineers; thus, their work cultural is similar. Due to the limited number of participants, these findings may not be generalizable outside of this working group. However, the literature supports studies with small sizes (< 10: Renaud et al., 2006; Siu et al., 2006; = 10: Venolia et al., 2001; < 20: Bellotti et al., 2003; Mackay, 1988; Mander et al., 1992; Siu et al., 2006; Whittaker & Sidner, 1996). The study included only the use of Microsoft Outlook because it is the

only option for these users, and did not include use of texting or other newer electronic communication methods, such as instant messaging.

Future studies could examine if some method of processing e-mail would be beneficial in reducing feelings of stress and overload, how different other types of jobs (i.e., transactional to strategic orientation) impact e-mail use, inclusion of other electronic communication means (e.g., instant messaging, collaboration tools), and why the participants commit to their strategies and, if not, what keeps them from doing so, as well as how to help users create strategies that work best for their personalities, working styles, and type of role.

Conclusion

This paper provides a pilot study that can serve as the foundation for future work to investigate the methods and strategies of e-mail and task management that will serve people who think for a living. This mixed methods study identified an alignment between a strong participant commitment to self-created e-mail management strategies and positive emotional responses, suggesting that how we work can change our perspective of e-mail. Research on e-mail management often focuses on quantitative data collection and techniques; however, in this study, the qualitative techniques revealed the gem in this connection between commitment and emotional state. Furthermore, this study shows no support for enactment of the elusive one-touch model and supports adding the few filer category of e-mail folder management aligned with use of contemporary improved search capabilities.

Acknowledgements

This paper was shaped by research performed for a class taught by Dr. Sarah Tracy. I am thankful that Dr. Tracy and the class graciously welcomed a life-long quantitative engineer into the realm of rigorous qualitative work, allowing a classmate to be “qual” curious, and my work has improved immensely because of this new knowledge. Thanks to Dr. Braden Allenby, Dr. Nancy Cooke, Dr. Amy Landis, and Dr. Kristen Parrish for their support in my research. Finally, thanks to Doris Berry for assisting with editing.

CHAPTER 4

WHEN READING E-MAIL IN THE RESTROOM IS NOT ENOUGH: A QUALITATIVE STUDY OF E-MAIL MANAGEMENT AT WORK

This chapter has been submitted to a peer-reviewed journal, *Behaviour and Technology*, and it appears as submitted with the exception of the text, reference, table, and figure formatting.

This study examines 10 participants' stories of efforts to manage an unrelenting barrage of e-mail. Participants confessed they keep up with e-mail by multitasking—reading e-mail while using the restroom. This mixed methods study demonstrates that a purposefully developed and consistently employed e-mail and task management strategy may have a positive outcome on attitudes about the use of e-mail. Users of a clearly articulated strategy see e-mail as a tool rather than a burden, report less stress, and are less likely to be overwhelmed by a full inbox. This study included predominately female participants, a rarity in human computer interaction literature. Consistent use of e-mail management strategies at the desk can obviate the need to catch up on e-mail in the restroom.

Introduction

Tomlinson, author of the first e-mail message in 1971 (Steckman & Andrews, 2017), probably did not imagine the recipients' plight (Denning, 1982) just a decade later, when e-mails began filling up inboxes at minimal, if any, cost to senders. Twenty-five years later, professionals received an average of 49 e-mails daily (Whittaker & Sidner, 1996), with the number rising to 87 e-mails a day by 2006 (D. Fisher et al., 2006)—the

same year Denning (2006) suggested that some workers might be spending an hour every day merely deleting unwanted e-mails. Although data from 2015 revealed the steep trajectory of e-mail volume had slowed to a 4% annual increase, the average office worker still receives an astonishing 121 e-mails per day (KnowBe4, 2017). Drucker (1959) likely could not have foreseen this year-over-year increase in communications volume or that it would eventually overwhelm our professional and personal lives when he coined the phrase, “knowledge worker”. As we approach a half century since Tomlinson’s first e-mail, knowledge workers—recipients of this deluge of e-mail—express feelings of stress related to their ability to manage their daily e-mail (Dabbish & Kraut, 2006; Jerejian et al., 2013; Kushlev & Dunn, 2015; Sumecki et al., 2011).

Ascribing Drucker’s understanding of staff skills and responsibilities to the contemporary office context according to the volume of e-mail received, *knowledge workers* use their expertise in the primary pursuit of creation or application of knowledge (Davenport, 2005) and now must attend to e-mail in addition to their primary work. Knowledge workers, then, are similar to *professionals* (Professional, n.d.); they engage in specific activities that require some level of education. Other terms for knowledge workers are “office worker” and “white collar worker[s]” (Sinclair, 1919, p. 12)—people who wear white-collared shirts and work in an office, some of whom might serve in the role of “boss.” These terms are used interchangeably in this paper because all of these individuals work in an office setting, use a computer to perform the majority of their job, and likely receive a significant volume of e-mail. There are more than 66 million such workers in the United States (U.S. Census Bureau, 2015) and more than 330 million

worldwide (Dobbs et al., 2012). These numbers are increasing as organizations encourage their workers to achieve higher levels of education to fill skill gaps. Given these increasing numbers of workers receiving increasing volumes of e-mail, a method to reduce stress or improve productivity among this population of workers could be helpful.

Although novel communication methods (e.g., social networking, text messaging) have become the standard in the social realm, e-mail is ubiquitous in the work environment. Even members of Gen Z, advocates of informal text messaging, embrace the use of e-mail for its competitive advantage; these newcomers to the workforce report perceiving themselves as “adult” because they use e-mail regularly (Mims, 2016). E-mail is the most popular and common method for communicating with fellow employees (Dietzen, 2017), and e-mail applications provide the foundational workspace for knowledge workers, incorporating many, if not all, of the tools professionals use daily (Whittaker et al., 2005). E-mail applications serve as PIM tools, offering the added features of tasks, calendars, and contact management that extend beyond electronic memorandum delivery (Bellotti et al., 2003; Whittaker et al., 2006; Zhang, 2015).

When the business world transitioned from reliance on paper-based systems to those involving electrons, clever developers recycled key terms and functional concepts from common language, such as *inbox*, *folders*, and *trash* (Malone, 1983; Mander et al., 1992; Whittaker & Hirschberg, 2001), but failed to ensure those paper handling processes actually worked well and achieved the best productivity in the electronic environment. Professionals’ frustration with their perceived and actual productivity regarding inbox management is reflected in descriptions such as “disgust” (referring to the size of the

inbox) and “seizures” (referring to the motivation to clean out the inbox; Whittaker & Sidner, 1996). These workers report being overwhelmed by e-mail, resulting in reduced productivity and work engagement, coupled with increased burnout (Reinke & Chamorro-Premuzic, 2014). Many workers report feeling pressured to check e-mail frequently (Renaud et al., 2006) and reply immediately (Hanrahan & Pérez-Quñones, 2015; Ramsay & Renaud, 2012). Some workers feel compelled to respond to a new e-mail as quickly as they would answer the phone (Jackson et al., 2003). A worker’s quick reply can serve as an attempt to preserve his or her professional image or “responsiveness image” (Tyler & Tang, 2003). These emotional reactions and descriptions support Renaud et al. (2006), who suggest describing e-mail as “e-synchronous” rather than “asynchronous,” given the near-obsessive attention paid to e-mail inboxes.

Stress associated with use of e-mail is well documented, underscoring professionals’ need for a solution to e-mail management that provides an acceptable, satisfying work-life balance and accommodates the increasing annual volume of messages. Eschewing theoretical framework, research in the field of human computer interaction focuses on two approaches to the problem: suggestions for new features or tools, and empirical studies of e-mail usage (Whittaker et al., 2005). Previous research offered software developers practical implications on early improvements to e-mail tools that contemporary users take for granted, such as the following:

- capability to search and sort by message threads (Venolia et al., 2001; Whittaker & Sidner, 1996);
- a few ready-made standard folders (Takkinen & Shahmehri, 1998);

- customizable reading views (Ducheneaut & Bellotti, 2001; Gwizdka & Chignell, 2004; Szóstek, 2011); and
- integrated to-do lists, contact information with pictures, and embedded availability status (Whittaker, 2005).

Empirical research involving users' historical e-mail categorization and management techniques reflect Whittaker and Sidner's (1996) three distinct categories: *no filers* (those who leave their e-mail—unsorted—in their inbox), *frequent filers* (those who vigorously strive to limit the number of messages in their inbox by using copious folders), and *spring cleaners* (those who perform inbox clean-ups every 1 to 3 months). Qualitative empirical research identified various types of strategies regarding e-mail (Bellotti et al., 2005; D. Fisher et al., 2006; Gwizdka, 2002, 2004; Hair, Renaud, & Ramsey, 2007; Siu et al., 2006; Venolia et al., 2001). More recent researchers (Narang et al., 2017) rely exclusively on quantitative and anonymous data (i.e., analysis of web mail service log data), which lacks the richness of participant accounts.

The most recent qualitative studies are more than 10 years old, and e-mail applications have evolved dramatically since then. Current research can add to the knowledge base by examining the specific strategies users have developed and employed and how users incorporated new features in contemporary e-mail applications (Ducheneaut & Watts, 2005). An up-to-date empirical study can provide designers with direction for future improvements to e-mail software, as well as professionals with methods to manage their e-mail in a way that provides work/life balance and minimizes e-mail induced stress. Szóstek's (2011) plea to focus on humans in this computer-human

interaction motivates continued attention on the human emotional aspects of using e-mail. This study aims to understand e-mail management strategies professionals currently practice and the impact of these e-mail strategies on professionals' perceptions of e-mail. The following question guides this project:

RQ: What e-mail management practices are currently in use and what do knowledge workers express as the joys, challenges, failures, and successes of using and managing e-mail? What emotions inform this discussion?

Background

What action can contemporary knowledge workers take to improve their work/life/e-mail balance? They have more e-mail than ever before, feel compelled to reply immediately, are increasingly stressed, and e-mail programs have already incorporated many of the improvements identified by prior research. Perhaps Mark et al.'s (2012) paradoxical study warrants a second look. Participants in this study gave up e-mail for one workweek and experienced less stress (measured via heart rate variability), switched tasks less frequently, reported improved focus on specific tasks, and experienced a slower pace of work life without e-mail. Others have threatened to engage in "e-mail bankruptcy" (Turkle, as cited in Musgrove, 2007), reflected in Lessig's solution of deleting all e-mail to start over. Despite the immediate success of these strategies, they are rarely used. One reason knowledge workers continue to tolerate the burden of e-mail is that, having spent time and effort training for their chosen careers, they wisely choose to avoid any action that might threaten their reputation, which could be the unintended result of giving up e-mail altogether or committing e-mail bankruptcy.

A quick review of popular literature reveals plenty of books, blogs, and articles that offer options on how to work “better” or “smarter.” Some of these works have cult-like followings, such as Allen’s (2008) “getting things done” five-step method, *Lifehacker* (Pash & Trapani, 2011), and Ferriss’s (2011) 4-hour workweek. Despite the popularity of these works, scholars’ findings contradict some of the “seemingly logical” advice in popular literature. For example, there is little evidence to support the “one touch only” model, the philosophy of which aligns with principles of scientific management (Taylor, 1914) and was popularized by Mann’s (2007) “inbox zero” method. These approaches fail to take hold because few people have the acumen to execute these perfectionistic models (Bergman & Whittaker, 2016). Studies consistently show that workers use inboxes as a task management tool—a virtual “to do” list. Workers leave e-mails in the inbox until the issue or task associated with that message is completed, effectively using e-mail in the inbox as a reminder to follow up on an action (Dabbish & Kraut, 2006; Siu et al., 2006; Whittaker & Sidner, 1996). Popular media suggests the extensive use of folders as a panacea for e-mail overload: extensive folder use often fails (Whittaker, 2011) and can actually increase workers’ feelings of overload (Dabbish & Kraut, 2006).

Spending more time on e-mail may help to reduce the volume in one’s inbox, but this behavior does not appear to reduce the stress associated with the e-mail (Barley et al., 2011). Those who tend to procrastinate may use the excuse of working on e-mail to defer launching what they perceive as boring or challenging tasks (Phillips & Reddie, 2007). If more time expended on slogging through the sea of e-mail does not provide relief,

perhaps less e-mail volume would prove helpful. Although some studies assert e-mail volume leads to greater stress (Shirren & Phillips, 2011), other studies claim those who report the highest feelings of overload might not have the highest volume of e-mail (Pignata et al., 2015). Reinke and Chamorro-Premuzic (2014) found no correlation between e-mail overload and e-mail antecedents (e.g., e-mail volume). Training people to manage e-mail can reduce employees' feelings of being overwhelmed (Soucek & Moser, 2010) even if the volume of e-mail does not change, all suggesting that reducing volume alone will not solve the problem for professionals drowning in e-mail.

Perhaps the answer might lie more in how often people do e-mail. Models suggest that checking e-mail less frequently and suppressing the urge for immediate reaction reduces work interruptions, thereby improving productivity (Gupta et al., 2011; Kanungo & Jain, 2008). Participant-based studies support this strategy, finding that checking e-mail less frequently (as opposed to every few minutes) positively affects users' well-being and users with less stress have higher productivity (Kushlev & Dunn, 2015). These findings are supported by studies in which participants wore heart rate monitors to directly measure the physiological impact of e-mail stress; those who spend more time on e-mail and check e-mail more frequently have lower productivity and higher stress (Mark et al., 2016). Checking e-mails less frequently calls for high levels of trust between managers and employees, as well as lowered expectations of speedy responses, both of which result in better employee job satisfaction and organizational commitment (Paczkowski & Kuruzovich, 2016). Although modifications to how frequently people do e-mail are promising for some, many professionals who perform tactical work need to

respond quickly to e-mails. These workers might find the strategy of checking e-mail less often impractical or impossible.

Despite many challenges and threats to the communication method (e.g., hacking, spam), e-mail remains the “main digital artery” for knowledge workers (Purcell & Rainie, 2014); as such, developing tactics and strategies to manage e-mail can be beneficial to those who spend their working hours using e-mail applications. This literature review reveals our inability to forego or delete e-mail. Adding more hours to our days does not lessen the load. Even if we could decrease the rate at which e-mail arrives in our inboxes, we might not realize less stress, and checking our boxes less often is not always an option. This study examines e-mail management strategies currently in use and the impact of these e-mail strategies on the emotions of those using e-mail.

Materials and Method

One-on-one interviews are common in studies involving human-computer interaction (Hammond et al., 1983; Mander et al., 1992). This method of data collection can improve outcomes when the researcher seeks the phenomenological aspects of systems or products that result in “sticky” products (e.g., Apple iPhone; Hartson & Pyla, 2012). Interviews provide “insight into cultural activities that might otherwise be missed in structured surveys or experiments” (Tracy, 2012, p. 5) and formed the foundation of this study. Empirically based studies can provide a better window into the evolving nature of e-mail systems (Whittaker et al., 2005). In this study, a semistructured interview protocol allowed for questions that enabled participants to share their stories of e-mail management tactics and strategies (Robson, 2011, p. 280). To supplement these

narratives, demographic and comparative data using Likert-type scales were also collected. Use of the “think aloud” technique (Hartson & Pyla, 2012) encouraged participants to provide rich, thick data that painted a detailed picture of the strategies in use.

As a focused participant observer, the interview process made use of the narrative interview technique with a deliberate naïveté interview stance to ensure unbiased collection of participants’ ideas, stories, and processes. The narrative interview technique was alternated with the responsive interview stance, allowing the researcher to demonstrate empathy with the participants (Tracy, 2012, p. 130). The interview guide for this study included 25 questions: five general demographic questions, two grand tour questions (e.g., “Show me how you process your e-mail” and “Tell me how you manage tasks that arrive via e-mail”), and 18 other prompts to capture equivalent information from each participant.

Participants

Guidance on qualitative study sample size is vague; the recommendation to conduct interviews “until theoretical saturation” is not particularly helpful when planning a study. Guest et al. (2006) provided assistance to determine when saturation does occur, finding the presence of meta-themes after six interviews and saturation within 12 interviews. With this general framework, this study targeted inclusion of 6–12 participants. After obtaining permission from the Arizona State University Institutional Review Board (IRB number STUDY00003844) and relevant business leaders at the authors’ employer, participants were recruited for the study. Ten people volunteered in

response to open calls, supplemented by snowball sampling (Robson, 2011). Participants included employees, alumni of an internal leadership/management development program, and elected members of an internal technical organization (i.e., highly thought of and respected technical professionals).

No measures of guarantees exist that this sample of participants have or use good e-mail management strategies, but membership in these groups reflects reputations as high-performing employees, and good time and workload management are hallmarks of high-performing employees. Two of these snowball sample participants can also be considered extreme case samples (Robson, 2011, p. 276) or “super users” due to their known passion for e-mail management strategies. All of the study participants knew the author prior to study commencement and worked in the same division of a global technology company with more than 75,000 employees and annual revenue in excess of \$20B (per the company website). Informed consent obtained from each participant included permission to audio-record interviews and capture screenshots. Each participant was assigned a pseudonym to ensure data remained confidential and could not be traced to individual participants.

As shown in Figure 1, participants were highly educated (70% with advanced degrees) and experienced ($M = 19$ years, $SD = 9$). Interviews were scheduled for one hour, although a few of the managers had previous commitments that necessitated shorter interviews. Each interview session included a few preliminary minutes of unrecorded time for explanation and rapport building.

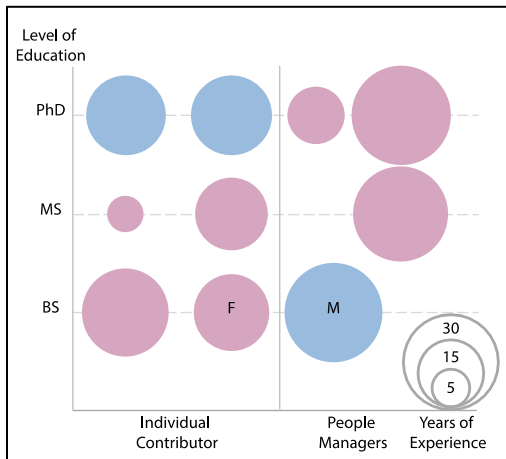


Figure 1. Demographic data show an educated, experienced, and largely female participant group.

Without exception, every participant added something more to their responses once the audio recording was stopped at the conclusion of the interview. These tidbits, captured via handwritten notes, were included in the field notes as reflections on the interview. During these unrecorded moments, several participants confessed that they regularly took their phones into the restroom, often upon waking, to catch up on e-mail, thus inspiring the title of this paper.

This homogeneous convenience sample (Robson, 2011) of colleagues follows many other studies of workplaces by a primary author (Barley et al., 2011; Bellotti et al., 2003; Hogan & Fisher, 2006; Hössjer & Eklundh, 2008; Mackay, 1988; Mander et al., 1992; Tyler & Tang, 2003; Venolia et al., 2001). Although many studies of human-computer interaction include a majority of male subjects, likely due to the overrepresentation of men in technology workspaces, the composition of this study involving predominantly female (70%) participants reflect the author's long-term efforts

to encourage more women to join Science, Technology, Engineering, and Math (STEM) fields.

Procedure

Audio recordings were transcribed as soon as practical after the interviews were completed. Transcribed interviews yielded approximately 100 pages of single-spaced text. The text was imported into NVivo for Mac, a qualitative data analysis software tool, for evaluation. The primary cycle of coding (Tracy, 2012) aligned the responses to the questions in the interview guide (e.g., “What are things that colleagues do with e-mail that drive you nuts?”). During this process, themes associated with emotions and processes provided coding focus, using methods such as repetitions, metaphors and analogies, and similarities (Robson, 2011; Ryan & Bernard, 2003). Code names during this phase reflected a direct relation to the topic (e.g., processing order, reflecting the order in which a participant processed his or her e-mail—typically first in, first out or last in, first out).

Following Saldaña’s (2015, p. 23) suggested technique of “contrasting data,” the two participants with the opposite rigor in their strategies served as the models from which codes were developed. For example, one of these participants described a strategy as a “religion,” and the other participant described a strategy indicative of “laissez-faire,” with inconsistent practices varying greatly over time. More than 40 codes emerged during this first cycle of coding. During coding of the interview transcripts, a spreadsheet was used to organize high-level answers to most of the interview questions and to compare participants’ answers to the interview questions. The final spreadsheet contained 54

columns of data for each of the participants. As a self-reflective check, the author included her own style of e-mail management in the spreadsheet, but her data were not evaluated as part of the study.

Results

E-Mail Management Strategies in Use

More than 36 aspects of how participants process their e-mail provided an overview of each individual's strategy for managing e-mail. Examples of aspects include whether the participant deletes e-mails from the inbox, tries to empty all e-mails from the inbox, when he or she reads e-mail (i.e., all through the day or at specific times), and whether he or she uses e-mail notifications. A sample of key e-mail management strategy characteristics developed by Counts (2017) is shown in Table 4.

Table 4. Select E-Mail Management Strategy Characteristics

Partici- pant #	Folder usage	Inbox deletion	Unread e- mail	Self-described strategy	Whittaker & Sidner classification
1	Low	No	40	Never delete, OneNote notebook, laptop	No filer
2	Low	No	168	Never delete, get them read	No filer
3	Low	No	10,431	Sort by subject, keep in inbox, task tool	No filer
4	Low	Move to archive	9	De-clutter; Either: task in inbox	Frequent filer
5	High	Move to archive	8	Get inbox = 0, task manager	Frequent filer
6	Med.	Mixed (some)	1	Memory, get rid of junk	Mix of all 3
7	High	Move to archive	1	Scary/urgent, knock it out, no junk	Frequent filer
8	High	Move to archive	2	Scan, file, review	Frequent filer
9	Med.	Mixed (some)	10,137	Skim, highlight, and leave the rest	No filer
10	High	Mixed (some)	588	Skim, tackle, schedule	Frequent filer

Emotions Regarding E-Mail Usage

Emotional reactions to e-mail and usage strategies revealed themselves in many ways. An early example of emotional reactions emerged in the description of the time frame in which participants reported they would quickly execute a task request that came to them via e-mail. One of the participants explained this “just do it” approach as, “If it's a quick response . . . I usually just try to bang that out.” This seemingly minor phrase, “just try to bang it out,” conveyed violent emotional tones. These connections continue as many of the participants used similar words to describe their e-mail screen as if it were a physical space, harking back to early comparisons of paper-based to electronic communication (Malone, 1983; Mander et al., 1992; Whittaker & Hirschberg, 2001). The metaphors relate to physical space, organization, and cleanliness, such as clutter, clean, junk, get rid of it, get it out of sight. Consider this sample of repetitive examples from four different participants: “Too much clutter is hard . . .”; “to keep clutter from my inbox . . .”; “Again, I don't like a lot of [laughter] clutter . . .”; “it just drives me insane, because it's just it's too much.” One participant expresses two sentiments in the same statement—doing something quick and clearing things out: “If I've got a bunch of 'em, I try to hit those first, just to clear 'em out and get 'em done.”

In an early construction of the interview guide, there was a simple question posed to solicit emotions around e-mail usage in a very straightforward way: “How do you feel about e-mail?” Given the desire to capture rich, emotional responses as a key component of this study, combined with knowledge of the participants’ proclivity towards left-brain thinking (most of the participants received their education in the field of engineering),

considerable effort went into designing this question in a way that afforded the opportunity to elicit high-quality responses of emotions in a lush, descriptive way. Therefore, beta testing via a Facebook post on the authors’ feed provided the opportunity to prototype the question prior to the formal study. Most of these Facebook friends would fit in the sample group of participants in terms of education and type of work activity.

The following questions appeared on this Facebook feed for several days: “What one word describes how you feel about e-mail? What color or animal would you call e-mail?” The word cloud (see Figure 2) represents the variety of responses that ranged along a continuum of “emotional tones,” some clearly negative, and some very positive. This prototype testing identified the need to provide additional direction to the participants to get one-word answers in the interviews and more precise prompts to elicit creative, emotion-filled answers.

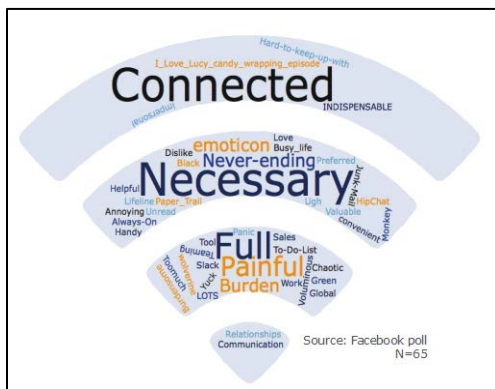


Figure 2. Word cloud of responses from Facebook friends’ feelings about e-mail (Counts, 2016).

The final set of questions, asked after much rapport building and with sufficient time remaining in the scheduled interview session to ensure participants did not feel rushed to provide answers, was intended to help participants describe their emotions

around e-mail usage and provide useful details: “If your e-mail was a movie character, what would it be? Or, what would its nickname be? Or, if your e-mail was an imaginary character, what would it be? Or, what color or animal name best describes your e-mail?” Most of the participants struggled through this process and took a few sentences to get to one word. One participant’s comment about this struggle verbalizes the others’ reactions well: “Asking an engineer a question like that is a pretty rough question; that’s a pretty abstract thing.” One participant asked permission to think about his answer and later sent a picture, which inspired using pictures² to represent all the other participants’ answers. The word itself inspired search term(s) to find an illustrative image.

For example, one of the participants gave the answer of “crazy cat.” Upon further probing, a deeper, emotionally charged meaning was revealed: “I feel kind of like it’s a persistent, crazy cat . . . always there and you need to watch it. . . . It can break loose at any moment, very quickly, day or night, and I have to respond.” Another participant shared the fear of what e-mail can really do by referring to e-mail as “Hannibal”: “He sneaks up on me . . . then the worst happens. . . . He spits out stuff all the time.” Yet another participant gave the answer of a “purse”: “E-mail would be kind of like my purse, right? . . . I guess that’s the best way I could put it—it’s holding all the information I need. I don’t need to memorize anything.”

² As this analysis progressed, concern developed that when the participants saw the outcome of this research, including specific details relevant to how they managed e-mail, aligned with the picture of their individualized answer to this question, some participants might experience negative reactions. Thus, the original words and images have been substituted with similar emotional content to further protect confidentiality of the participant data. The quoted phrases from participants have been kept as close as possible to the original transcript. The author’s colleagues provided the words used to create the images shown in the paper after discussing these findings.

Although the images themselves might not hold a negative or positive emotional connotation, the picture combined with the interview and the overall tone of the discussion reveal a pattern of emotional content that varied for each participant. A metaphor analysis (Tracy, Lutgen-Sandvik, & Alberts, 2006) of the conversation that led to the single-word answer and analysis of the codes for the entire interview that revealed emotional themes supported a ranking of sorts to differentiate the range of participants' emotions. The extent of differences in tone and emotional content of participants' interviews suggested that viewing all the images along a continuum based upon the emotional content of the analysis could suggest some insights.

The descriptions of “Hannibal” and “purse,” along with the emotional content and tone of the respective interviews, anchored the spectrum. The participant who described e-mail as “Hannibal” expressed the least positive declarations about using e-mail and articulated many concerns, including some about how others might perceive negative job performance: “I should do that more often, but I don't” (referring to ensuring everything in the inbox actually gets read); “I've turned off all the alerts to e-mails, otherwise they would be going off all the time”; and “they can send me all the information they want in e-mail—it's the actions that come from e-mail that get me overloaded.”

In contrast, the participant who referred to e-mail as a “purse” perceives e-mail as a favorable tool that allows work to be done more efficiently, even providing “counciling” [*sic*] for coworkers on how to best use e-mail. This participant created an individualized system by combining advice from three of the most well-respected gurus on time/work management and said, “I don't like fixed systems. I like to improve 'em and

make 'em better.” The participant mentioned different gurus’ systems and techniques 17 times during the interview. To reinforce this sentiment, this participant provided links to videos from these experts for the interviewer to watch as homework after the discussion. With these two participants serving as the anchors for the continuum, pair-wise comparisons between the overall tone of the interviews and quantity of emotional descriptors created the order of the pictures offered by the other participants along the continuum used for data analysis.

Results on a Continuum

During analysis, the continuum provided a foundation upon which to iteratively align specific e-mail management strategy characteristics—some from Table 4—of the participants above the image of their choice. This process was performed iteratively during analysis, one characteristic at a time. For the sake of brevity in this presentation, Figure 3 shows all the items in one view, with the characteristics defined as follows (listed in the order shown in the figure, from the bottom up):

- E-mail read frequency: Most participants stated that they kept their e-mail screen up all day long and checked e-mail frequently. One participant reported checking e-mail only at the beginning and end of the day. Two indicated they try to limit the amount of time they spend checking e-mail, but do not adhere consistently to that routine (“Number” indicates the number of times checking e-mail per day and “All” indicates the e-mail application remains open all day long for continued e-mail checking).
- Inbox for task management: Consistent with findings in the literature

(Whittaker & Sidner, 1996), most of the participants leave e-mails in their inboxes as reminders of actions they need to take (Yes = “Y” or No = “N” to indicate if they used the inbox as a task reminder).

- Folder usage: A rating of low, medium, or high based on the number of folders used (“L”: < 6 folders, “M”: between 6 and 20, “H”: > 20).
- Delete from inbox: Whether participant has an active strategy to remove e-mail from the inbox, either by permanent deletion from the system or by moving e-mail into folders (Yes = “Y,” No = “N,” and “Mix” = inconsistent moving or deletion).
- Number of unread e-mails in the inbox: Number of unread e-mails present in participants’ inbox—not the total number of e-mails in the inbox—as witnessed from the screen shots of inboxes and folder structures captured from each participant.
- Where archiving occurs: An indication of where participants archive at least some of their e-mail. Some keep every e-mail, most keep the non-junk (those deemed work-related) e-mails, but all archive to some extent. This column indicates the location of the archive, whether in a separate folder, their general inbox, or a mix between other folders and the inbox (“Inbox,” “Folders,” or “Mix”).
- Commitment to system: The last column, added during the iterative analysis process, provides a rating of individual participants’ commitment to their own personal strategy. This rating of high, medium, or low reflects the participant’s

self-reported persistence and consistency in the use of an individual strategy based on the participant’s indication of devotion through the transcripts. A participant received a rating of high if he or she communicated a clear, well-developed strategy, could discuss or teach the strategy to others, and indicated a strong desire to “deal” with all the e-mail received. A rating of low indicated the participant did not clearly verbalize any specific or consistent strategy. Participants with a low rating often relied on memory to remember they needed to address an item; they often knew that they missed responding to some e-mail. An example from the participant who chose “alligator” as a descriptor for e-mail illustrates the challenge of a lack of a consistent strategy: “Yes, it is all by memory. No wonder I’m so stressed out!” Interestingly, this characteristic was not offered in response to a specific interview question; each participant voluntarily revealed his or her own commitment (or not) to an individualized strategy of managing e-mail.

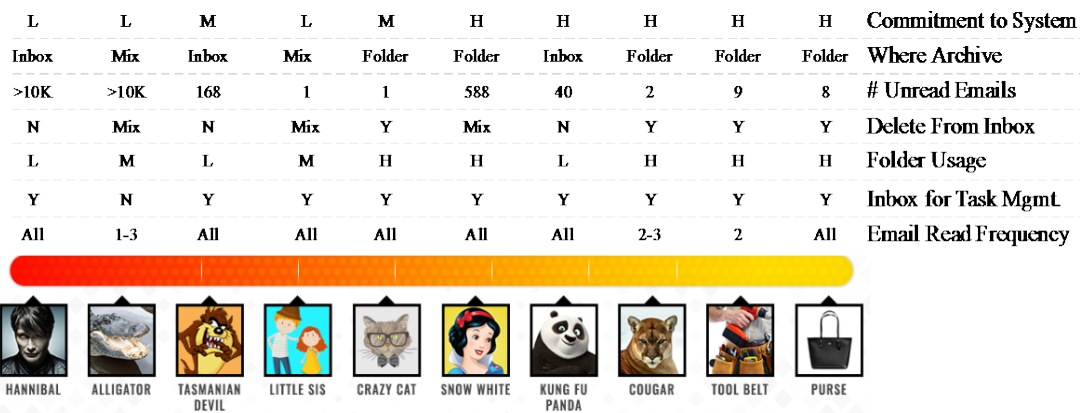


Figure 3. Participants' description of e-mail aligned with e-mail management characteristics shown along a continuum of increasingly positive perspective.

The participants who chose purse and tool belt as metaphors to represent their feelings related to e-mail have much in common. Both participants entered the study through snowball sampling; other participants had suggested them due to their passion—and sometimes fervor—around e-mail management. Known as “super users,” both put effort and time into the development of a strategy, have taught others their system, and both used the metaphor of “being religious” about commitment to their own system. For one of these super users, adhering to “religion” causes some long days because the participant does not leave the office until the inbox is empty.

The participant who used the purse metaphor spoke about motivation for researching and developing the system: “I felt very inefficient without a system. It felt like I could do a much better job at my job if I had a system. . . . I was sick and tired—20 years working . . . I was ready for a change.” The participant who used the tool belt metaphor described a discussion with a colleague who asked about the system: “It’s like any tool, right, you got to learn how to use the tool and manage it; otherwise, the e-mail will manage you, rather than you managing the e-mail.” Remarkably, these participants provided great value to this study and neither would have participated in the study had they not been identified by others. The extreme commitment of these two participants illuminated the relationship between e-mail management strategy and emotional perception of using e-mail, which needs further examination.

Most of the participants use either Yahoo or Gmail for their personal e-mail communication. Interestingly, several of the participants who have a strong, self-developed system expressed frustration with these services as the changes put in place to

help users often dismantled the system these super users had put in place. One participant expressed, “Every time I log into my Yahoo account, and a pop-up message says, ‘Switch to the newest Yahoo Mail’ I cringe. I start thinking of how long it’s gonna take me to figure out how to work around these improvements.” This participant processes e-mail by moving e-mail into folders after reviewing the content. As Yahoo and Gmail improve their software, those changes sometime affect this system for processing e-mail, which this participant uses as the reminder of tasks needing further attention.

Those on the right side of the continuum have a robust task management system and strong commitment to the system they have developed. These participants clearly understand that a challenging aspect of managing and getting through e-mail lies in the requests for action, knowing that action items can be embedded in most e-mails (Bellotti et al., 2003; Ducheneaut & Bellotti, 2001; Siu et al., 2006). Most use a combination of Outlook features (e.g., tasks, flags, read/unread) and other electronic lists to keep an all-inclusive list of tasks they need to complete. These users have analyzed their behavior and developed these methods to make sure they know what needs to be done. They clearly understand that e-mail content drives action on their part. One user described the process to review each e-mail as follows: “What’s the real ask here, what’s the message, is there something for me to do? Then it will come out of the inbox and go on the to-do list.” One participant schedules time in the Outlook calendar to work on tasks that require more than a few minutes. These “meeting notices” from the Outlook calendar serve as a reminder; this participant reviews those still open daily and reschedules the “meeting” if the task was not completed by the end of the workday.

Participants on the right side of the continuum (Figure 4) all describe e-mail as a tool that helps them be more efficient and perform better in their jobs. Those on the left side of the continuum do not express robust methods of task management and seem to be overwhelmed by the volume and expectations of e-mail. One participant stated, “I’m a little embarrassed to show you my inbox” (referring to over 10,000 unread e-mails) and another said, “I manage that (referring to the task list) in my head.” These participants had more negative and emotionally charged responses to e-mail: “the kind that make me groan, I hate doing that work” and “I’m way behind, I’ve been way behind for a while. . . That e-mail is a request from a year ago. I feel horrible when I look at it.” Members of this group did not express consistent practices in how they use e-mail. For example, Little Sis gave an example of inconsistent use of Outlook features: “My issue is I want to become more proficient with being able to do stuff like that. . . . I’ve played around with it a couple times by sayin’, ‘Okay, we’ll try this and that,’ and it’s okay. Then time passes, I haven’t done it, okay, ‘How do I do that again?’ It’s pretty easy, but it’s like Excel. You use 10% of the functionality.”

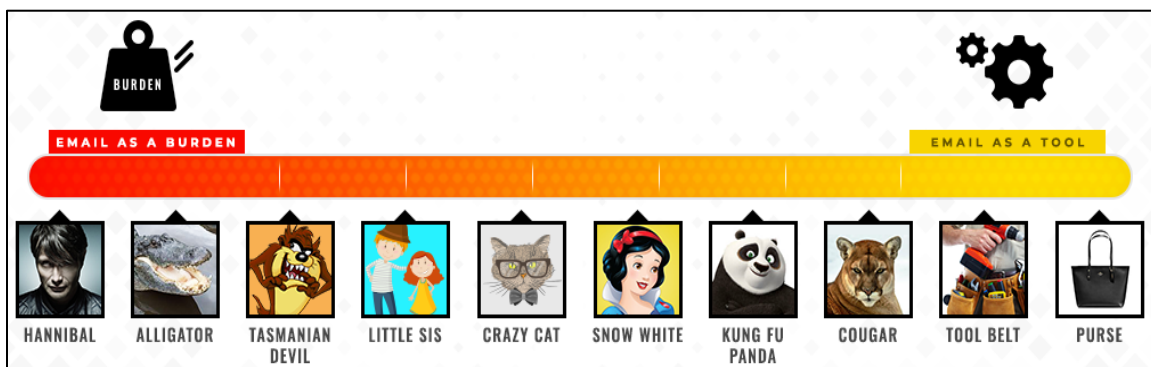


Figure 4. Continuum of perceptions regarding e-mail as burden or tool.

Another spoke of inconsistency in how incoming e-mail is filed: “I should do that more often, but I don’t.” Several of these participants had hundreds, if not thousands, of

unread and read e-mail in their inbox. Some reported a lack of confidence in knowing whether the issue in the e-mail was addressed or outstanding. These participants' coworkers often knew that urgent matters needed another communication method (e.g., text, instant message). As a result, these participants express they perceive e-mail as more a burden than a tool. Figure 4 shows the visual continuum, anchored with these opposing perceptions of e-mail as a burden versus a tool.

Discussion

Participants in this study employ different processes to manage their e-mail and the ensuing tasks that arrive electronically. As represented in Figure 4, those who have developed a personalized process for managing e-mail and consistently apply this process perceive e-mail in a more positive light, using mostly upbeat comments during the interview. This group expressed that using e-mail has a positive impact on their ability to get work done; members of this group often referred to e-mail as a tool. Participants on the right side of the continuum (Participants 1, 4, 5, 8, and 10 from Table 1; Kung Fu Panda, Tool Belt, Purse, Cougar, and Snow White from Figure 3) all have a high commitment to steady and consistent use of their strategy; they also express less stress about managing e-mail.

These participants have more in common than those on the left side of the continuum. Those on the right side of the continuum all use some method to regularly disposition the e-mail that arrives in their inbox. Most of these participants physically move the e-mail out of the inbox into other folders, either by reading the content or taking action based on the content, and one marks the e-mail as read once the task or

request in the e-mail has been addressed. Thus, this action leaves only the “unhandled” tasks in the inbox, either physically or via read status, creating a clear visual indicator of the work remaining. The literature documents the strategy of leaving e-mail in inboxes to serve as a cue for the need to take action (Dabbish & Kraut, 2006; Siu et al., 2006; Whittaker & Sidner, 1996). This management technique appears to help these participants feel less stress about what work they need to accomplish because they can clearly see what remains. This clear view of needed action, coupled with the faithful use of such actions, might give the participants confidence in the completeness of the inbox task list.

Those on the left half of the continuum (Participants 2, 3, 6, 7, and 9 from Table 1; Tasmanian Devil, Hannibal, Little Sis, Crazy Cat, and Alligator from Figure 3) shared more consistent expressions of being overwhelmed by the quantity of e-mail they receive and stress about their ability to deal with those e-mails. These participants reported more agreement with the statement, “E-mails have a negative impact on my ability to get my job done.” Most members of this group would be classified as a “no filer” based on Whittaker and Sidner’s (1996) observations. Two of these participants reported they often process their e-mail in a first in, first out pattern as opposed to the remainder of the pool that process their messages in a last in, first out pattern.

Some participants believe that processing messages using the first in, first out sequence gives opportunities for wasted time; one participant said, “One thing I have learned is that I’ve gotten burned in the past. If you start with the oldest ones, it may have already been resolved by the time you get to the top of your list.” Additionally, this half

of the continuum typically searches within their inbox to find the tasks that they need to complete, when they remember to do so. As Dabbish and Kraut (2006) suggested, it seems logical that looking through thousands of e-mails might feel a little daunting at times. Finally, this group shared different strategies at different times and did not delineate a clear process or rationale for how and why they took a certain action with a specific type of e-mail, reporting more of a mixture of behavior in different time frames.

Limitations and Future Work

Literature supports sample sizes of 10 and under for qualitative studies (Renaud et al., 2006; Siu et al., 2006; Venolia et al., 2001), but the low number of participants limit generalization of the findings. Participants in this study are very homogeneous; they all have a lengthy history of employment within the same organization and almost all received their education in engineering. As such, their experiences and work culture include little diversity. The study limited questioning to participants' use of Microsoft Outlook and did not include use of texting or other newer electronic communication methods such as instant messaging. Inclusion of other electronic communication tools could help this work to be scalable or transferable across multiple platforms, and a larger participant sample could extend the findings beyond the small subculture represented in this study.

Although the study relied on some participant self-reported data, which can be inaccurate, the study did include actual observations by the interviewer to counter some of the claims by the participants. Lastly, because the interviews and data collection occurred at one instant in time, the possibility exists that a participant could have reported

more negative or positive emotional content due to having a bad or good day. Future studies could examine whether a particular method of processing e-mail might be beneficial in reducing feelings of stress and overload, why the participants commit to their strategies and, if not, what keeps them from doing so, as well as how to help users create strategies that work best for their personalities, working styles, and type of role.

Conclusion

Reflecting on the research question of the study, the answer is that knowledge workers employ a variety of e-mail management strategies and express a range of emotions concerning the use of those strategies. This mixed methods study involving 10 professionals from a technically based workplace revealed a self-developed, individualized e-mail and task management strategy is aligned with a strong commitment to that strategy and positive emotional responses. The data from this study suggest that developing and committing to the use of a strategy that one can clearly articulate may result in perceiving e-mail as more of a tool than a burden. Those who perceive e-mail as a tool report fewer feelings of stress and of being overwhelmed by the e-mail they receive.

Perhaps the software companies interested in developing for all audiences should consider the users that have taken the time to craft their own system and see e-mail as a critical tool. Many of the improvements these companies put in place are a disservice to these dedicated users. There are more than 330 million knowledge workers worldwide (Dobbs et al., 2012). Methods that result in less stress for these workers could have a positive impact on knowledge workers' productivity because those with lower stress

report higher levels of productivity (Kanungo & Jain, 2008). Helping individuals see e-mail as a business-critical tool may also reduce workers' feelings of overload (Sumecki et al., 2011).

Research of e-mail management often focuses on quantitative data collection techniques. The use of qualitative techniques in the present study revealed a connection between commitment and emotional state. Further research can provide methods and strategies that might reduce the need for knowledge workers to take their smartphones into the restroom to get through their e-mail.

Acknowledgements

The author thanks the participants who eagerly shared their methods for using e-mail and trusted me to share some experiences that had most likely never been shared with others. I also thank the anonymous reviewers for feedback that improved this paper. Dr. Sarah Tracy and her advanced qualitative data analysis students graciously critiqued the study during its formation and planning process, providing valuable assistance to ensure a rigorous and fruitful study. Dr. Tracy crafted the class to provide a space and guidance for students to create publishable papers. She shares her high standards with her students and I'm thankful she did so. Finally, thanks to Doris Berry for assisting with editing.

CHAPTER 5

E-MAIL NOTIFICATION AND PROCESSING FREQUENCY MATCHMAKING: CAN HOW OFTEN YOU ATTEND TO E-MAIL HAVE AN IMPACT ON YOUR PRODUCTIVITY?

This mixed methods study of knowledge workers investigates the impact of e-mail reading frequency and adjustment of e-mail notifications on workers' productivity and stress levels. This work builds on Kushlev and Dunn's (2015) study by adding adjustment of e-mail notifications and the type of work tasks in which knowledge workers engage, using tactical and strategic work task types as a contrasting dyad. The participants used two different e-mail management strategies for one week each: one week where participants were instructed to read e-mail frequently and use e-mail notifications and then in the other week participants were asked to read e-mail infrequently and turn off notifications. Although literature recommends reading e-mail infrequently and working with fewer distractions, no difference in median productivity or daily stress scores were experienced between the two e-mail management strategies. This work contributes in four ways: provides data on the distribution of work task types for these participants, includes a predominance of female knowledge workers—a rarity in human-computer interaction studies, demonstrates the difficulty for knowledge workers to change their e-mail management strategies (which may have become habits), and shows that few follow the recommendations of literature. Changing the frequency of e-mail engagement and enabling or disabling e-mail notifications based upon the type of

work one does for periods of time may be the best solution to provide improved productivity and reduced stress.

Introduction

Although the term “crackberry” is now almost extinct along with the once-ubiquitous Blackberry devices, scholars continue to call for organizations to develop policies to limit the potential impact from what was once thought of an addiction to the use of a Blackberry only, but now is represented by any mobile e-mail application (Ramsay & Renaud, 2012; Turel & Serenko, 2010). E-mail and Internet usage have more than doubled since 2000, with 90% of US residents reporting frequent usage (Pew Research, 2014), half of whom report feeling more productive due to this increased e-mail and connectivity (Purcell & Rainie, 2014). Data from 2015 reveal that the average office worker receives 121 e-mails (KnowBe4, 2017) during a typical working day, which equates to an e-mail every 4 minutes, an arrival rate corroborated by research (Iqbal & Horvitz, 2007).

Although these same workers may feel more productive, workers who use e-mail report continued increases in the volume of e-mail they receive, and feelings of stress about their ability to respond in a timely manner (Dabbish & Kraut, 2006; Jerejian et al., 2013). Many report feelings of pressure to check e-mail frequently (Renaud et al., 2006) and reply immediately (Hanrahan & Pérez-Quñones, 2015; Ramsay & Renaud, 2012), with some responding to a new e-mail as quickly as they would answer the phone (Jackson et al., 2003). Some believe a quick reply can serve as an attempt to preserve their professional image or “responsiveness image” (Tyler & Tang, 2003). Other

researchers have asserted that, if criteria for other addictive behaviors were applied to e-mail use, 15% of their study participants would meet the clinical criteria for addiction (Marulanda-Carter & Jackson, 2012). Regardless of whether e-mail usage borders on addiction, interruptions of work to check and process e-mail have revealed a negative impact on productivity levels (Siu et al., 2006; Renaud et al., 2006).

Those who examine trends in technology have warned that connectivity through these electronic devices (e.g., computers, smartphones) might be distracting workers from true innovation (Newport, 2016; Turkle, 2016). Powers (2010) suggested this sentiment in a strongly worded phrase: “Although we think of our screens as productivity tools, they actually undermine the serial focus that’s the essence of true productivity” (p. 16). Are 21st-century professionals left with an untenable question of whether they should do their real work or do e-mail?

This study applies to those who spend most of their day using and interacting with a computer. Some might call them knowledge workers—meaning someone who uses his or her expertise in the primary pursuit of creation or application of knowledge (Davenport, 2005). Others might call them “professionals” (Professional, n.d.), indicating they engage in a specific professional activity that requires a level of education, or “information workers”, those whose work revolves around a computer (Mark, Gonzalez, & Harris, 2005), or a “white collar worker” (Sinclair, 1919, p. 12). Whatever they are called, all of these types of jobs involve many cognitive tasks (Wickens, Gordon, & Liu, 2004). Some might also use the term “office worker”; while this later term connotes similarity to tasks performed by a white collar worker, the role of an office worker may

not require the same level of education and may not involve the same level of deep or creative thinking to accomplish assigned tasks. In this study, we assume the role of an office worker is similar to that of a knowledge worker. Estimates show at least 330 million people worldwide work in these types of roles (Dobbs et al., 2012); thus, any improvement in working environment or productivity would likely have a great impact on productivity of professionals.

These knowledge workers report feeling the increasing need to reply immediately, which conflicts with advice from productivity and organization experts who strongly suggest limiting the number of times workers check e-mail (Ferriss, 2011; Morgenstern, 2011; Pash & Trapani, 2011). These productivity and organization experts typically prescribe engaging in two to three sessions per day for processing e-mail, leaving the remainder of the work day free to work on other tasks that might require deep thinking or creativity. Checking e-mail less frequently reduces work interruptions, thereby improving productivity (Gupta et al., 2011; Kanungo & Jain, 2008; Kushlev & Dunn, 2015; Mark et al., 2016).

Although restricting the frequency of e-mail checking might be helpful for some workers, specifically those who have more strategic or creative roles, many professionals who perform work that is tactical or administrative in nature (e.g., a purchasing agent or manufacturing manager) and need to respond quickly to e-mails might find the strategy of checking e-mail less often impractical or impossible. For workers in these roles, failure to respond promptly to e-mail might have a negative impact on their professional reputation and image, as well as substantial harm to their work product when they miss

critical time-bound communication. Furthermore, enabled e-mail notifications cause an interruption for each and every e-mail, which could be as often as every 4 minutes, assuming the e-mail arrival rate noted earlier. These interruptions could make committing to a strategy of limiting e-mail reading frequency extremely difficult and not particularly beneficial if the focused attention on real work is never realized.

Most of the advice on how best to manage e-mail offers only a one-size-fits-all solution (Ferriss, 2011; Morgenstern, 2011; Pash & Trapani, 2011). Perhaps a better answer lies in a solution allowing for options based upon the type of work tasks being performed. Examining the different types of work task types knowledge workers perform could provide a better understanding of strategies to allow for focused work through optimization of e-mail reading strategies and e-mail notification usage. With the desire for an easy-to-understand, contrasting dyad on a continuum, this study used the contrasts of “tactical” and “strategic” to describe types of work tasks in which knowledge workers might engage. For this study, a *tactical* (Tactical, n.d.) task type is defined as a specific procedure performed to produce a result, often with small-scale actions and a limited view of the end goal, whereas a *strategic* (Strategic, n.d.) task type implies a broader, more complex effort, as in a general plan that is created to achieve a greater goal, usually over a long period of time, and one that integrates as a piece of a larger whole.

What is or are the best way(s) to work in the electronic age or, as Friedman (2006, p. 5) phrased it, in “the age of interruption”? This conundrum inspired a study to examine e-mail reading frequency and e-mail notification usage, along with work task type. Building on Kushlev and Dunn’s (2015) study that investigated the impact of e-mail

checking frequency on a variety of stress and well-being measures, this study adds by examining the type of work tasks in which participants engage, and asking participants to adjust e-mail notifications to align with e-mail reading frequency. The study includes self-reported productivity as an additional study measure. Thus, the following overarching question guided this project:

RQ: Could aligning e-mail management practices of reading frequency and use of e-mail notifications have an impact on productivity and stress levels for knowledge workers? Would the type of work tasks in which the knowledge workers engage—strategic versus tactical—influence any impact on productivity or stress levels?

Background

Some professionals may fantasize about committing e-mail bankruptcy, a term coined by Turkle, a professor at MIT (Musgrove, 2007), but few follow through with the fantasy. In a rare paradoxical study that bordered on committing e-mail bankruptcy, Mark et al. (2012) asked participants to give up e-mail for one workweek. Participants who followed this guideline reported less stress (measured via heart rate variability), switched tasks less often, and experienced a slower pace of work life without e-mail. Although these options sound enticing, a report published by Pew Research (Purcell & Rainie, 2014, para. 7) noted that e-mail maintains its hold as the “main digital artery” for performing work, especially for knowledge workers; thus, these strategies would have a very limited effective shelf life. E-mail continues to be the most frequent and favored method for communicating with colleagues (Dietzen, 2017) and provides the

foundational workspace for office workers by incorporating most of the tools (e.g., e-mail, task management, calendars, and contact management) used by professionals on a daily basis (Bellotti et al., 2003; Whittaker et al., 2005; Whittaker et al., 2006; Zhang, 2015). It is clear that e-mail will continue to be a constant presence in the work lives of people who perform office work.

Given professional work requires using e-mail, the answer might lie in reducing the frequency of checking e-mail because this strategy reduces work interruptions, thereby improving productivity (Gupta et al., 2011; Kanungo & Jain, 2008). In addition to improving productivity, reducing the frequency of checking e-mail was found to have a positive effect on users' well-being: they reported lower stress (Kushlev & Dunn, 2015, Mark et al., 2016). To be effective, these strategies of reduced e-mail checking frequency must be used in concert with changing the use of e-mail notifications, lacking in prior research, because the notifications break the user's focus on the primary task. The impact of e-mail notifications as a source of informational awareness, beneficial to some and comfortable for many users, is well documented as a distraction (Iqbal & Horvitz, 2010). These e-mail notifications encourage and facilitate continuous checking of newly arriving e-mails, resulting in a continuous flow of interruptions that interfere with a user's ability to continuously focus on a task (Renaud, Ramsey, & Hair, 2008).

McFarlane (2002) defined the interruption taxonomy with four options: immediate, negotiated, mediated, and scheduled. An e-mail notification could be classified as a negotiated interruption, given that a user could ignore the notification until he or she has time to address the e-mail. Nevertheless, the notification itself serves as a

stimulus to the user, thus distracting focus with the interruption. The time to complete main tasks increases when frequent interruptions occur, but the type of task moderates whether accuracy may be affected, with creative writing tasks (Foroughi, Werner, Nelson, & Boehm-Davis, 2014) being more negatively affected than tasks involving comprehension, as measured by online tests (Bowman, Levine, Waite, & Gendron, 2010; Mansi & Levy, 2013).

Research suggests that the more users engage in multitasking, or dealing with interruptions, the worse their performance on tests that involve task-switching (Ophir, Nass, & Wagner, 2009). The timing of an interruption has an impact on the main task: earlier is worse than later in a task (Cutrell, Czerwinski, & Horvitz, 2001). The source of the interruptions is also a factor: external interruptions, such as e-mail notifications, are more harmful than internal or self-initiated interruptions (Katidioti, Borst, van Vugt, and Taatgen, 2016). The user's ability to choose when to be interrupted (Czerwinski, Cutrell, & Horvitz, 2000), to negotiate availability such as that afforded by instant messaging systems (Nardi, Whittaker, & Bradner, 2000), or to defer the interruption just 90 seconds to reach a logical break point in work decreased user frustration and improved reaction time (Iqbal & Bailey, 2008). In general, research revealed notifications have a negative impact on work due to their interruption of memory functions (Czerwinski et al., 2000).

Katidioti et al. (2016) explained the interruption process, starting with a main task. They referred to the time between the moment of the interruption and the beginning of action on the interruption task as the *interruption lag* and the time from completion of the interruption tasks to resumption of the main task as the *resumption lag*. They found

that completion of the main task took longer if the interruption was self-imposed, meaning the user decided to switch tasks (such as respond to an e-mail without a notification), as opposed to an external interruption, such as a coworker calling on the phone. The resumption lag, which could be quite long, showed no difference between self-interruptions and external interruptions. In one study, although the average resumption lag was 10 minutes, up to 27% of the resumption lags were more than 2 hours (Iqbal & Horvitz, 2007). Mark et al. (2005) found that 77% of interrupted tasks were addressed in the same day—within 25 minutes—leaving the remaining 23% of tasks addressed the next day or days later—or perhaps never addressed at all, because they were long forgotten.

The result of these interruptions might be called “work fragmentation, a break in continuous work activity” (Mark et al., 2005, p. 321) or *multitasking*, a term originating in the 1960s and meaning the process of performing two tasks simultaneously (Multitasking, n.d.). Multitasking has been delineated further into *simple multitasking*, ideally motivated by a desire for greater productivity through the pairing of two automatic or routine activities, and *complex multitasking*, or the pairing of two tasks that both require cognitive function (Stone, 2009). Complex multitasking is also referred to as “continuous partial attention” (Stone, 2009, para. 2), which is motivated by the desire to not miss anything. Finally, because computers have become a medium that encourages reading or doing more than one activity at a time, the term “media multitasking” (Foehr, 2006, p. 7) describes the practice of engaging in more than one media activity at a time, such as using instant messaging and e-mail simultaneously.

HCI literature suggests that task switching with e-mail can be easy for information workers; the most difficult task switching was reported with more complex, longer projects where greater productivity loss was reported, as was more difficulty in remembering the tasks (Czerwinski, Horvitz, & Wilhite, 2004). These interruptions do not always have negative consequences; some interruptions provide welcome breaks in work (Adler & Benbunan-Fich, 2013) and offer information necessary for task completion. They might even contribute to a “digital evolution” of sorts, with our brains evolving to process vast amounts of data quickly (Small & Vorgan, 2008, p. 42). Some benefits can be realized from certain interruptions, but e-mail notifications that are neither mediated nor scheduled result in negative impacts on worker performance, and the positive potential of strategies that limit task switching behavior suggests the need for further efforts to understand when and how these strategies are helpful.

This line of research is further supported by Iqbal and Horvitz (2010), who suggested that research with participants in different work contexts might prove helpful because users react differently to e-mail notifications and demonstrate different patterns of attention and disruption. There is a need to shift the course of study to understand the types of work and tasks to those involving the knowledge worker. Those performing knowledge work engage in a high level of cognitive tasks (Wickens et al., 2004), but the composition of these jobs includes a variety of task types, often in unequal proportions (McGrath, 1984). McGrath (1984) conducted a complete analysis of task types, presenting a model with mutually exclusive, exhaustive, and logically related categories. This model, referred to as a *circumplex*, built on the foundation of work from nine other

primary researchers and includes eight task types and four quadrants that create a complex framework.

The quadrant formation of McGrath's (1984) circumplex is composed of four types of tasks: generate, choose, negotiate, and execute. The execution, implementation, or performance tasks anchor one end of a continuum because much of "work of the world involves these tasks" (McGrath, 1984, p. 63), whereas creative tasks and dealing with uncertainty anchors the other end of the continuum. Researchers have used similar concepts to demonstrate the contrasts in types of tasks as "prescribed" versus "cognitive" (Patrick & James, 2004, p. 259). McGrath (1984, p. 66) noted that the creative and planning tasks are prominent in "real, everyday life," but are underrepresented in research; therefore, in this study, the inclusion of the strategic type of work tasks can contribute to the knowledge base.

Returning to the contrasting dyad of tactical and strategic to describe types of work in which knowledge workers might engage over time, tactical tasks are usually repetitive, administrative, and require less experience and education than are needed for strategic tasks while strategic tasks require critical thinking, planning, coordinating, and more experience and knowledge than are required for tactical tasks (Hartman, Bentley, Richards, & Krebs, 2005). As Goodhue and Thompson (1995) argued, a technology that fits the task at hand—in other words, strategic when strategic work is needed or tactical when tactical work is needed—will have the greatest impact on that task. This study investigated e-mail management strategies, checking frequency paired with notification

use, that match the type of work tasks in which the knowledge worker most frequently engages.

Materials and Method

Study Design

This study sought to understand if knowledge workers perceive an improvement in productivity or reduction in stress as they vary the frequency with which they attend to e-mail and use e-mail notifications. For this study, these work task types were defined as follows:

- *Strategic work* is that which involves thinking, creating, and setting direction. This type of work is associated with a long-term impact on the organization.
- *Tactical work* is that which is transactional in nature, administrative, and often repetitive. Tasks in this category would have an impact on the organization on a day-to-day basis.

When a knowledge worker performs strategic work tasks, he or she should benefit from attending to e-mail infrequently and turning off e-mail notifications to allow full focus on these tasks that require thinking and creating. Likewise, when a knowledge worker performs tactical work tasks, he or she should benefit from attending to e-mail frequently and using e-mail notifications to allow quick access to communications. In the design of this study it was assumed that knowledge workers would report that the majority of their work tasks for a given day would be categorized in one or the other of these categories and therefore daily work processes would align better with one style or the other. With these definitions, the follow hypotheses guided the study:

H1: Attending to e-mail less frequently and turning off e-mail notifications will have a favorable impact on productivity and stress levels for knowledge workers.

H2: Compliance with the e-mail processing strategies aligned with work task type should be higher when the strategies align with the participant's usual style of e-mail management. For example, if the participant usually attends to e-mail all day long, it should be easier for that participant to comply with reading e-mail all day long during the part of the study when he or she is asked to read e-mail all day.

H3: When the participant shifts the e-mail processing styles of reading frequency and use of notifications to match the type of work tasks he or she performs, favorable changes in productivity and stress will be realized. For example, if a participant's work tasks are predominantly strategic and he or she usually reads e-mail frequently and uses e-mail notifications, he or she will benefit from shifting those e-mail processing strategies to read infrequently and turn off notifications. When the participants make these shifts in e-mail processing style to match the type of work tasks they perform, they will report a favorable change in productivity or stress.

Following several days of baseline data collection, each participant was asked to follow the e-mail reading frequency and e-mail notification usage guide outlined in Table 5 for one workweek for both tactical and strategic work role task types. The participants were asked to follow the assignments for the entire week, throughout every day regardless of any variation in work task types that occurred within the day or day to day. In Week 1, participants were assigned the combination most closely aligned with their self-reported split of work role task type, then they were asked to switch to the

combination for the other work role task type in Week 2. For example, if a participant indicated 55% of his or her workday was spent on tactical tasks, he or she would follow the tactical assignments by using e-mail notifications and frequently attending to e-mail during Week 1 of the study, and then switch during Week 2 to the strategic method by turning off all e-mail notifications and reading e-mail infrequently, as few as two times daily.

Table 5. Participant Assignments for E-Mail Notification Usage and Frequency of Attending to E-Mail for Different Role Task Type Weekly Assignments/Study Week

Role work task type	E-mail notification	Time attending to e-mail
Tactical	On	Frequent (as often as they can, hourly if possible)
Strategic	Off	Restricted (ideally two times daily)

Table 6 provides a summary of the number of surveys participants received throughout the study, by week of the study. The study concluded with a face-to-face meeting with each participant to capture final comments and concerns.

Table 6. Number of Study Surveys Administered to Participants by Study Week

Study week	Surveys administered (<i>n</i>)
Initial	1
Baseline week	4
Tactical task type matching weeks	4
Strategic task type matching weeks	4
Final	1

Procedure

Multiple surveys were administered using Qualtrics, an online customizable survey tool, to collect data for the study, complemented by a study discussion before

beginning the study and after conclusion of the final survey. The initial survey yielded general demographic information, initial assessment of job task type composition (e.g., percentage of work tasks reflecting aspects of strategic, tactical, or other), and self-reported current productivity and stress levels. Four additional surveys, each of which repeated the questions included in the initial survey regarding productivity and stress levels, allowed for development of a baseline level for participants beyond the single initial surveys. These surveys were delivered via e-mail to participants late in their work days (approximately 3 p.m. local time) on four consecutive work days.

Initial assignments (e.g., strategic or tactical management options) were e-mailed to participants on the Monday following completion of the baseline week, with instructions to implement the assigned strategy during that workweek. A brief paragraph with the literature supporting this recommended weekly strategy with references (i.e., for those using the strategic management options, the references supported that alignment, and vice versa) provided the participants with justification for the requested actions, underscored by the researcher's encouragement to commit to consistent usage throughout the week. There is limited literature supporting the use of frequent e-mail reading and notifications; thus, much less information and fewer references were provided prior to the week during which participants were asked to align their e-mail management practices with those of tactical e-mail management strategies. Near the end of the work day on Monday through Thursday, the participants received a brief survey similar to the survey used during the baseline data collection week, accompanied by the request for participants to capture data. The following week, the participants received reverse

instructions from Week 1 (e.g., if the Week 1 assignment aligned with tactical strategies, then in Week 2, the assignment aligned with strategic tasks).

These instructions also included step-by-step directions showing participants how to turn on or off all e-mail notifications (i.e., sound, desktop, and icon) in Outlook.

Outlook provides three e-mail notification options, or combinations of the three, upon e-mail arrival: sound, desktop, or icon. The desktop notification floats in the lower right-hand corner of the screen momentarily, hovering over open applications (see Figure 5), whereas the icon notification (see Figure 6) merely adds the image of a closed e-mail message in the Outlook icon in the taskbar. During the strategic week, participants were asked to turn off all three types of notifications and during the tactical week, participants were asked to turn on at least the desktop notification.

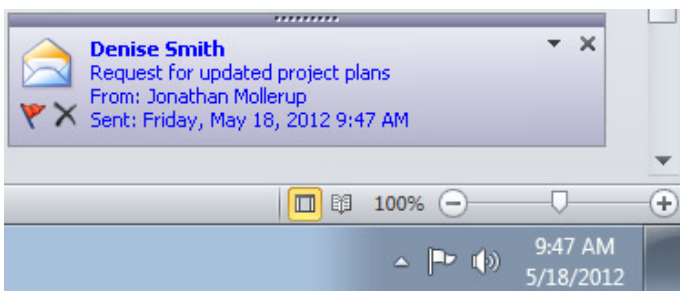


Figure 5. E-mail desktop notification option in Outlook (Microsoft, n.d.-a).



Figure 6. Outlook icon notification showing the pre-arrival condition (left) and the post-arrival condition (right) (Microsoft, n.d.-b).

Participants

Through open calls for participation and snowball sampling (Robson, 2011), 20 employees in the same division of a global technology company with more than 75,000

employees and revenue in excess of \$20 billion (per the company website) volunteered to participate in this study. The relevant business leaders at the primary author's employer provided permission for the study after the primary author/researcher obtained approval from the Arizona State University Institutional Review Board (IRB number STUDY00003844). All of these participants are colleagues of the primary author and were known prior to the start of the study. This relationship could have influenced the answers and/or compliance with the study. Participants may have answered indicating compliance when they had not complied, or they may have provided more favorable answers to questions about their own performance. Repetition of the same questions in multiple surveys attempted to offset the latter potential influence. Staggered participation allowed for participants' absence due to work travel or vacation. No reminders were sent out, and some participants provided better compliance and response to the surveys than others.

Six of the original 20 participants who volunteered did not complete enough of the study materials for inclusion in the final data set. Two participants did not complete the initial survey, which was the action that started the study process. Eighteen participants completed the initial survey; these participants were assigned participant numbers and began the study process. Four of the 18 completed less than half of the total surveys, typically due to time away from work during the study period, leaving 14 study participants (thus Participant numbers 6, 7, 12, and 13 are not included in the data herein). Of the 14 participants who completed the study, nine were women and five were men. These participants were mostly individual contributors (10 of the 14 do not manage

others) and had experience in office settings ($M = 20$ years working professionally, $SD = 10$). Each participant kindly provided his or her time for the study voluntarily. All of these participants use a recent version of Microsoft Outlook; thus, the study materials include questions and processes regarding this application.

This homogeneous convenience sample (Robson, 2011) of colleagues follows many other studies of workplaces by a primary author (Barley et al., 2011; Bellotti et al., 2003; Hogan & Fisher, 2006; Hössjer & Eklundh, 2008; Mackay, 1988; Mander et al., 1992; Tyler & Tang, 2003; Venolia et al., 2001) and small sample sizes (Mackay, 1988; Whittaker & Sidner, 1996; Bellotti et al., 2003). Although the sample was homogeneous in terms of workplace and years of experience, the sample does include a variety of levels within the organization: participants included two project analysts, several program managers, one director, and many engineers. Unlike many previous studies reflective of those conducted in the field of HCI, which include a majority of male subjects (likely due to the overrepresentation of men in technology workspaces), the composition of this study was predominately female (64%) in nature.

Results

Initial Data: Pre-Study E-Mail Reading Frequency and Device Usage

Literature suggests that e-mail usage frequency could be an interruption to focused work, so detailed questions queried the participants on their current habits surrounding use of e-mail. The participants indicated both the usage frequency and total time each day they read, responded to, or composed e-mail, as well as the percentage of time for each aspect of e-mail activity. As represented in Figure 7, participants attended

to e-mail for 2 hours daily on average, ranging from a minimum of 1 hour to 5 hours daily. The data in this table is sorted in the order of total time attending to e-mail, from least to highest. Most of the participants reported spending the largest percentage of their time reading e-mail versus responding or composing e-mail. In this question, multiple e-mail actions (read, respond, or compose) were differentiated to obtain the detail; however, throughout the rest of the paper, the terms *reading* and *attend to* are used interchangeably to mean any of these actions.

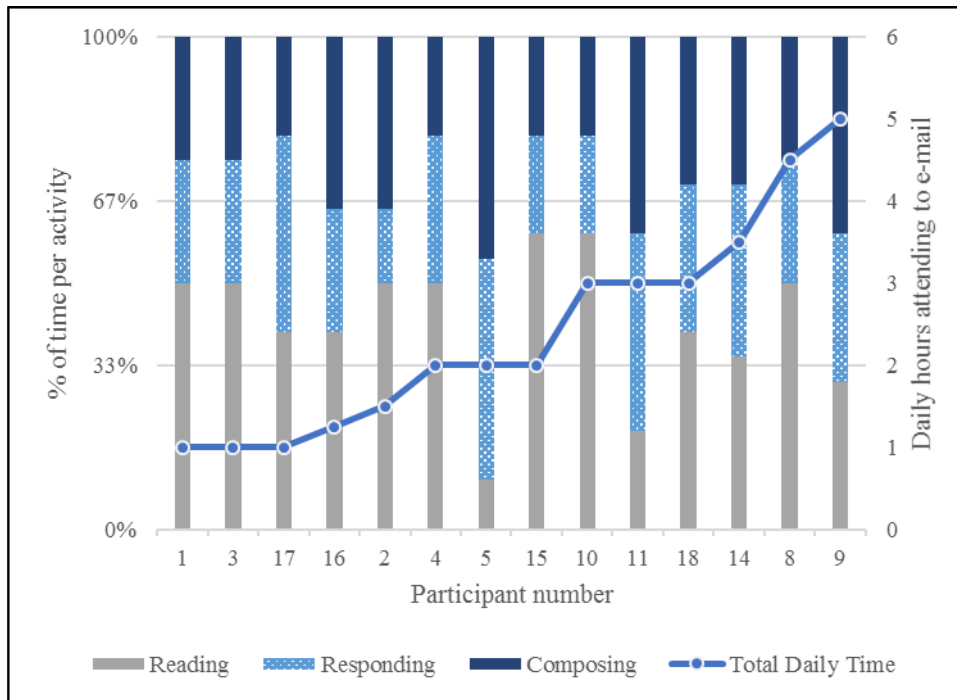


Figure 7. Time spent attending to e-mail per day and percentage allocated to reading, responding to, and composing activities.

Participants were also asked how often and with what devices they accessed e-mail. Figure 8 shows the number of devices participants used to access e-mail (e.g., computer, smartphone, or tablet), the frequency of attending to e-mail, indicated by the size of the bubble (e.g., 1–2x a day, hourly, every 30 minutes, or all day), and gender,

indicated by color (i.e., blue with dots = male, pink = female). In this study, women revealed a wider variety of e-mail usage, both in terms of number of devices and the frequency of attending to e-mail, whereas the men in this study attend to e-mail every 30 minutes or all day long.

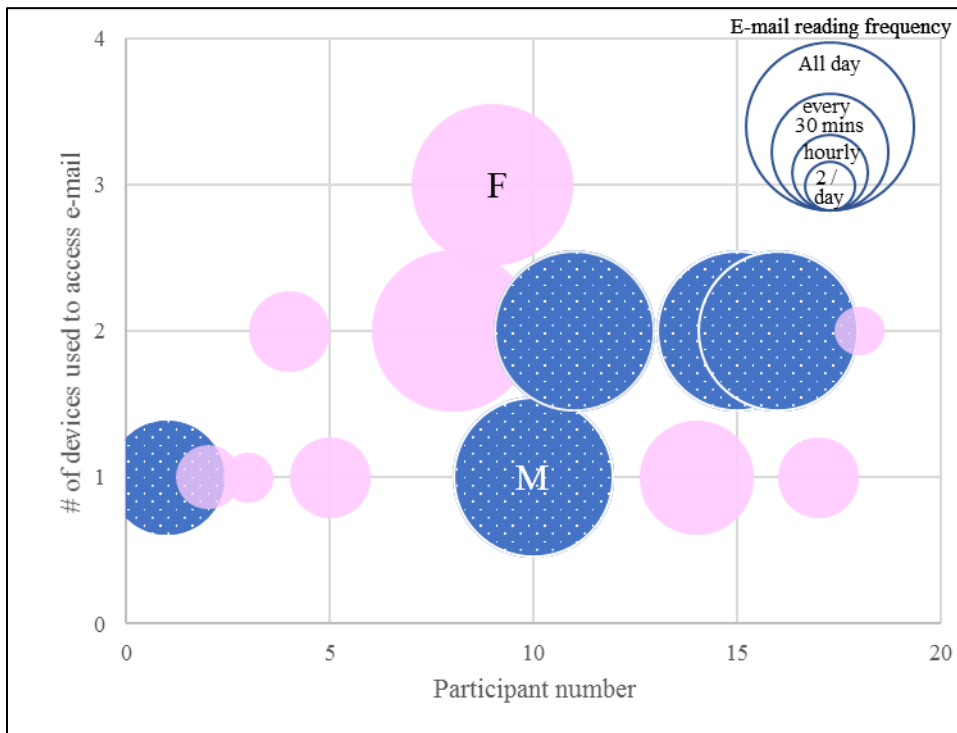


Figure 8. Number of devices used to access e-mail and frequency of access by gender.

Initial Data: Reported Role Task Type

As explained earlier, the initial recruitment of participants included the expected percentage of split between tactical and strategic work to balance the pool of participants: approximately half of participants served in roles in which more than 50% of their work was expected to be more tactical than strategic and the other half of the participants served in roles in which more than 50% of their work was expected to be more strategic than tactical. An assumption was made that participants with “manager” in their title would report higher levels of strategic work than those who served in roles as individual

contributors. During the initial study survey, participants were asked how much of their work would be considered strategic and how much would be considered tactical, with the definitions provided in the Study Design section. The survey included the option of “other” in addition to strategic and tactical, with a request to describe the other activities. All the descriptions participants provided as other fit into the classification of tactical; thus, the two categories were combined for purposes of reporting. Although the initial assumption was that the group was evenly balanced between tactical and strategic, only three of the participants indicated their job type included activities with more than 50% of a strategic nature, as shown in Figure 9.

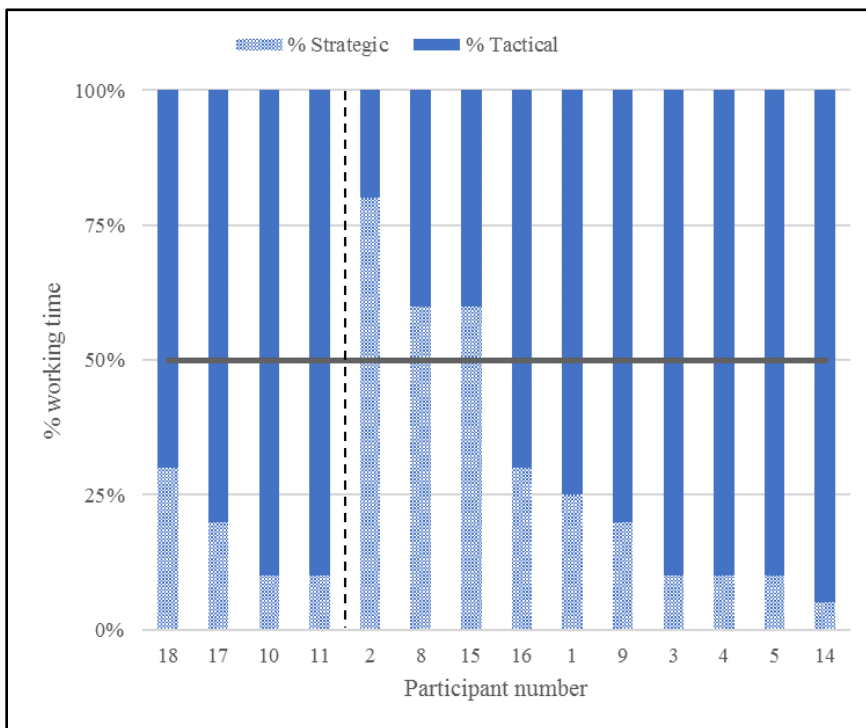


Figure 9. Participants' initial assessment of type of work: strategic versus tactical. The dotted line separates the managers (on the left) from the individual contributors (on the right).

Throughout the remaining sections of this paper, the data presented typically show only the percentage of the strategic type of work, not as a pejorative reflection on

the type of work, but rather because (a) the either-or nature of work means the reporting would be mirror image/opposites, so reporting on only one category respects brevity; and (b) many authors suggest the greater need for more a strategic type of focused work rather than tactical work, given that continuous connectivity makes tactical work easier to perform while avoiding more focused, difficult efforts (Newport, 2016; Powers, 2010; Turkle, 2016).

Weekly Data: Role Task Type Actual Data

Each time the participants were administered a survey, they were asked to report the percentage of the type of work, strategic or tactical, they had performed during the previous day. Figure 10 represents the results of the average of all the daily survey data relative to the participants' initial report. The initial survey asked participants the percentage of time they spent working on strategic and tactical types of tasks, as well as the range of that percentage in typical time periods. Likewise, the data from all the other surveys (excluding the initial survey) provide an indication of actual experiences for the participants. Figure 10 shows the participants' indicated high level of variation, both in predicted initial values and, on average, reported daily values. Five participants' predictions of their actual work were very close during the study period (the reported actual data were within 5% of their prediction), four reported actual values within 10% of predicted values, and five participants reported actual values more than 17% different from predicted values.

Participants 10, 11, 17 and 18 reported they manage others or have titles that include manager. As shown in Figure 9, these four participants initially reported that

most of their work tasks are tactical in nature. The *actual* reported data, shown in Figure 10, indicate that these participants did not spend more of their work day performing strategic types of tasks than the other participants. The four managers reported they spend 29% of their day on strategic work, compared to 32% for the other participants. The p -value of 0.77 for a two-sample t test comparing these two distributions results in a failure to reject the null hypothesis that these two groups are equal, clearly indicating that there is not a significant difference between the groups. Thus, the initial assumption that those with manager in their title would have work that was composed of mostly strategic types of tasks was not correct for this sample.

Furthermore, an assumption was made that the participants' work task type of strategic or tactical would remain fairly constant within a day and day to day. Therefore, a strategy to match the work task type with the e-mail management would be beneficial. As is shown in Figure 10, the actual data reveals large variations in work content day to day, with all participants reporting at least 10% variation day to day and more than half with day to day variation in work content greater than 50%. Thus, this assumption was also incorrect for this sample.

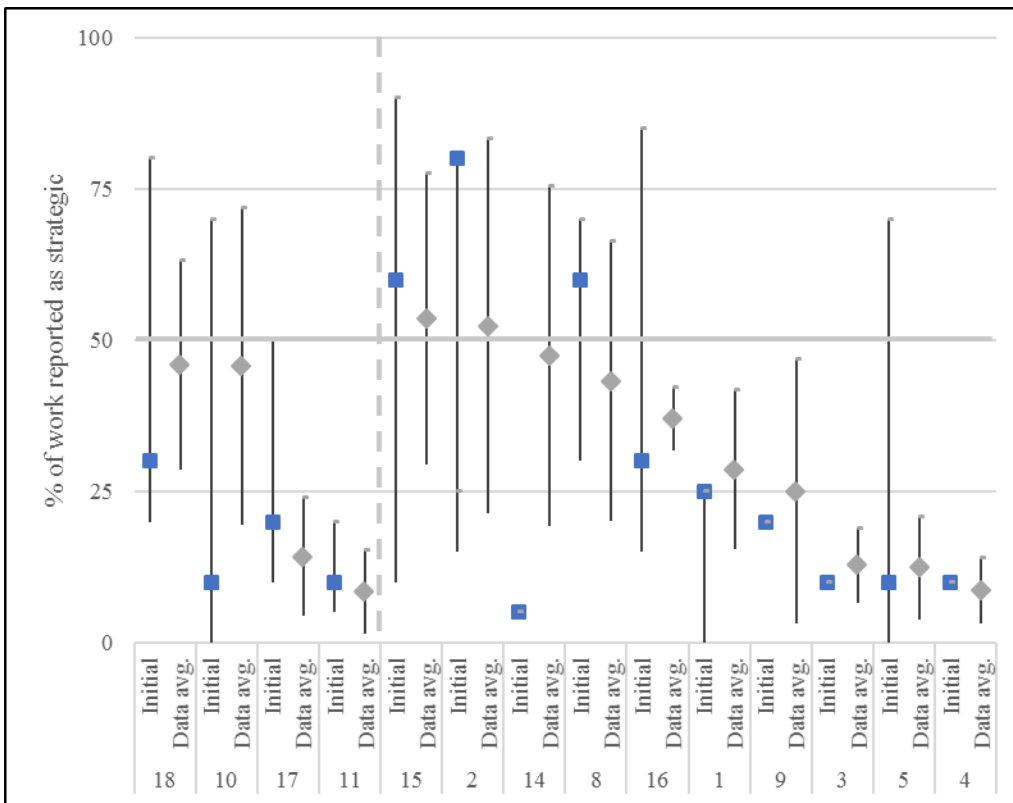


Figure 10. Strategic work type percentage by participant, comparing data from initial survey to data from all other surveys. The blue square marker indicates pre-study data, with the grey diamond marker indicating average of all the other survey data. The bar reflects one standard deviation on either side of the average of the actual daily reported percentage.

Weekly Data: Participant Compliance for Weekly Task Types (Study Phases)

Compared to Usual Style

Participants reported their e-mail reading frequency and use of the various types of e-mail notifications offered in Outlook (i.e., sound, desktop, or icon) during each survey. They reported a variety of e-mail notification combinations prior to enrolling in the study: four used no notifications, four used both the desktop and icon, three used the desktop only, two used the icon only, and one used both the desktop and sound notifications. During the study, the survey question reminded the participant of the

desired setting or reading frequency for that study week, and the question asked if the participant had complied with these requests.

The number in each cell in Table 7 indicates the percentage of surveys to which the participant responded in the affirmative, reflecting that he or she had complied with the study request for that week (e.g., use of notifications and frequency of e-mail use). The gray shaded cells indicate the usual style for the participant. For example, the gray cells in Row 1 of the table indicate Participant 1 reported attending to e-mail frequently and not using e-mail notifications as a usual practice. None of the participants usually followed both the recommendations to reduce the frequency of checking e-mail and to turn off e-mail notifications to limit distractions, which align with the research direction of both academic (Gupta et al., 2011; Iqbal & Horvitz, 2010; Kanungo & Jain, 2008) and popular literature (Ferriss, 2011; Morgenstern, 2011; Pash & Trapani, 2011) that this study suggests aligning with strategic task types. Half of the participants (8, 9, 10, 14, 15, 16, and 17) usually read e-mail frequently and use notifications, both recommendations for the tactical week of this study.

Table 7. Percentage of Compliance with Weekly Requests and Compliance When Matching or Not Matching Participant's Usual Style.

Participant #	Strategic week			Tactical week		
	Low reading frequency	No notifications	Full week compliance	High reading frequency	Using notifications	Full week compliance
1	100	100	100	75	25	25
2	100	100	100	67	100	67
3	0	100	0	25	75	25
4	100	50	50	100	100	100
5	100	100	100	100	100	100
8	0	0	0	100	100	100
9	67	100	67	100	100	100
10	100	33	33	100	100	100
11	50	100	50	75	100	75
14	100	25	25	100	100	100
15	100	100	100	50	100	50
16	67	67	67	67	67	67
17	100	100	100	75	100	75
18	0	100	0	33	67	33
Average	70	76	56	76	88	72
Matching usual style	33	88	-	86	91	85
Not matching usual style	80	73	56	42	81	61

Note. A shaded gray cell indicates the participant's usual style. *N* per cell ranges from 2 to 4, depending upon the number of surveys to which the participant responded during each week.

“Full week compliance” indicates the percentage of time for which the participant reported compliance with both requests at the same time (e.g., the request for both use of notifications and frequency of e-mail use). Overall, the participants complied with both requests of the study 56% of the time during the strategic week and 72% of the time during the tactical week. Full compliance with the requests of the study proved difficult to achieve: only five participants reported full compliance in the strategic week, and only

six reported full compliance in the tactical week. In other words, only five participants and six participants, respectively, were able to comply with the request made each of the two weeks 100% of the time. The higher overall compliance during that tactical week was expected because the requests aligned well with most of the participants' usual styles. Three participants did not report full compliance with either request during the strategic week, but all participants achieved some level of compliance during the tactical week. Remarkably, two participants (15 and 17) fully complied with the styles during the strategic week, even though compliance involved the use of styles that were opposite to their usual style.

Compliance with the request for low e-mail reading frequency during the strategic week (70%) was slightly lower than the compliance with the request for frequent e-mail reading during the tactical week (76%). Three participants reported no compliance with infrequent e-mail reading during the strategic week; this subgroup included two participants who reported their usual style as reading e-mail infrequently. In contrast, all the participants reported at least partially complying with the request to read e-mail frequently during the tactical week. The high compliance (88%) with the use of notifications during the tactical week was expected because most of the participants typically use notifications and, for those who do usually use notifications, the compliance was even higher (91%). Compliance (76%) with the request to turn notifications off during the strategic week was higher than expected.

The last two rows in Table 7 reflect the average compliance with the style requests when the request matches the participants' usual style compared to when the

requested style does not match their usual style. In all cases except the low e-mail reading frequency, participants reported higher compliance when the requested style matched their usual style. In the case of low e-mail reading frequency, only three participants reported this as their usual style and, during the strategic week when this style was the request, two of those three did not comply; thus, with little data on which to report, this result may be misleading. This result and the lack of participants reporting usual infrequent e-mail reading may point to days during which they needed more frequent e-mail contact or had difficulty adhering to the request. This result is concerning, given that reading e-mail less frequently is the most common recommendation for improving productivity and reducing stress among professionals (Ferriss, 2011; Gupta et al., 2011; Iqbal & Horvitz, 2010; Kanungo & Jain, 2008; Morgenstern, 2011; Pash & Trapani, 2011).

Weekly Data: Compliance Compared to Usual Work Task Types

Table 8 combines the information from Figure 10 and Table 7 and indicates the participants who fully complied with the requests for each study week and alignment with the type of work tasks they perform. Only two participants (2 and 15) report doing more than 50% strategic task work, on average. There is little overlap with full compliance to study week requests and alignment with reported work task type. Only Participants 2 and 15 complied with the study requirements during the strategic week and do work that is more strategic than tactical. Conversely, many participants (4, 5, 9, 10, and 14) complied with the study requests during the tactical week and do work that is

more tactical than strategic. Only one participant, Participant 5, reported compliance with the requests for both study weeks and, thus, is noted on both top lines of this table.

Table 8. Alignment for Full Study Compliance and Usual Work Task Type Composition, by Participant Number

Participant #	Strategic	Tactical
Full compliance (by study week)	1, <u>2</u> , <u>5</u> , 15, 17	4 , <u>5</u> , 8 , 9 , 10 , 14
Work task alignment (> 50%)	2 , 15	1, 3, 4 , 5 , 8 , 9 , 10 , 11, 14 , 16, 17, 18

Note. **Bold numbers** indicate a participant whose work task type aligns with the assignment for the week when he or she complied fully, and the underlined number shows the one participant who fully complied in both weeks.

Weekly Data: Productivity and Stress Related Measures

In each of the surveys, participants were asked to report five measures, each using a 5-point Likert-type scale, as follows:

- Thinking over the day, how productive was your work day? (5 = excellent, 4 = good, 3 = average, 2 = poor, 1 = terrible)
- How true is this statement? Today, I felt satisfied with my productivity. (5 = strongly agree, 4 = somewhat agree, 3 = neither agree or disagree, 2 = somewhat disagree, 1 = strongly disagree)
- How true is this statement? Today, I accomplished the most important tasks I needed to. (5 = strongly agree, 4 = somewhat agree, 3 = neither agree or disagree, 2 = somewhat disagree, 1 = strongly disagree)
- Thinking over the day, what was your highest stress level? (5 = very high, 4 = high, 3 = moderate, 2 = low, 1 = very low)

- Thinking over the day, what was your average stress level? (5 = very high, 4 = high, 3 = moderate, 2 = low, 1 = very low)

The first three measures are related to productivity; an increase in score is favorable. The last two measures are related to stress levels; a decrease in score is favorable. Many of the measures from the surveys, such as those just described, are ordinal data. From a pure statistical standpoint, ordinal data is not numeric data and as such traditional parametric statistics and data analysis techniques should not be employed. Fortunately, many offer solutions for analysis, including using median values (Stevens, 1946). Stevens (1946, p. 679) even suggests that there may be benefits from ignoring the limitations of this scale and the use of medians, “...for this ‘illegal’ statisticizing there can be invoked a kind of pragmatic sanction: In numerous instances it leads to fruitful results”. Further supported by contemporary advice (Robson, 2011, p. 421) “.... do not let it inhibit you from carrying out simple statistical analyses..... provided it seems likely to shed light on what the data are trying to tell you” and the use of averages in similar work by Kushlev and Dunn (2015). Thus, throughout this paper when it helps the readers make sense of the data, simple statistical calculations, such as averages and percentage differences, were performed and presented. When an average is used, the differences between the measures of the ordinal scale are assumed to be equal and the data are treated as if the data used an interval scale. In some cases, the median is shown along with the maximum and minimum value to illuminate the richness of the spread of the data.

Table 9 shows the differences between the mean scores for the strategic and baseline study weeks for these five measures. Given the variation in compliance with the study requests, as shown in Table 7, the differences in these scores are provided by level of compliance with the requests for the week, indicating those who complied with the requests for the week at least 50% of the time and those who complied with the requests for the week less than or equal to 50% of the time. All the data for each measure were averaged by week and then the difference between the weeks is indicated by level of compliance. A positive number indicates a favorable change or improvement for the three measures related to productivity, with the assumption that higher productivity is favorable. Likewise, a negative number indicates a favorable change or improvement for the last two measures related to stress levels, with the assumption that lower stress is favorable. Furthermore, given the responses were provided using a 5-point scale, a full point difference equates to a 20% change in score, and a half a point difference equates to a 10% change in score.

Table 9. Comparison of Means for Measures Between the Strategic and Baseline Study Weeks for Three Measures of Productivity and Two Measures of Stress

Strategic - baseline						
Compliance (%)	<i>n</i>	Productivity level	Satisfied w/ productivity	Important tasks done	Highest stress	Average stress
> 50	7	1.6	0.2	1.1	0.1	-0.8
≤ 50	7	-0.8	-3.8	-0.7	-0.3	-0.8

The participants who complied more than 50% of the time reported favorable improvements in the measures related to performance (productivity, getting the most important tasks done, and satisfaction with their productivity), whereas the participants

who did not comply at least 50% of the time reported unfavorable changes in all three of the productivity related measures. Those who complied more than 50% of the time reported a reduction in average stress and a slight increase in the highest stress. Those who complied less than 50% reported the same reduction in average stress and a slight reduction in the highest stress. Of all the changes in Table 9, the changes with values of 1 or greater are of interest—specifically, for those who complied, the favorable change in productivity and getting the important tasks done and, for those who did not comply, the unfavorable reduction in satisfaction with productivity.

Table 10 shows the same mean differences as Table 9, but between the tactical and baseline weeks. For those who complied more than 50% of the time, all five measures indicated favorable, significant improvements. Those who complied 50% of the time or less did experience a favorable improvement in productivity, but the scores for the other measures were unfavorable, flat, or very slight.

Table 10. Comparison of Means for Measures Between Tactical and Baseline Study Weeks for Three Measures of Productivity and Two Measures of Stress

		Tactical - baseline				
Compliance (%)	<i>n</i>	Productivity level	Satisfied w/ productivity	Important tasks done	Highest stress	Average stress
> 50	10	2.8	1.3	1.4	-1.4	-2.2
≤ 50	4	1.7	-0.2	0.0	0.8	-0.3

Given that the scores for the measures are ordinal data, using the difference between the means for the study weeks may be indicating a change that is not as favorable as was really experienced by the participants, thus analysis was also performed with median values. Figure 11 shows the median value for the baseline and strategic

weeks for those participants who complied more than 50% of the time as well as the minimum and maximum measures during those weeks. The percent of work that is strategic—the average from Figure 10—is also shown in parenthesis next to the participant number. As a reminder, note that the scales for the productivity and stress measures are reversed; an increase in productivity and a decrease in stress are favorable changes. Thus ideally, participants' productivity improves and stress declines in the strategic week, as compared to the baseline week because the participants attended to e-mail only a few times a day and they turned off e-mail notifications, allowing greater focus and less interruptions. Although none of the participants achieved this ideal favorable change, fortunately none of the participants experienced the exact opposite, a reduction in productivity and an increase in stress. Only two participants (5 and 15) show improvements in productivity, however their stress level remained the same. Conversely two participants (1 and 16) experienced a reduction in stress but their productivity levels remained the same. Five of the seven participants experienced either neutral or favorable changes.

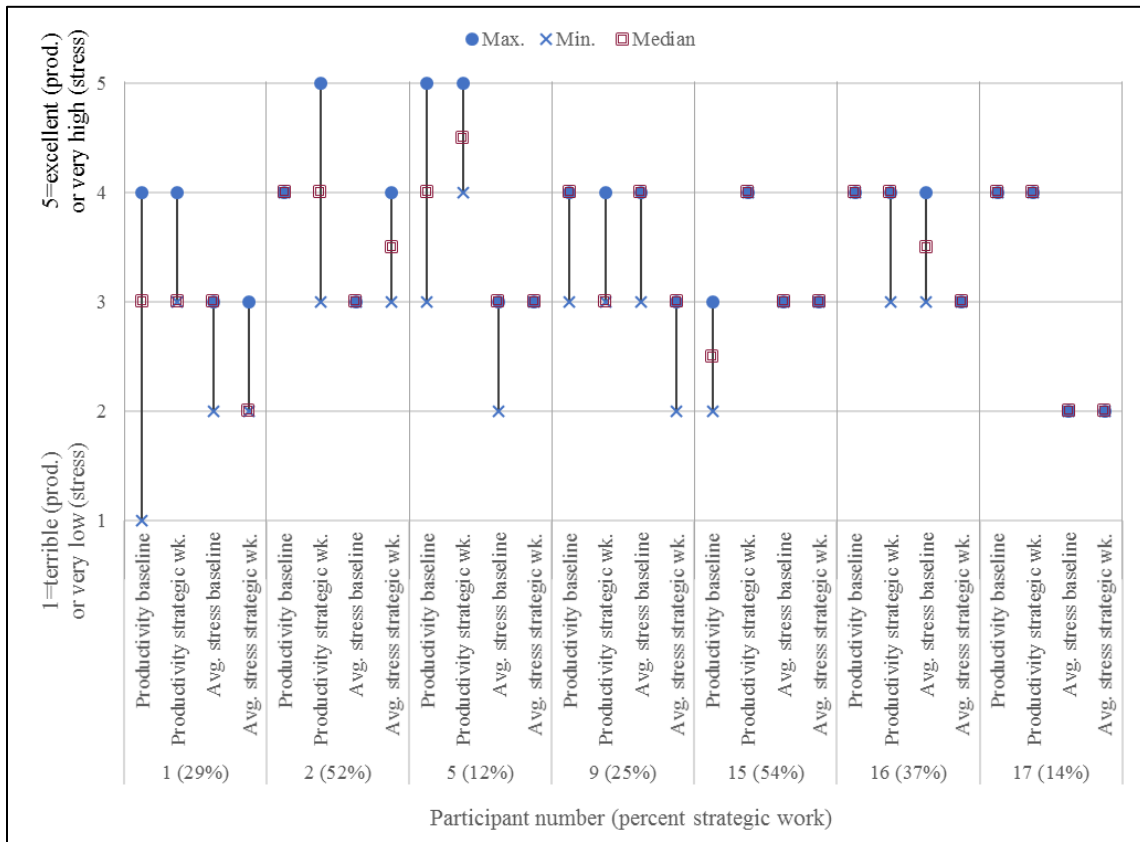


Figure 11. Participant scores for productivity and stress during baseline and strategic weeks for those who complied more than 50% of the time.

Similarly, Figure 12 shows the median scores for the baseline and tactical weeks for those participants who complied with the requests for the week more than 50% of the time as well as the minimum and maximum measures during those weeks. The percent of work that is tactical in nature, 100 minus the average from Figure 10, is also shown in parenthesis next to the participant number. Similar to the data from the strategic management practices although none of the participants achieved the ideal favorable change of a productivity increase and reduction in stress, fortunately none of the participants experienced the exact opposite, a reduction in productivity and an increase in stress. Three participants (4, 11, and 14) show improvements in productivity, however stress level remained the same for Participant 4 and the stress level increased for the other

two (Participants 11 and 14). Three participants (8, 9, and 16) experienced a reduction in stress but their productivity levels remained the same. In this condition, none of the participants reported a reduction in productivity. Seven of the ten participants experienced either neutral or favorable changes.

Interestingly, the participants used more of the scale options during the tactical week. During this week, all five levels of productivity were used, and four of the five levels of average stress were reported; none of the participants reported very high stress. Whereas during the strategic week only three of the stress levels were used, with none of the participants reporting very high or very low stress. The use of more of the scale in the tactical week may be the reason that the mean values from Table 10 show greater differences. Even with greater use of the scale during the tactical week, the median productivity scores for those who complied greater than 50% of the time were the same for both the weeks in both cases. The median value for the productivity measure during all the study weeks was good. Similarly, the median daily stress levels were the same, moderate, throughout all the study weeks.

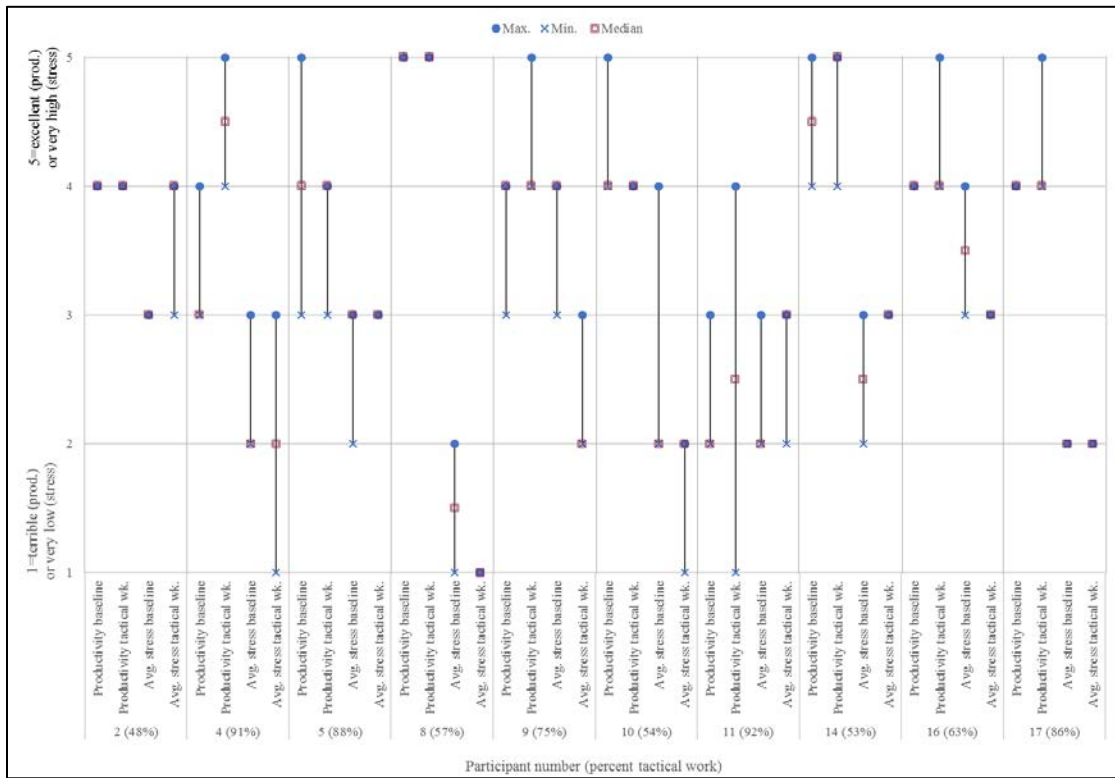


Figure 12. Participant scores for productivity and stress during baseline and tactical weeks for those who complied more than 50% of the time.

Participant Final E-mail Management Style Choice

An objective of the study was to understand what settings the participants would choose after having accommodated the weeks during which requests were made regarding how frequently they read e-mail and the e-mail notifications they used. This data was collected through the final survey and eleven of the participants answered this last survey. Participants were asked how often they had attended to e-mail and what their current e-mail notification settings were on the day they answered the survey, in the same way they had been asked the same questions throughout the other surveys. An additional question, one not posed on the previous surveys, asked participants if, in the future, they would change or adjust either the time attending to e-mail or the use of e-mail notifications.

Seven of the 11 participants who answered the final survey reported a change in the time attending to e-mail from the original survey, two indicated they increased their frequency of e-mail reading, and five reduced their e-mail reading frequency. Their reported actual results in this survey align with the answers the group gave to indicate whether they would change the frequency of attending to e-mail in the future.

Five of the 11 participants reported different e-mail notification settings from the original survey; one turned all notifications off, two moved from desktop notifications (see Figure 5) to the icon notification (see Figure 6), and two went from no notifications to using a desktop notification. The latter two might have simply not have taken the time to disengage the notifications because they had been instructed to engage the notifications in the last week of the study. Six of the 11 participants answered that they might change how they used e-mail notifications, thus one participant indicated a potential change but had not yet engaged in a change.

Discussion

Given the call for more strategic, focused work (Newport, 2016; Powers, 2010; Turkle, 2016), the data revealed there is an opportunity for the members of this sample to adjust their e-mail management strategies to allow more focused work time. Despite an attempt to balance the type of work tasks among the participants during the selection process, this sample remarked that much of their time is spent doing more tactical than strategic types of work. Participants reported a wide range of variation in the type of work they performed, although given the dramatic differences between what they initially believed about their work task distribution versus what they reported day to day over the

course of the study, they may not be aware of the differences between their perceived work composition and their actual work composition. Both scholarly and popular literature recommend reducing the frequency of checking e-mail and limiting distractions to reduce stress and improve productivity (Ferriss, 2011; Gupta et al., 2011; Iqbal & Horvitz, 2010; Kanungo & Jain, 2008; Morgenstern, 2011; Pash & Trapani, 2011), but none of the participants report both limiting e-mail processing frequency and limiting the use of notifications that lead to distractions. Notable findings of the study are that a low percentage of time (31%) is spent on strategic activities, there is high variation between the estimate of how the participants spend their time and what they report, and that none of them follow literature recommendations.

Hypothesis 1

An examination of Table 9 aids in addressing the first hypothesis regarding whether attending to e-mail less frequently and turning off e-mail notifications could have a favorable impact on productivity and stress levels for knowledge workers. Those participants who complied with the study requests reported favorable changes to all measures using means, except a very small increase in the highest stress level. However, Figure 11, using median values, shows that none of the participants experienced the ideal response of an increase in productivity and a decrease in stress at the same time. Thus, at the highest level examining averages, there is support for this hypothesis but the median data, by participant, do not indicate a favorable change when examining both productivity and stress at the same time.

Although this hypothesis questions only the changes associated with strategic work type e-mail management practices, the data from the tactical week could either support or refute such support. Thus, the data from the tactical week is examined as well. The averages in Table 10, indicate more favorable differences between the tactical week and the baseline week than during the strategic week and the baseline week. Similarly, Figure 12 shows that none of the participants experienced both improved productivity and reduced stress when examining the median values. As such, this hypothesis is not supported.

Hypothesis 2

Table 7 provides support to answer the question of whether participants would have higher compliance to the e-mail management styles if the styles requested for the week aligned with their usual e-mail management style. The last two rows of this table reflect tabulated percentage compliance when the requested modification matched (or did not match) participants' usual style. The participants complied better when the request matched their usual style, except for that of low e-mail reading frequency. It is perplexing that two of the participants who usually attend to e-mail infrequently were not able to comply at all with this request during the study. Perhaps both of these participants had urgent work situations during that week or answered the question in error. This result may point to the difficulty of attending to e-mail infrequently and support the reason why very few of these participants report this approach as a usual style. Thus, this hypothesis is partially supported as three of the four compliance levels were higher when matching the usual style of the participants.

Hypothesis 3

The last hypothesis investigates the outcomes of participants who shift their e-mail processing styles of reading frequency and use of notifications to match the type of work tasks they perform. This hypothesis is not as easily examined as the others. Further review of Table 7 along with Figures 11 and 12 offers guidance to help determine if support for this hypothesis is warranted.

Although none of the participants experienced the ideal pattern of improved productivity along with a reduction in stress levels, examining the work type task and changes for the participants can provide insight into this hypothesis. As shown in the parenthesis next to the participant number in Figure 11, two participants reported work task types of a strategic nature (2 and 15). Participant 2 reported work that is mostly strategic and indicated a regular habit of attending to e-mail infrequently, but acknowledged using notifications. Thus, for this study week, disabling notifications was a change this participant. Although a flat productivity level might be acceptable, an increase in average daily stress level is likely not. Figure 12 shows a similar pattern of flat productivity and an increase in average stress level for the data from the tactical week for Participant 2. Thus, data from this participant does not support any decision about the hypothesis.

Participant 15 reports the highest percentage of strategic work type of the entire study and acknowledged a favorable change in the median value for productivity and no change in average daily stress, likely a more palatable change. This participant usually attends to e-mail frequently and uses notifications; changing both these aspects from the

participant's usual working style did improve productivity. This participant's experience likely supports the hypothesis.

Next, Figure 12 shows the contributions from the tactical week data and none of the participants experienced the ideal change of improved productivity and reduced stress. Only Participant 4 reported improved productivity, with no change in average daily stress levels. Although Participant 4 favors the tactical e-mail management processing style of high reading frequency this participant does not use notifications and has one of the highest percentages of tactical work task types. Because these e-mail management strategies are a partial change for Participant 4, this experience partially supports the hypothesis. Thus, the data from those who report mostly tactical work tasks do not support the hypothesis. Combined with the limited support from other participants, the hypothesis that work task types aligned with e-mail management strategy styles is not supported in this study.

Participant Qualitative Comments

In final face-to-face meetings with each participant, most reported strong preferences for one method or another, suggesting that changing working habits can be perceived as difficult, and supporting the result that not every participant was able to comply with the study requests for changing e-mail management styles. Several participants clearly justified their work process and indicated their work environment did not easily support change. For example, one participant said, "I use e-mail as real-time communication throughout the day, so having e-mail notifications on and checking my e-mail regularly helps me stay on top of issues and discussions going on through the day."

Similarly, two participants mentioned needing to have e-mail notification on because they missed critical items without having them. However, several of the participants noted that they enjoyed knowing different options for e-mail notifications, and some of these participants chose only the icon notification during the final survey. This option might be perceived as a less intrusive notification, providing less immediate interruption of the flow of work, allowing the participant to self-interrupt when he or she desired a break in the work flow.

Others indicated they appreciated participating in the study because it helped them realize the effect and impact of the different working styles. One participant shared, “I don't like being interrupted for ‘petty’ things, so I appreciated working without e-mail notifications.” Six of the participants indicated they would limit or schedule time to attend to e-mail in the future. One participant said he or she would “use e-mail less as a ‘procrastination’ excuse” and turn off e-mail and the notifications to focus more on work.

Limitations and Future Studies

The low number of participants limits the generalizability of the findings; however, the literature supports studies with small sizes (< 10: Renaud et al., 2006; Siu et al., 2006; = 10: Venolia et al., 2001; < 20: Bellotti et al., 2003; Mackay, 1988; Mander et al., 1992; Siu et al., 2006; Whittaker & Sidner, 1996). Additionally, study participants represented a decidedly homogeneous group: they all have long employment with the same organization and almost all received education in engineering. As such, their experiences and work culture include little diversity. All study participants knew the primary author; this professional familiarity may have influenced their answers because

they might have not wanted to reveal any information or data they perceived might have an unfavorable impact on the author's perception of them and their reputation. Repetition of many of the study questions was employed to provide additional support for the outcome of the study. It was assumed that most participants would not be able to track the answers from day to day, thus repetition of the question should support higher quality answers.

The study limited questioning to the use of Microsoft Outlook and did not include use of newer electronic communication methods, such as instant messaging or texting. Future research could expand on this work by including other electronic communication modes, expanding the sample size for the study, and the length of the time the participants engaged in the study.

Conclusion

This mixed methods study of 14 knowledge workers, nine women and five men, reveals that the practices of these workers does not align with the recommendations from literature to encourage deep, strategic thinking. This work builds on Kushlev and Dunn's (2015) study by adding investigation of the type of work task types in which participants engage while modifying their e-mail reading frequency. Furthermore, this study adds to previous studies by adjusting e-mail notifications matched to the e-mail reading frequency with the goal of either allowing more undistracted, focused work time or providing real-time information.

The research question for which answers were sought was, "Could aligning e-mail management practices of reading frequency and use of e-mail notifications have an

impact on productivity and stress levels for knowledge workers? Would the type of work tasks in which the knowledge workers engage—strategic versus tactical—influence any impact on productivity or stress levels?” Perhaps. Some of the participants in the study who reduced the frequency of e-mail use and disabled e-mail notifications did show improved productivity and no change in stress during strategic week, despite expressing difficulty with the change. However, these measures were not that different during the tactical week when participants checked e-mail frequently and engaged notifications, leading to question the effectiveness of recommendations in the literature to use opposite e-mail management strategies.

Although many might assume these technical workers spend a good part of their day deep in thought, the data suggest quite the opposite. The majority of them report that their work is mostly tactical in nature. Furthermore, most of these participants engage in e-mail use all throughout the day and regularly have e-mail notifications enabled, providing constant interruptions in their work flow. These e-mail management strategies might explain the lack of time performing strategic work because the workers likely would not experience a long enough uninterrupted time to get in a “flow.” As artificial intelligence improves and more of this tactical work can be accomplished without human involvement, can these workers shift to doing more of the strategic work that requires more deep thinking? Are these workers performing more tactical work because tactical tasks are what the job requires, or it is because the tactical work is easier as it requires less focused attention?

The lack of compliance to study requests for changing e-mail management strategies suggests these strategies are not only a preference but are actually a habit (Habit, n.d.): a settled or regular tendency or practice, especially one that is difficult to forego. The software industry should take note of this information because it may be beneficial to consider the literature on habit change as they design PIM programs. Although most of the group expressed strong preferences for their original frequency of e-mail use and engagement of e-mail notifications, five of the participants reported they were engaging in e-mail less often at the end of the survey and three reduced or eliminated e-mail notifications, suggesting that the study experience may have helped these participants gain an understanding of the benefits they might garner if they change these habits.

Possibly the best recommendation was summed up by one of the participants when asked what, if anything, he or she would change going forward. The participant said, "I'll check e-mail as needed based on the day's activities." Changing the frequency of e-mail engagement and enabling or disabling e-mail notifications based upon the type of work that is done before a worker begins each day may be the best solution to provide improved productivity and reduced stress. However, the large variation in work content day to day experienced by these participants suggests that following one strategy all day may not be the best solution. Conceivably alternating between these strategies throughout the day as the work task type changes might also be a possible solution. To enable this modulating strategy, perhaps the software developers for e-mail tools, especially

Outlook, could make a “snooze” button to allow workers to easily turn off access or notifications for set periods of time.

Although this work does not provide a clear answer for how knowledge workers should align their e-mail management strategies to achieve optimal performance at work, some participants did experience some favorable improvements, but more importantly the experience itself provided self-learning for these participants. Using tools developed in the HCI community for self-experimentation with behavior changes may prove helpful in this application as well such as that by Lee, et al., (2017). Building on Kushlev and Dunn’s (2015) study, this work contributes in four ways. First, this work offers a glimpse of the work task type distributions of this sample of knowledge workers, revealing that most of their work is tactical rather than strategic. Second, with women comprising the majority of the sample, this study contributes to the body of literature on HCI. Most previous studies involved primarily male participants from similar technical workplaces. Third, the lack of compliance to the study requests shows the difficulty for knowledge workers to change their e-mail management strategies, which may have become habits. Last, none of these participants follow the recommendations of literature to reduce the frequency of attending to e-mail and use no notifications, a combination that would allow focused work times. This incongruity may provide a clue to unlock the mystery that might help knowledge workers find their own unique optimal way to accomplish their work.

CHAPTER 6

IT'S SIMPLE: DELIBERATE CONVERSATIONS CAN IMPROVE PROFESSIONAL COMMUNICATION IN THE ELECTRONIC AGE

Using case study methodology, this study examines the efforts of five teams to improve team members' electronic communication. This study reveals the value of the team engaging in a simple conversation about how they communicate with each other through electronic channels. Through a 90-minute facilitated discussion, these teams developed straightforward and easy-to-follow plans to achieve improved electronic communication. The process presented in this paper helped these teams report improvements in productivity, effective communications, and reduced stress. This study contributes by adding to the knowledge base of strategies to manage electronic communication in four ways: (a) including women as the majority of the study participants—a rarity in HCI literature, (b) using case study methodology, (c) examining team electronic communication “in the wild” using team members' natural work, and (d) providing concrete suggestions for knowledge workers to improve their electronic communication. These suggestions use the familiar “five *Ws* and how” framework as a scaffold to help knowledge workers improve team electronic communication.

Introduction

In 1945, Bush, a prominent engineer, inventor, and scientific administrator, predicted many contemporary devices, including the modern-day office and computer with his description of the *memex*:

A memex is a device in which some individual stores all his books, records, and communications, which is mechanized so that it may be consulted with exceeding

speed and flexibility. It is an enlarged intimate supplement to his memory. It consists of a desk, and while it can presumably be operated from a distance, it is primarily the piece of furniture at which he works. On the top are slanting translucent screens, on which material can be projected for convenient reading. There is a keyboard, . . . Otherwise it looks like an ordinary desk. (Bush, 1945, p. 106)

“As We May Think” (Bush, 1945, p. 101) expanded the ever-growing body of knowledge on approaches and tools to help the “thinking man,” scientists, professionals, and humankind access and understand the vast sum of human knowledge. Almost all the tools Bush predicted are represented among contemporary technology, but these tools have done little to unburden the thinking person from the enormous amount of knowledge available and the daunting task of understanding it. Although the 21st-century thinking worker has access to considerably more information than his or her counterparts did in 1945, the human ability to deal with that information has not improved to enable comprehension of the ever-expanding body of knowledge. These thinking workers report getting more electronic communication than ever, leading them to express feelings of stress about their ability to respond, and being overwhelmed due to this volume of electronic communication (Dabbish & Kraut, 2006; Jerejian et al., 2013; Kushlev & Dunn, 2015; Sumecki et al., 2011).

Bush’s (1945) thinking men align with Drucker’s (1959) knowledge workers, those who “think for a living” and use expertise in the primary pursuit of creation or application of knowledge (Davenport, 2005, p. 23). Knowledge workers are similar to *professionals* (Professional, n.d.): they engage in specific activities that require some level of education. Other terms for knowledge workers are “office workers” and “white collar worker[s]” (Sinclair, 1919, p. 12)—people who wear white-collared shirts, like the

boss, and work in an office. Recognizing that these latter terms may require less education or expertise, these terms are used interchangeably in this paper because all these individuals work in an office setting, use a computer to perform the majority of their job, and likely receive a substantial volume of electronic communication.

There are more than 66 million such workers in the United States (U.S. Census Bureau, 2015) and more than 330 million worldwide (Dobbs et al., 2012). These numbers are increasing as organizations encourage their workers and those in the pipeline to achieve higher levels of education to fill skill gaps. Given that there will be more knowledge workers in the future who will continue to receive increasing volumes of electronic communication, strategies to manage this volume of communication that reduce stress or improve productivity among this population of workers could be valuable.

Although popular literature (Allen, 2008; Ferriss, 2011; Pash & Trapani, 2011) offers many practical, logical solutions to deal with the onslaught of electronic communications, most of these solutions focus only on the individual. However, in the 21st-century professional working environment, individuals rarely do their work entirely on their own; work is mostly accomplished in teams (Albers Mohrman, Tenkasi, Lawler, & Ledford, 1995; Salas, Cooke, & Rosen, 2008). As such, there is a need to develop tactics and strategies to help professionals working in teams to manage their electronic communication.

This study investigates whether processes for teams to discuss and develop protocols for communication (e.g., use e-mail for this type of information and use instant

message (IM) for another type, or teammates agree to use a high priority flag if a response is needed in a certain time frame) can help teams improve their electronic communication, with improvement measured through reduced stress or improved productivity. Natural work teams, those who create their own unique electronic communication processes, provide their experiences to help answer the following research question: How can team electronic communications be improved to increase perceived team productivity and reduce the stress perceived by team members?

Background

In the 1940s, when Bush (1945) wrote about how people think, the daily business of receiving and sharing information involved a few simple communications methods and mediums: paper-based (typed memorandums, books, telegraphs) material, face-to-face communication, telephone calls, radio, and perhaps a rare television show. Knowledge workers in the 21st century have many more modes of communication, thanks to computerized technological advances: conference and video calls, IM, e-mail, social media, podcasts, audio books, webinars, and many more. According to Pew Research (Purcell & Rainie, 2014, para. 1), for today's knowledge worker, "life on the job means life online": 87% of working adults in the United States report using e-mail or the web daily. Half of these working adults report feeling more productive because of this increased communication and connectivity, although the increased connectivity gives them flexibility in when they work, they end up working more hours (Purcell & Rainie, 2014).

Although electronic communications have been exchanged (Van Vleck, 2012), and early Internet connections available (Huurdean, 2003) since the mid-1960s, it was not until the mid-1990s that electronic communications as we know it began its steep growth and widespread adoption in the business environment (Reimer, 2005). The forerunner in electronic communications has been e-mail, the volume of which surpassed “snail mail” delivered by the USPS in 1996 (Stephens, 2007). Current data indicate that the average office worker receives 121 e-mails per day (KnowBe4, 2017, para. 7), which equates to an e-mail every 4 minutes. Almost half the global population is connected, and “unplugging is nearly impossible” (Rainie & Anderson, 2017, p. 7). The same researchers who sent the first e-mail message also laid the technical groundwork for the revolution in communication through the use of messaging, starting with simple text messages using Short Message Service (SMS), then extended with Multimedia Messaging Service (MMS), and most recently expanded to include Social Networking Service (SNS). SNS applications such as Facebook Messenger, Twitter, Kik, WeChat, Viber, Snapchat, and WhatsApp result in easy connection with others through both computer and mobile access (Faklaris & Hook, 2016). Much of knowledge workers’ messaging is performed on business-related, computer-based platforms but the sheer volume of users and messages on popular applications is staggering: for example, WhatsApp reports over 1 billion active users and 60 billion messages sent daily (Facebook, 2018).

Unplugging is nearly impossible. New sources of electronic communications emerge at a high rate, and professionals need to figure out how to organize the information they share in groups. In addition to personal information management (PIM),

professionals must now learn how to wrangle yet another set of data: group information management (Bergman & Whittaker, 2016). Literature asserts that management of electronic information is not a single-person sport; completing the tasks that arrive via e-mail often requires information and/or input from others (Bellotti et al., 2003; Gwizdka, 2002; Markus, 1994; Tyler & Tang, 2003; Whittaker et al., 2006). Working with others results in a process known as “interleaving” of task management (Bellotti et al., 2005), meaning that a response must be received to complete a task, and now the user must simultaneously keep track of these outstanding tasks while waiting for the reply. This interleaving and interdependence on others for file storage and data sharing magnify the amount of work, tasks, and information to which a professional must attend to accomplish the work, particularly in teams.

Methods

Study Design

This applied real-world research uses existing natural working teams who experience interleaving tasks in which one team member depends upon another for information or action to complete a task. These coworkers collaborate as a natural team in a normal course of business, as opposed to teams created for testing purposes (e.g., concocted). Assisting these teams in their working environment provides real-world “in the wild” situations (i.e., teams are working in their natural working setting) and the resulting data can benefit many other professionals because in-the-wild research is not often performed (McGrath, 1984; Salas et al., 2008). Natural working teams are unique in that they reflect a range of circumstances, resulting in high levels of diversity because the

teams vary in many ways: task responsibility, assignments of a permanent (e.g., a team that supports a product line or supplier) or temporary (e.g., created to solve a problem or design a new product) nature, size, and geographic locations (e.g., co-location or multiple physical locations). This diversity lends itself to case study research methods. An embedded, multiple case design is employed for this study (Yin, 2014, p. 50), with each team representing a case and each team member representing an embedded unit of analysis, as shown below in Figure 13.

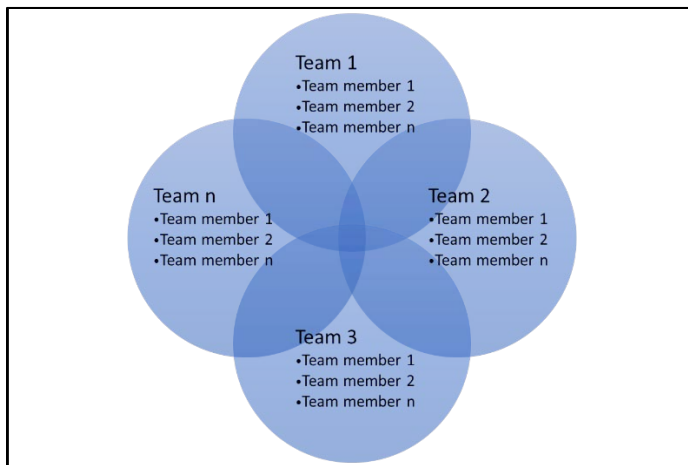


Figure 13. Embedded case study design.

Procedure

Five teams participated in this study through four phases, as outlined in Figure 14. Each team was administered an initial (pre-meeting) survey to allow for the collection of baseline data and understand challenges for the team. Next, the team participated in a team/focus group meeting to create a unique electronic communication plan, addressing any concerns or shortfalls the team revealed during the pre-meeting survey data or the meeting. After the meeting, the team implemented their unique plan for at least 4 weeks. During this implementation phase, four surveys were administered to collect data on team

members' use of the plan, and feedback was provided to the team members on what was working well and what needed to improve. Then, a final survey was administered to collect post-implementation data, allowing for comparisons to the baseline data from the pre-meeting survey. Survey questions were reviewed with a beta-test audience, similar in composition and background to the group under study, to ensure the questions were worded clearly and the typical answers align with the desired outcomes. All surveys were administered online through Qualtrics, an online customizable survey tool.

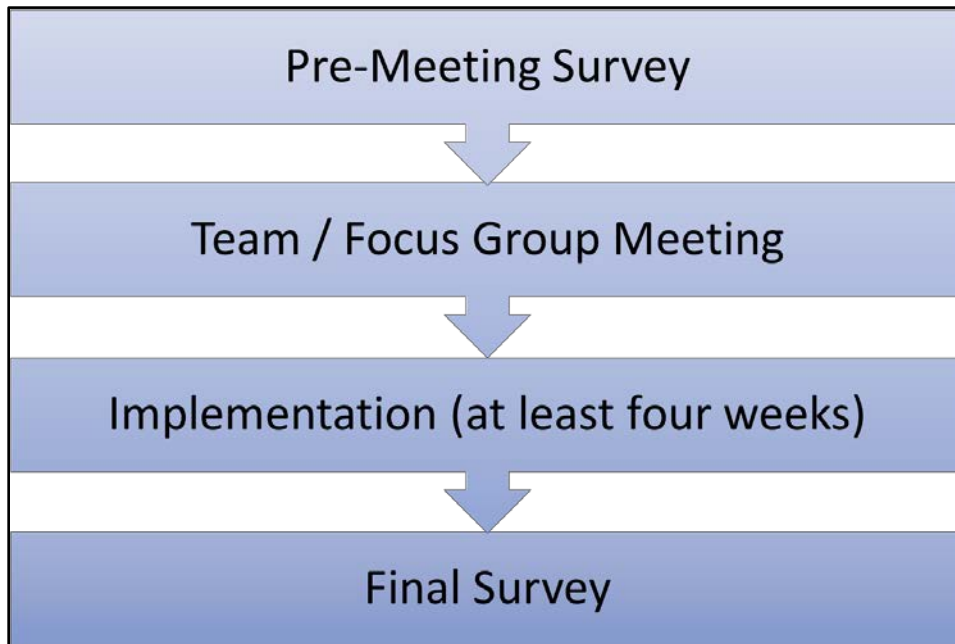


Figure 14. Four study phases provided the foundation of the study procedure.

Pre-Meeting Survey

The pre-meeting survey captured information about the team members' current communication practices and perceived effectiveness of those practices, which served as a starting point for the discussion in the focus group meetings. This survey included questions on multiple types of communication, including non-electronic methods, to avoid limiting the team to any specific methods. However, throughout recruitment,

potential participants were advised that the topic of the study would be electronic communication. The pre-meeting survey data served as a baseline against which to compare data collected in the weekly and/or final surveys. General demographic data were collected as part of this survey, as well as data about the participant's role on the team, where the participant spends working time, and his or her educational background.

Team/Focus Group Meeting

Following the pre-meeting survey, the teams participated in a facilitated team/focus group meeting to create their unique electronic communication plan. Some of these meetings were held face to face and some virtually; most of the meetings were scheduled for 90 minutes. In keeping with participants' agreements, these meetings were audio-recorded; the audio recordings later served as reference for the research team. These carefully planned and skillfully facilitated meetings (Lunt & Livingstone, 1996; Morgan, 1997; Newman, 2002; Rosenbaum, Cockton, Coyne, Muller, & Rauch, 2002), although not the strict focus group meetings originally developed by Merton and Lazarsfeld (Newman, 2002), did align in spirit with the original definition, particularly through creating a space for participants to openly discuss their communication processes, similar to Morgan's (1997, p. 22) description: "Focus groups are fundamentally a way of listening to people and learning from them. Focus groups create lines of communication."

These meetings used participant data to start the conversation and relied on the participants themselves to identify problem areas. Literature provides ample support for such expanded use of focus groups in a variety of fields and aims (Lee, Smith-Jackson, Nussbaum, Tomioka, & Bhatkhande, 2004: use of product-interactive focus groups for

requirements capture and usability assessment; Lunt & Livingstone, 1996: using focus groups to simulate ethnographic processes of talk and argument; Salvador & Howells, 1998: focus troupe, dramatic vignettes using a new product concept as a prop or dramatic element).

These facilitated meetings followed a three-step process for focus groups (modified from Morgan, 1997, p. 23):

1. Identify the information the participants need to say (i.e., “Here is what isn’t working”) via the pre-meeting survey data.
2. Create the conversation among the team participants (i.e., “How might we work better?”).
3. Summarize what was heard from the team participants (i.e., “Here is what we will change”) via the implementation plan.

The focus group meetings were purposely structured to allow any type of problems around electronic communication to emerge. Data from the pre-meeting survey provided a foundation for discussion, but the teams drove the discussion of issues and solutions. Each meeting afforded teams the latitude to discuss any issues of concern, but facilitation guidance encouraged the team members to address at least one aspect of concern about electronic communication.

During the focus group meetings, examples of best practices were shared with the team participants around their areas of concern. Examples included the following:

- Use the *to:* field in e-mails to signify action needed, and use the carbon copy (*cc:*) field to provide passive awareness (Fussell et al., 1998; Layman, Williams, Damian, & Bures, 2006).
- Ensure e-mail communication has a clear and consistent “question” format to allow for answers, particularly when communicating asynchronously (Layman et al., 2006).
- Be specific with the expected action, if any, when you copy someone (Van Zanten, 2014).
- Be concise and direct, and send the e-mail at the right time for the recipient to be most likely to open it. Create the right level of urgency in the subject line, and ensure the length of the message fits the need of attention (Polyakov, 2016).
- Understand the challenges with shared folders. The retrieval rate with shared folders is 5 times worse than with those folders individuals create for their own use. Group storage folder structures tend to be deeper (to help others understand and reduce “clutter”). With personal storage, the user “knows” the document; with group storage, the user does not (Bergman & Whittaker, 2016).
- Use instant messaging (IM) for both coordinating activities (e.g., scheduling) and for working together in collaborative activities. While communications about coordinating tend to be brief and conversations about collaborative work tend to be longer and fast paced, IM works well for both types of

communication. Work interruptions by overuse of IM can undermine productivity. To mitigate the impact on productivity, users should consider modulating when they log into IM to match the schedule of when they are willing to be interrupted (Leskovec & Horvitz, 2008).

Implementation Surveys

Following the focus group meeting, the plan for the team was provided electronically, with a suggestion to print out and display the plan in a prominent location (e.g., next to each team member's computer) for easy reference. Each periodic survey during implementation began with a summary of the plan to remind the participants about their team plan. If at least three participants responded to the periodic survey, early the following week, a summary of the data was provided to the team members for adjustments. After the team used their plan for at least 4 weeks, a post-study survey was administered to collect comparison data. Table 11 summarizes the number of surveys provided during each phase of the study.

Table 11. Number of Surveys Presented to Participants by Study Phase

Study phase	Surveys administered (<i>n</i>)
Pre-meeting	1
Implementation	4
Final	1

Participants

Open calls for participation and snowball sampling (Robson, 2011) resulted in recruitment of 28 employees of a global technology company with more than 75,000 employees and revenue in excess of \$20 billion (per the company website) as participants

in this study. For this study, the definition of a team was guided by that of Salas, Dickinson, Converse, and Tannenbaum (as cited in Fowlkes, Lane, Salas, Franz, & Oser, 1994, p. 4):

A distinguishable set of two or more people who interact dynamically, interdependently, and adaptively toward a common and valued goal/objective/mission, who have each been assigned specific roles or functions to perform, and who have limited life-span membership.

Potential participants were provided the following definition of a team during the recruitment process:

Three or more people, working together towards a common goal or objective. The teams can be formal, meaning the team is designated as the Product XX Development Team or Process YY Improvement team, or informal, a group of people who work together to achieve a goal.

Although Salas et al. (as cited in Fowlkes et al., 1994) define a team as a minimum of two people, the minimum for this study was set at three people per team to ensure the study of electronic communication beyond that of just two people, which could be more like studying individuals communicating with each other. The upper limit for team size was set at 10, given the suggestion of 10 was a reasonable upper limit to facilitate in discussion through the focus group meeting with one facilitator (Govindarajan & Gupta, 2001).

The relevant business leaders at the primary author's employer granted permission for the study after the primary author/researcher received approval from the Arizona State University Institutional Review Board (IRB number STUDY00007101). Timing of team participation was staggered to allow for scheduling of the team meeting and maximum participation of the team members. During the team meeting and in the surveys, participants were requested to provide times of expected absence due to

vacation; surveys were scheduled to be administered around team member absences, if possible. Reminders were sent out for each survey. Some participants provided better compliance and response to the surveys than did others.

This organization does provide resources for team leaders and managers to utilize when starting new teams such as communication guides, roles and responsibility templates, and processes to manage team tasks. However, these tools are hardly ever used for teams with ongoing responsibility as members leave the team and others join. Occasionally, when a team is newly created, or an employee takes on a new management role, HR is engaged to use these tools with the team, but this is more of an exception rather than a rule in this workplace culture. Thus, even though tools are available most of the participants have not used them in methods as proposed in this study.

Results

Participant Demographics

Participants were mostly individual contributors who had no other employees reporting to them because they are not managers, female, and highly educated, with 93% having at least a bachelor's degree, predominately in engineering. These participants are the primary author's work colleagues; their level of participation and the answers they provided may have been influenced by a prior relationship. Participants may have answered indicating compliance when they had not complied, or they may have provided more favorable answers to questions about their own performance. Repetition of the same questions attempted to offset the latter potential influence. These prior working relationships varied by team, as follows. Team 1 included no members known to the

primary researcher prior to the study. For the other teams, the percentage shown indicates the members known by the primary researcher prior to the study, Team 2: 11%; Team 3: 20%, Team 4: 50%, Team 5: 100%. Table 12 outlines the basic demographic information about members of the teams.

Table 12. Participant Demographic Information

Team	Number on team	Women	Men	Individual contributors	Managers	Avg. direct reports	Avg. team age	Avg. time on team (months)
1	6	6	0	5	1	6	39	26
2*	9	8	0	6	2	4	30	16
3	5	3	2	4	1	1	37	8
4	4	2	2	4	0	-	28	21
5	4	1	3	2	2	5	50	12
Total or average	28	20	7	21	6	4	36	17

Note. *One participant from Team 2 did not fill out the requested demographic information

The timing of the study was modified to accommodate team activities, holidays, and expected frequency of communication. Members of Teams 1 and 4 communicate frequently, sometimes daily. Members of Team 3 typically at least weekly, and members of Team 5 communicate between weekly and monthly. The overall study time frame for these four teams varied between 6 and 8 working weeks. Team 2 is a cross-company team that communicates most often monthly; thus, the overall time frame for this team was extended to 12 weeks to incorporate data from more communication between teammates over the course of the study.

Most of the team members work in a primary office location in North America, with one participant working in Europe. Table 13 provides detail on the percentage of time the team participants work at different physical locations and the total number of

locations at which members of each team work and overall. Team 1 includes members who have offices in a few different company locations or who work from home in different cities; this team rarely has face-to-face team meetings. The members of Team 2 all reside in the same metropolitan area, but they work in three different company campus locations; they plan bimonthly face-to-face meetings. The members of Team 3 have offices in three different company campus locations; most of the members reside within the same metropolitan area, and one resides in Europe. Team 3 has periodic face-to-face team meetings. Although both Team 4 and Team 5 include only one primary site among the team members, the two teams have different office arrangements. The members of Team 4 sit in very close proximity to each other, whereas the members from Team 5 sit in different buildings within the same site.

Table 13. Work Locations of Team Members

Participant	Primary office (%)	Another company office location (%)	Work from home (%)	Other office location (i.e., supplier; %)	Other (%)	Total team sites (<i>N</i>)
1	58	0	42	0	0	3
2	89	5	6	0	0	3
3	83	12	5	0	0	3
4	88	3	3	7	0	1
5	75	3	11	11	0	1
Average	78	4	15	3	0	8

Throughout the course of the study, each participant received six surveys. Half of the participants filled out all six surveys; overall, 85% of the surveys were completed. Six participants (from Team 1, Participants 4 and 6; from Team 2, Participants 1, 5, 6, and 9) did not complete both the pre-meeting survey and the final survey. Data from these

participants were removed from the data set used for the remaining analysis. The final data set contained data from 22 participants.

Thus far, in this study, we have not distinguished between a team and a group. As noted by S. G. Fisher, Hunter, and Macrosson (1997), most literature uses these terms interchangeably, as does this company. These two terms have considerable common ground; however, a differentiating descriptor used to describe teams is *well-rounded*, potentially implying that members bring different skills to bear to the team and, in a group, this may not be the case (S. G. Fisher et al., 1997) because group members may have similar skills. This view is supported in the Salas et al.'s (as cited in Fowlkes et al., 1994, p. 4) definition:

A distinguishable set of two or more people who interact dynamically, interdependently, and adaptively toward a common and valued goal/objective/mission, who have each been assigned specific roles or functions to perform, and who have limited life-span membership. (*emphasis added*)

For this study, job title offers insight into the member's role on the team or group, and thus serves as a surrogate measure for the differences in roles within teams. Table 14 shows the percentage of members of each team who have different job titles. With this lens, it is apparent that Team 5 acts as a team because all members have different roles, whereas on Teams 1 and 4, less than 25% of the participants have different roles; Teams 1 and 4 are more likely groups rather than teams. On both Teams 2 and 3, most of the members fill different roles, but there is some overlap in roles. Regardless of this distinction between the teams, we present the results of the study using the term team.

Table 14. Team Participants with Different Job Titles

Team	Different job titles (%)
1	17
2	63
3	60
4	25
5	100

Pre-Meeting Communication Use and Effectiveness

Each participant provided initial data through the pre-meeting survey prior to the team meeting. From these data, an understanding was achieved regarding what methods of communication the team was using, the frequency of use, as well as the effectiveness of those methods. Given the goal of open-ended problem solving for communications of the team, a large number of communication methods were included in this initial survey ranging from face-to-face meetings to file sharing. Table 15 summarizes these initial answers by team members; for each, a mean answer is provided by team. Communication frequency was scored on an 8-point Likert-type scale (1 = *multiple times per day* and 8 = *never*). Communication effectiveness was scored on a 5-point Likert-type scale (1 = *extremely effective* and 5 = *not effective at all*). These scales are different to accommodate a finer degree of communication frequency greater than is available through the tradition 5-point scale used in most study measures. Many of the measures from the surveys, such as communication frequency and effectiveness just described, are ordinal data. From a pure statistical standpoint, ordinal data is not numeric data and as such traditional parametric statistics and data analysis techniques should not be employed. Fortunately, many offer solutions for analysis, including using median values

(Stevens, 1946). Stevens (1946, p. 679) suggests that there may be benefits from ignoring the limitations of this scale, “...for this ‘illegal’ statisticizing there can be invoked a kind of pragmatic sanction: In numerous instances it leads to fruitful results”. Further supported by contemporary advice (Robson, 2011, p. 421) “... do not let it inhibit you from carrying out simple statistical analyses.... provided it seems likely to shed light on what the data are trying to tell you”. Thus, throughout this paper when it helps the participants or readers make sense of the data, simple statistical calculations, such as averages and percentage differences, were performed and presented. When an average is used the differences between the measures of the ordinal scale are assumed to be equal and the data are treated as if the data used an interval scale. In some cases, the median is shown along with the maximum and minimum value to show the richness of the spread of the data.

Given that physical proximity might influence the frequency and types of communications methods, the number of work location sites from Table 13 are included below the team name. All teams report that face-to-face meetings are the most effective; however, most of the teams do not meet face to face frequently. Team 4 has the most frequent face-to-face meetings of all the teams, but the members of this team sits in very close proximity to each other and, surprisingly, face-to-face meeting represents only the third most frequent communication method for them. All the teams indicate that e-mail is the top or one of the most frequent communications methods for the team, but e-mail rates as one of the least effective methods for the teams. The authors did not define

effectiveness for the participants; rather, the participants self-assessed effectiveness according to their own perceptions.

Table 15. Averages for Team Communication Frequency and Effectiveness

Method	Team 1 (3 sites)		Team 2 (3 sites)		Team 3 (3 sites)		Team 4 (1 site)		Team 5 (1 site)	
	Freq.	Effect.	Freq.	Effect.	Freq.	Effect.	Freq.	Effect.	Freq.	Effect.
Face-to-face meetings	4.5	1.7	6.0	1.9	4.0	1.4	2.8	1.5	4.0	1.3
Text	5.8	3.4	7.5	2.7	7.8	2.5	4.0	2.5	4.8	3.8
Phone call	4.7	2.2	7.0	2.3	4.8	2.3	5.0	2.0	4.5	2.5
Virtual meetings	1.7	2.2	5.4	2.5	2.8	2.2	3.8	2.8	4.0	3.0
E-mail	1.3	2.7	3.5	3.0	1.6	2.6	1.8	3.5	2.0	3.0
File sharing	4.3	2.6	4.6	3.0	5.6	2.0	3.0	3.8	6.3	4.0
Instant messaging	1.3	2.0	5.1	2.6	4.4	2.8	2.0	2.8	3.0	3.0

Note. Cell colors indicate rank within the column, with green indicating the lowest (most favorable) score and red indicating the highest (least favorable) score. Communication frequency 8-point scale: 1 = *multiple times a day* and 8 = *never*; communication effectiveness 5-point scale: 1 = *extremely effective* and 5 = *not effective at all*. Freq. = frequency. Effect. = effectiveness.

In the pre-meeting survey, participants were asked several measures other than types of communication, many of which were repeated in all surveys during the study. These other measures included their own productivity and stress levels, as well as what worked well with the team communication and what could be improved. Figure 15 shows a sample of the data that were shared during one of the team meetings, reflecting opportunities for discussion during subsequent meetings. Items in the top half of this figure relate more to team measures than individual measures, whereas the items in the bottom half relate more to individual measures than to team measures. The top eight items were the result of using a 5-point Likert-type scale (1 = *favorable* and 5 =

unfavorable). The last two measures asked the participants about their stress levels; these measures were reported on 5-point Likert-type scales (1 = *very high* and 5 = *very low*), thus reversing which end of the scale is favorable. The data from Figure 18, Table 19, and the qualitative data collected from the pre-meeting survey provided the foundation for the team communication plan that was developed during the meetings; each communication plan was unique to the team.

		Extremely (1)	-	Not (5)	Average
Team's Communication	Effectiveness				2.50
		Always (1)	-	Never (5)	
Teammate's Clarity on Requests	Information Clarity				3.50
	Deadline Clarity				3.50
		Ex. Easy (1)	-	Ex. Difficult (5)	
From Teammates	Ease of Getting Info.				2.50
		Excellent (1)	-	Terrible (5)	
Individual	Productivity				1.75
		Strongly Agree (1)	-	Strongly Disagree (5)	
	Most Important Task				1.50
		Great Deal (1)	-	Not (5)	
	Control of Accessibility				2.75
		Ex. Positive (1)	-	Ex. Negative (5)	
	Impact of Access.				2.50
		Very Hi (1)	-	Very Low (5)	
	Highest Stress				2.50
	Average Stress				3.25

Figure 15. Sample team data shared during team focus group meeting.

Implementation Plans Developed During the Team Meetings/Focus Groups

Each team crafted its own plan for improved communication during the focus group meeting. The facilitated team meetings/focus groups were a setting in which teams could explore and address concerns highlighted in data from the pre-meeting survey and discussions during the meeting. Facilitation steered the participants to ensure they considered including at least one electronic communication process in the final plan, as opposed to only other communication processes (e.g., face to face). During the meeting, a “start/stop/continue” framework supported discussion for changes the team would

implement. Items not included in this framework were captured in a “parking lot” and provided to the team for later discussion, if warranted. After the meeting, each team’s unique plan was provided to them electronically, with the suggestion to print it out and to display it in a prominent location, allowing for easy reference. Each team identified between seven and nine changes they wanted to implement. In total, the teams attempted 38 changes. These changes are easily grouped into six areas, as shown in Table 16.

Table 16. Number of Types of Changes Each Team Attempted

Type of change	Team 1	Team 2	Team 3	Team 4	Team 5	Total
Action item clarity	4	3	5	3	6	21
Group document storage		4	1	1		6
Group meeting process		1	1	3		5
Notification of availability	2					2
E-mail subject line indications	1	1				2
Clear indication of urgency	1				1	2

As indicated in Table 16, more than half of the changes related to gaining clarity in action item communication (e.g., what is the action item, who owns completing the action, when is it due). Table 17 provides a summary of the content of the changes each team created for its own implementation.

Table 17. Summary of Top Focus Areas of Change in Team Communication Plans

Team	Summary of focus area	Action details
1	E-mail addressing and action item clarity	Use <i>action</i> in subject line, those with action on <i>to</i> line, due date, clear “ask” in body, high importance flag if urgent.
2	Joint file storage and clarity of actions	Use Box, an application, for file storage and point teammates toward files in Box rather than send files. Ensure clarity in action item requests, what is the ask or need, and when is it due.
3	Joint file storage, template for actions, and video conferencing	Use Box, an application, for file storage; set up folders for standard items. Engage a template for action items: use <i>action</i> in subject line, those with action on <i>to</i> line, body to include, ask (what is needed), why, and need by date. Use video conferencing for team meetings.
4	Rubric for group actions stored on shared site, and meeting practices	Clear rubric for what items are included in group meeting, template for each category, review frequency, owner, and scope. Agree on discussion time for each topic and use a timer. Share ownership of staff meeting.
5	Clarity in e-mails for action items	Include who, what, when, and why. Indicate purpose and urgency early in e-mail. Use <i>to</i> line for those with actions, <i>cc</i> line for FYI. Change subject line if topic content changes.

Although each team’s plan is unique, they all have share three common themes:

1. Seeking clarity for action items, regardless of the communication method (e.g., via e-mail or group website). Two teams suggested using some portion of the familiar who/what/where/when expression to aid in this effort.
2. Using common tools to provide secondary communication clues (e.g., those with action should be included on the *to* line of an e-mail).
3. Methods for distribution of frequently used files and organization of these shared files within a storage location.

Productivity Measure Over the Study

During all phases of the study, each survey included a question on individual productivity, asking the participant to self-assess and rate his or her own productivity. A

5-point Likert-type scale (1 = *excellent* and 5 = *terrible*) was used for this measure.

Figure 16 shows the median, maximum and minimum scores, by team, over the study.

The arrows indicate the overall trend for the team's results. There is little variation among the scores by team as most participants used only three of the five possible scores. Participants were asked to rate how the measures compare at the time of the final survey to before the team undertook the study; for this measure, the 5-point scale was 1 = *much better* to 5 = *much worse*.

Three of the teams (1, 4, and 5) experienced an increase in self-rated productivity during the study. Although two of the teams only reported the increase at the end of the study, all three teams indicated the productivity was at least somewhat better by the end of the study compared to before the team engaged in the study. Team 3 showed no change in productivity during the study and the median of the measure comparing productivity prior to the study showed no change as well. Team 2 experienced a reduction in productivity during the study and also reported no change from prior to the study. Even with two teams experiencing no change in productivity, overall the teams together reported a median value of somewhat better when comparing productivity after the study to prior to beginning the study.

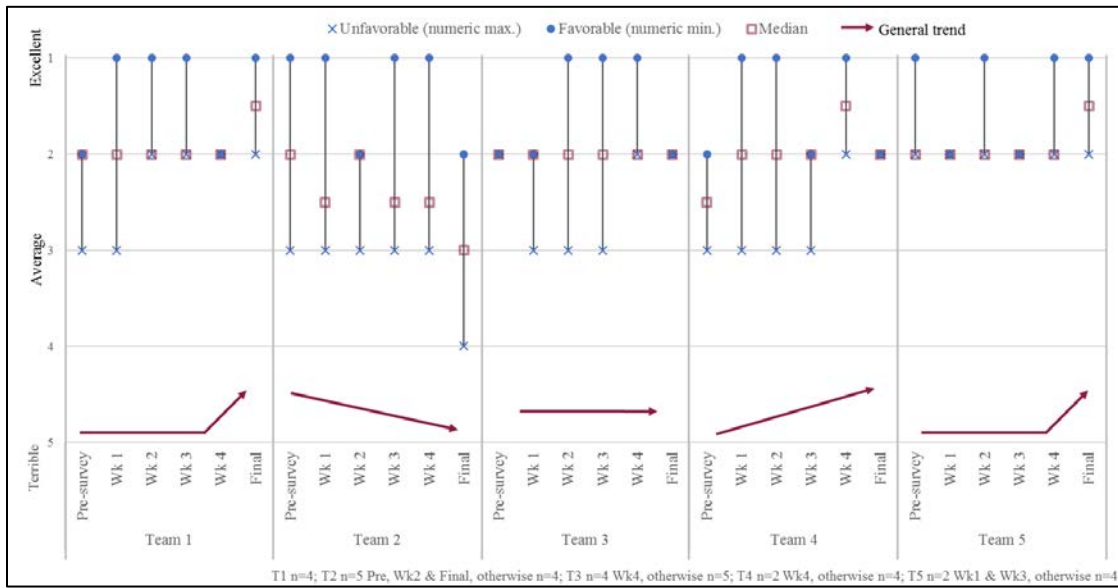


Figure 16. Median, maximum, and minimum productivity measures during study.

Effectiveness of Communication

Similar to the question on effectiveness of the types of communication in the pre-meeting survey, the participants were asked to rate the effectiveness of the team's electronic communication during the implementation. This question used a 5-point Likert-type scale (1 = *extremely effective* and 5 = *not effective at all*). In posing this question, the participants were asked to focus on the effectiveness of communication with teammates who were participating in this study. Effectiveness was not defined for the participants; rather, the participants self-assessed effectiveness according to their own perceptions. Figure 17 shows the median, maximum and minimum scores, by team, over the study. The arrows indicate the overall trend for the team's results, showing that three of the four teams experienced an improvement in communication effectiveness over the course of the study. Teams 1 and 4 saw the largest changes. Interestingly, three of the four teams reported improvements in the first three weeks of the study, noted with annotations on in Figure 17. Overall the teams together reported a median value of

somewhat better when comparing communication effectiveness after the study to prior to beginning the study.

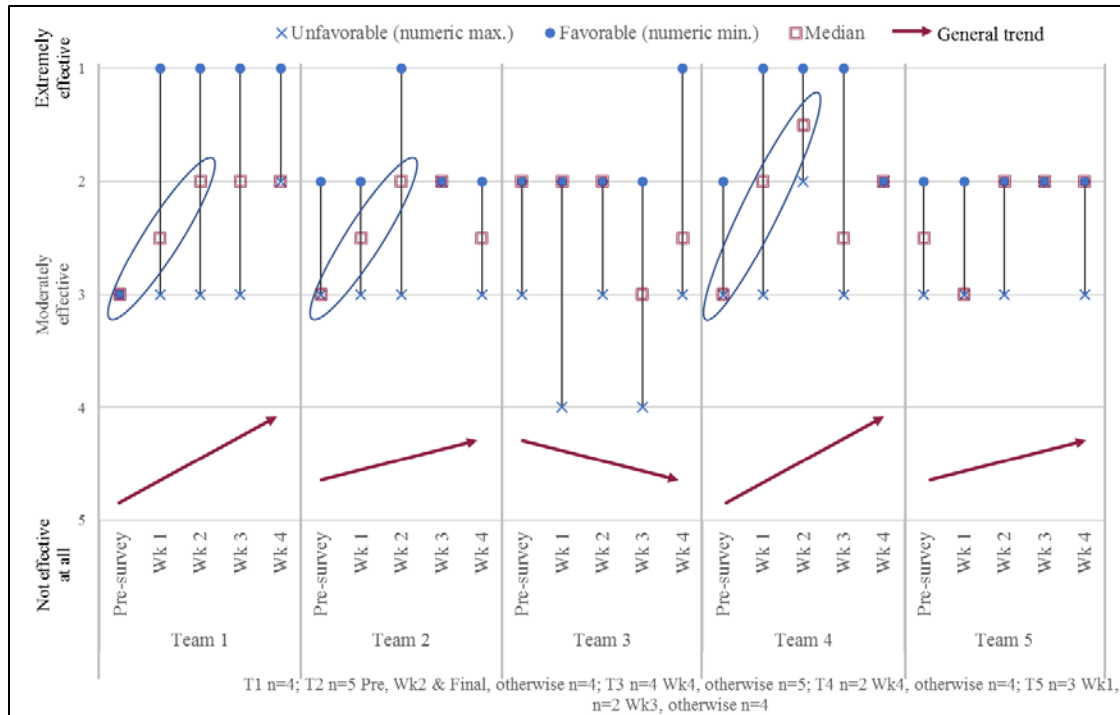


Figure 17. Median, maximum, and minimum communication effectiveness measures during study.

Stress Level

Participants were asked many times throughout the study to rate their stress level over the previous few days. A 5-point Likert-type scale (1 = *very high* and 5 = *very low*) was used for this measure. Participants' scores were reported along the full scale for this measure. When the scores for this measure are compared from the pre-meeting survey to the final survey, a decreased score is a favorable change; a decrease means the stress level went down over the course of the study. Figure 18 shows these reported levels with the median, maximum and minimum values, the latter two noted as favorable or unfavorable. Three teams reported a reduction in stress from the beginning to the end and

two teams reported no change at the end. Overall the teams together reported a median value of about the same when comparing stress after the study to prior to beginning the study, except for Team 5, who reported a median value of somewhat better.

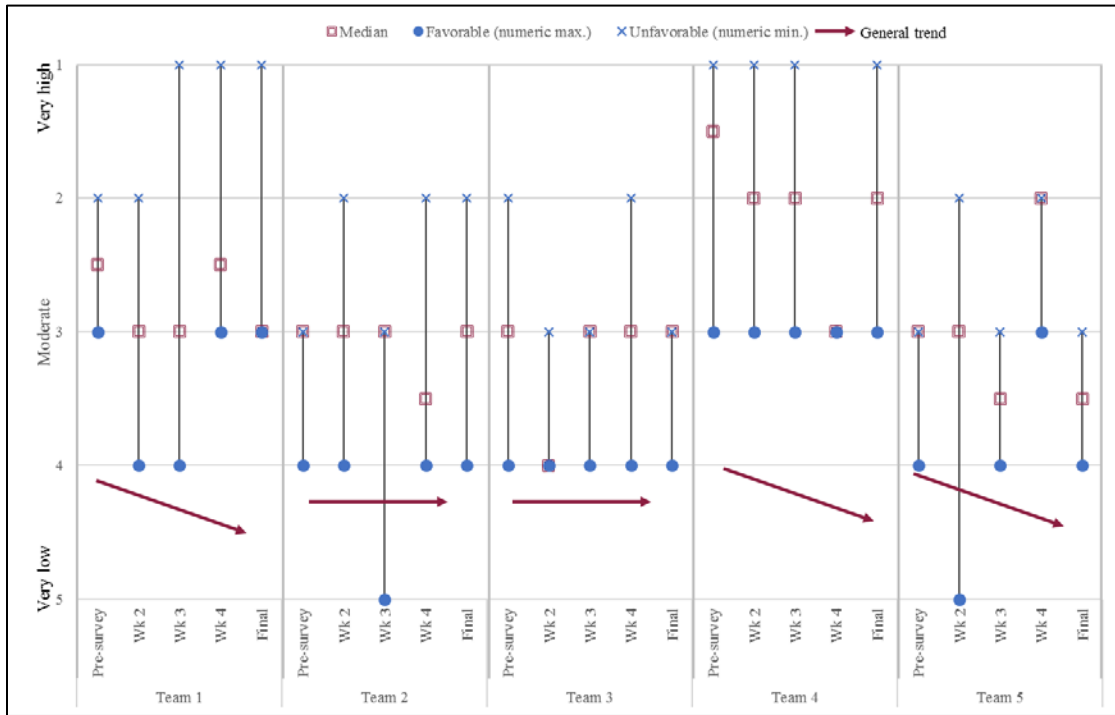


Figure 18. Median, maximum, and minimum stress measures during study.

Overall Team Communication Plan Change Results

In the final survey, the participants were asked to rate how well they themselves followed each aspect of the plan and how well the team followed that same aspect. Participants answered this question using a 5-point Likert-type scale (1 = *extremely* and 5 = *not at all*; note: “well” was implied in the wording of the question). For all teams except for Team 2, the participants typically indicated they themselves followed the plan better than the team did. Those on Team 2 indicated that 75% of the time, the team followed the plan better than the individuals did.

This survey also asked the participants how useful these types of changes were and how likely they were to continue using these changes after the study ended. Both questions were answered using a 5-point Likert-type scale (1 = *extremely* and 5 = *not at all*). Typically, there was alignment between how well a change was followed and the usefulness of the change; in other words, if a change was followed, the team found the change useful and if a change was not often followed, the change was not rated as highly useful. The teams rated most of the changes as either extremely useful or very useful, with 88% of the changes having an average usefulness score of 2.0 or greater. Although each team's plan was different, there are some similarities between the changes selected by the teams.

Most notable is that all five teams believed improvement was needed in the area of clearly specifying a due date or at least a time frame (e.g., within a week) when creating an action item. Each team crafted a change related to ensuring that team members communicated when they needed the action completed. This change was perceived as between very useful and extremely useful, resulting in an average usefulness score of 1.6 (1 = *extremely useful* and 5 = *not at all useful*). Not only was this change useful, but also the teams are likely to continue using this improvement, given an average score of 1.5 (1 = *extremely likely* and 5 = *not at all likely*). Also contributing to the similarities in the plans, four teams included having a clear "ask" in their requests, meaning members of the team should make sure that readers of any communication would understand what is be asked of them in a request for action. This change had a score of 1.6 for usefulness, and a 1.6 for likelihood of continued use.

Three of the teams experimented with using the address lines of the e-mail to indicate who had an action by putting those needed to act on the *to:* line and those for whom the e-mail was information only on the carbon copy (*cc:*) line. All three teams attempted these two changes together. One team found this approach quite useful and reported they were able to implement the change well—this was Team 3’s highest rated item in terms of usefulness—but other teams did not share Team 3’s sentiments. Team 1 reported this change as the least useful and least often followed of any of the changes they attempted.

Given the geographical distance among team members, Team 3 attempted using a video camera during group meetings. This change received the lowest scores of all the changes attempted by all the teams. Table 18 outlines the most and least successful changes reported by each team; this evaluation combines the scores for all four of the measures discussed (i.e., how well do you follow the change, how well did the team follow the change, how useful was the change, and how likely are you to continue using the change).

Table 18. Summary of Most and Least Successful Changes by Team

Team	Most successful change	Least successful change
Team 1	Use notifications of out of office (via Outlook and through shared calendar)	Include those with actions on the <i>cc</i> line
Team 2	Use Box, an application, for sharing documents rather than send files	Stop forwarding attachments that are already in Box
Team 3	Include those with actions on the <i>to</i> line	Use video for team meetings
Team 4	Use tools at staff meeting (e.g., agenda, time limits, and routine topics)	Use a template for what to report in group meetings
Team 5	Include a clear due date or time-frame in the e-mail	Change the subject line when the content of the e-mail subject changes

Coworker Feedback

After the final survey data were recorded, each team was provided with an anonymous link for a survey to investigate if their coworkers experienced any differences in electronic communication due to participation in the study. The participants were asked to share the link along with an introductory letter explaining the study with five of their closest coworkers who did not participate on their team. A total of 11 responses were received; none from coworkers of participants of Teams 1 and 4, three from coworkers of participants of Team 2, six from coworkers of participants of Team 3, and two from coworkers of participants of Team 5. Coworker responses were generally favorable. These coworkers indicated that they usually understand what is needed, when it is needed, and why when they received a request from the teammates who provided the survey link to them since the participants had begun the study. Additionally, these coworkers report slightly better electronic communication after team members participated in the study and that the changes have had a positive impact on the coworker's ability to get work done.

Summary of Key Study Measures

A summary of the trends from the key study measures follows.

- **Productivity:** Three of the five teams (1, 4, and 5) reported improvements during the study and overall the teams reported that productivity was somewhat better after completing the study.
- **Communication effectiveness:** Four of the five teams (1, 2, 4, and 5) saw improvement during the study and overall the teams reported that communication effectiveness was somewhat better after completing the study. Three teams experienced consistent improvements in the first three weeks of the study after beginning the changes they identified.
- **Stress:** Three of the five teams (1, 4, and 5) reported reduction in stress during the study though overall the teams reported that stress was about the same after completing the study.

This process provided a consistent impact on the measures for Teams 1, 4 and 5.

Taken together, all three key measures provided favorable improvements for the teams and with the exception of stress, the teams reported they felt the measured aspect was somewhat better than before they engaged in the study.

Discussion

The summary of focus areas for change outlined in Table 17 are well supported in the literature as challenge areas. Two main areas stand out: needed clarity around action items, and difficulty with group file storage. The high number of suggested changes concerning action items links directly to the need for information from others (Bellotti et

al., 2003; Gwizdka, 2002; Markus, 1994; Tyler & Tang, 2003; Whittaker et al., 2006) or the interleaving of task management (Bellotti et al., 2005). Bergman and Whittaker (2016) outlined many of the failures of group information management systems, suggesting that “using other people’s organization leads to worse results than using no organization at all” (p. 150). Thus, it not surprising that these areas were the ones of greatest concern for these teams.

Effectiveness of Communication

The one measure of the study that showed clear improvement from most teams and received a rating of somewhat better after the study was effectiveness of communication. Further supporting the finding that communication effectiveness was favorably improved with the study process, participants also reported positive change in responses to questions included in both the pre-meeting and final surveys concerning accuracy of communication from their teammates who participated in the study. Favorable improvements were reported in clarity of action requests, meaning the participants knew what action they needed to take when requested to act by a teammate. Getting information from teammates became easier during the study, and teammates also improved in clearly stating a deadline for action completion. Furthermore, the participants ranked the team meeting/focus group as the most valuable part of the process by a 2 to 1 margin, and more than half of the comments specifically referred to the value of the meeting and open discussion. The improvements in communication effectiveness overall and favorable improvements for detailed aspects combined with the favorable

comments (qualitative data) provide support of this process as a method for improved team communication.

Overall Study Process and Ease of Use

Participants reported that following the plans was a quite achievable task. We queried how well the participants themselves followed the plan and how well their team as a whole followed the plan. Initially, there was a 3% difference overall, with the participants reporting they followed the plans better than their teams. This difference disappeared by the final week of the study, when reports indicated there no differences between the individuals following the plans and teams following the plans, on average. This pattern was mirrored in the rated ease of following the plan. At the beginning of implementation, the participants rated following the plans as somewhat easy to follow—a score of 2 on a 5-point Likert-type scale (1 = *extremely easy* and 5 = *extremely difficult*). This rating steadily improved throughout the study, achieving an increase of 6% in the last week of the study. Thus, the longer the participants used their team plan, the easier it became to do so, both for the individual and the team.

The participants were asked if they would recommend this process to colleagues to discuss team communication and craft potential improvements. On a scale of 1 to 10 (1 = *not at all likely* and 10 = *extremely likely*), the group replied with an average of 7.6. Using the Net Promoter Score index, three of the participants would be classified as detractors, 10 as passives, and seven as promoters. Three-quarters of the participants provided qualitative comments, and all but one comment was positive. The unfavorable comment pointed to the complexity of the surveys themselves. Most of the comments

revealed that the team meeting itself was helpful and participants appreciated the accountability of the periodic surveys. A few participants remarked that simply taking the surveys got them thinking about how they spend their time and what they focus on. Several participants indicated they would have welcomed the opportunity for a second facilitated meeting after the halfway point of the study.

Comparison of Team Diversity to Key Measures

The five teams that participated in this study are diverse in many ways. The team diversity aspects of communication frequency, physical distance in primary office location combined with frequency of face-to-face meetings, and similarity of roles were examined for trends, listed in the rank order indicated by the scale in parentheses:

- Communication frequency (high to low): Team 1, 4, 3, 5, and 2
- Physical distance (close to far): Team 4, 5, 2, 3, and 1
- Similarity of roles (similar, as in a group, to dissimilar, as in a team): Team 1, 4, 3, 2, and 5

Teams 1 and 4 have the most frequent communication and have the most similarity in roles within the team; in other words, these teams are more like a group. Interestingly, Teams 1 and 4 represent the extremes in terms of physical distance from each other, yet they both experienced favorable changes in three of the four measures. These trends might suggest that this process works best for groups with frequent communication and that the process works well, regardless of physical location.

Recommendations for Knowledge Workers and Software Developers

A team communication plan was uniquely developed for each team to address the challenges, good practices, and constraints of the individual team's current environments. There may be benefit in many of the changes the teams attempted, given that 88% of the changes were rated as extremely useful or very useful and 75% of the changes were extremely likely or very likely to be used after the study ended. Before reviewing the most successful changes, it is worth looking at those changes that were not rated as useful or were more difficult than expected for the teams to implement. Three types of changes proved difficult to implement: using video conferencing, actions concerning shared document storage, and specific changes to e-mail subject lines.

One of the teams wanted to add video to their team meetings by using meeting rooms enabled with video conferencing technology. The team did not share specifics, but it is clear from the data they had trouble accomplishing use of the video because this change received the lowest (least favorable) scores for all four measures for any of the teams (e.g., how well the individual followed, how well the team followed, how useful, and how likely to continue using). Several teams identified shared document storage as an area in which they wanted to improve. While one team indicated using Box, a document storage application, as the most successful change, that same team also reported that not forwarding documents that were already uploaded to Box as a change with which they least complied. Lastly, three teams tried to change how they used the subject lines of e-mail messages. One team tried to ensure they changed the subject line of an e-mail if the content of the body of the message changed as they replied or

forwarded the message, and this approach proved most challenging for this team to implement. Two teams also experienced some difficulty adding *action* to the subject line of an e-mail message when the body of the message included an action item.

Although the teams experienced different levels of success and usefulness for the changes in which they engaged, there are some similarities in the changes the teams identified and ranked as most helpful. When instructed to use the five *Ws*, most of these participants would think of the familiar root cause analysis tool of five whys (Liker, 2004), but for clarifying electronic communication, they would be better served with an older tool, the five *Ws* and how, often thought of as having originated in the field of journalism (Hart, 1996). The who, what, when, where, why, and how framework is commonly used in education, as early as kindergarten, to help students frame problems and stories (McGrue, 2015). In fact, this framework is so commonly used that a song and video were recorded to help explain the framework (Simek, 2015). Thus, using this familiar framework as a structure to compile all the best changes the teams developed could make adoption of these strategies easier for others to implement. Listed below are actions these teams found helpful to improve communication clarity within the framework of the five *Ws* and how:

- Who: Make sure that the person intended to act understands he or she needs to take action.
 - Identify who needs to act early in the body of the request in some way that is highlighted. If the request is being sent by e-mail to multiple

recipients, those tasked with an action should be identified on the *to*: line.

- Use common roles to help identify who should be responsible for action. Discuss this process openly and have a rubric prepared to help understand who should own common types of actions (e.g., assigned action owners related to work assignments).
- What: Clearly articulate what action is needed.
 - If you initiate this request, identify the actions needed early in the request and use some method of highlighting the action (e.g., bold or colored text) to ensure the reader sees what you are asking him or her to do. Ensure that if you received this request, you understand the steps you need to take and what result or outcome is desired.
- When: Clearly state when the action needs to be completed.
 - Provide a firm date or at least a time frame, in a way that can easily be seen (e.g., early in request or with text highlighting): for example, by April 11, 2018 or by the end of the week. If the action is recurring, indicated the frequency of review (e.g., weekly, monthly).
 - If e-mailing and you need a quick reply, use the high importance flag. If the item is really urgent, skip asynchronous communication methods all together and use a synchronous method (e.g., phone, or even instant message) where you will get confirmation your colleague received the message.

- Let colleagues know when you are not available using team calendars or out of office messages.
- Where: Consider setting up thoughtful joint storage locations.
 - Engage as much of the team as possible to discuss how to set up storage locations for documents used by many members. Adding a reference page to this file storage location and including common information many members will need (e.g., charge numbers, key project information, project goals and objectives) may prove to be a time-saving measure.
- Why: Give some background to explain why the action is needed.
 - The context you give may help the person responsible for taking the action to understand what you really need or identify an interaction with another action.
- How: Help the team have efficient and successful meetings.
 - Take joint ownership for success of the meeting by using an agenda, routine topics, and time limits (if needed).

This framework captures the best practices in this study through three measures: the most successful changes incorporated by each team, those changes that were most successful overall, and the changes selected by more than four of the five teams. This framework helps knowledge workers to illuminate implicit assumptions embedded in their work. As Medina-Mora, Winograd, Flores, and Flores' (1993) *ActionWorkflow Loop* suggests all these tasks exchanged between knowledge workers involve negotiation

through a communication loop with a proposal, agreement, performance and satisfaction. The challenge for knowledge workers is that these phases of the communication loop are usually not explicit and distinct. By using the five Ws and how framework, these communication phases and the commitment to performance can be clearly understood.

Although the most popular mechanism for 21st-century communication is electronic, these opportunities for improving communication clarity are likely the same areas that would have been applied in the pen-and-paper age. Thus, software developers should include these common communication challenges as they plan for the next generation of electronic communication solutions. Perhaps in a manner similar to the way that Outlook now prompts users with “You may have forgotten to attach a file,” future software updates can prompt users with reminders relevant to actions such as, “Have you asked a question clearly?” or “You asked for an action, but didn’t specify when it needed to be completed.” Alternatively, software could automatically include those with actions on the *to:* line or further integrate task reminders from e-mails. The more industry can incorporate options to help users with these aspects of communication that are persistently difficult to accomplish, the greater impact successful communication software can have on productivity and stress.

Limitations and Future Work

The participants in this study were a decidedly homogeneous group: they all have long employment with the same organization and almost all received education in engineering; thus, their experiences and work culture include little diversity. The low number of participants limits the statistical generalizability of the findings; nevertheless,

the literature supports studies with small sizes (< 10: Renaud et al., 2006; Siu et al., 2006; = 10: Venolia et al., 2001; < 20: Bellotti et al., 2003; Mackay, 1988; Mander et al., 1992; Siu et al., 2006; Whittaker & Sidner, 1996). In defense of the study, the case study framework supports analytical generalizations (Yin, 2014, p. 40) such as those in the five Ws and how framework. Because each team created its own unique set of changes, the resulting multiple case studies are theoretical replications (Yin, 2014, p. 57). Furthermore, the pre-meeting and post-study surveys served as boundaries of a short-term longitudinal case study: they are the anticipated stages where changes in team action should occur (Yin, 2014, p. 53).

The timing of the study might have influenced the measures, particularly the measure of stress. Although the study process adjusted for vacations and holidays, the study started as early as late October for the first team and completed in early February for the last team. As such, most of the teams reported data near or around major holidays and these holidays, well known for increased stress levels, could have had an impact on the participants' work and well-being reported during the study unrelated to the study itself.

Future research could expand on this work by extending the sample size for the study, allowing for a second meeting, as suggested by several of the participants, increasing the length of the time the participants engaged in the study, and scheduling the study to avoid major holiday time frames. For the teams that do not have communication at least every other week, the process may need to be modified or studied over a longer period. Perhaps another study could use the full five Ws and how framework as a

prescriptive set of actions to determine if full engagement would yield more consistent results, thus providing literal replications for the case study analysis.

Conclusion

Even though the teams were given plenty of latitude to create their own unique plans to improve communication, as those plans were drafted and the changes appeared to be different, the types of changes coalesced into six distinct types that reflected the recommendations of aligning with the what, who, when, why, where and how framework. The five *Ws* and how framework is further supported by all of the teams having rated these changes as extremely useful or very useful. Improvement in the teams' self-rated communication effectiveness and favorable improvements in productivity suggest that teams may benefit from having open discussions about their communication processes. The data clearly answers the beginning question: teams can expect improved productivity and improved communication effectiveness by engaging in discussions about how the team communicates and shares information electronically. These open discussions within teams can be well worth the investment in time to have the conversations. One participant summed up the study experience with a recommendation to others, "The initial discussion about communication needs, desires, and best practices is something that should be done on every team (overtly)."

Although the changes suggested in the five *Ws* and how framework seem small and simple, even small changes can have positive impact on the lives of the knowledge workers who implement such changes. With 66 million knowledge workers in the United States (U.S. Census Bureau, 2015), assuming an hourly rate of \$30 (DPE/AFL-CIO,

2013), spending a mere 5 minutes a day to improve team communication practices could yield \$40B in annual savings if every knowledge worker applied the five *Ws* and how framework to dealing with electronic communications. The investment of time to have the team conversation would pay for itself in 3 weeks. Over the course of a year, 5 minutes a day would add up to 20 hours—half a week of work. Imagine the innovations that could emerge if just a portion of the 66 million knowledge workers applied these small changes and put to creative use the time they gained from this practice.

This study contributes by adding to the existing knowledge base on strategies to manage electronic communication in four ways. First, 71% of the participants in this study are women, a rarity in most HCI literature. Next, because case study methodology is not often used in this type of research in the HCI electronic communication literature, this study contributes by providing an example of the use of case study and extends the body of knowledge using case study framework for other HCI researchers. Research involving electronic communication—specifically about e-mail—is well represented in literature, but the HCI community rarely engages in research of teams in their regular work environment to investigate methods to improve electronic communication. Last, and most importantly, offering information about the five *Ws* and how framework for improving team electronic communication allows professionals to easily engage in accessible methods to improve their work.

CHAPTER 7

CONCLUSION

Summary

Chapter 3 examined current e-mail management strategies to compare those with the foundational work of Whittaker and Sidner (1996), taking into account the most popular e-mail tools in use in office settings. This work supports adding a few filer category to the Whittaker and Sidner categorization of e-mail folder management because contemporary search capabilities allow for less organization in saved files. Furthermore, this study showed no support for enactment of the elusive one-touch model through several participant observations, despite their claims of achieving an empty inbox on a regular basis.

Chapter 4 examined the emotions expressed by knowledge workers about their use of e-mail and the strategies they use to manage e-mail. The participants crafted words to describe their emotions; these words were then placed along a continuum, based upon analysis of the interview using metaphor analysis. The continuum spanned from those who perceive e-mail as a burden to those who see e-mail as a tool. The data from this study suggest that developing and committing to the use of a strategy that one can clearly articulate may result in perceiving e-mail as more of a tool than a burden. Those who perceive e-mail as a tool report fewer feelings of stress and of being overwhelmed by the e-mail they receive. This chapter contributed the concept of the continuum as a way to convince knowledge workers to develop strategies.

The study in Chapter 5 sought to determine if modifications in e-mail reading frequency and the use of e-mail notification could improve knowledge workers' productivity and stress levels. The study examined the work task types of the study participants through the amount of strategic (e.g., creative, thinking, long-term work) relative to tactical (e.g., administrative, repetitive work) tasks. Matching the e-mail reading frequency and use of notifications provided an interruption-free time for strategic work or, conversely, quick-paced, timely information for tactical work. Although some participants did experience favorable improvements in productivity and stress, the experience of the study itself promoted self-learning for these participants. Building on Kushlev and Dunn's (2015) study, this work contributes in four ways: (a) providing a glimpse of the work task type distributions of these knowledge workers, indicating most of their work is tactical rather than strategic; (b) including a larger than usual representation of women as study participants; (c) revealing how e-mail management strategies are like habits; and (d) providing evidence of no participants following recommendations of literature to create uninterrupted time within their work days.

Chapter 6 investigated if a method of using a conversation among team members could help improve electronic communications within the team. Although the teams were given plenty of latitude to create their own unique plans, each plan included common themes: clarity of action items, using e-mail addressing protocol to provide secondary communication methods to show who needed to act, and methods to share multiple-user files within the team. The most successful changes the teams implemented coalesced into six distinct types of changes. The familiar five *Ws* and how framework was then used as a

structure to outline these successful changes. This familiar mantra was implemented in the hope that it will aid knowledge workers in easily implementing these improvements.

Although the changes suggested in the framework seem small and simple, even small changes can have a major impact on the lives of the knowledge workers who implement these changes. All the teams reported improvement in the team's self-rated communication effectiveness after participating in the study, and most indicated the open discussion with their team was the most valuable component of the study. This study contributes by adding to the existing knowledge base on strategies to manage electronic communication in four ways: (a) inclusion of female participants, a rarity in most HCI literature; (b) use of case study research; (c) engaging teams within their regular work environments, and (d) incorporating the five *Ws* and how framework for improving team electronic communication that others can easily utilize.

Future Work

Given the high number of knowledge workers around the world and the ever-increasing volume of electronic communication and expectations for timely replies, any tools or methods that can improve productivity, reduce stress, or respect the work/life balance could be beneficial to many. There are numerous areas in which future work could focus its attention to advance knowledge of electronic communication management practices, such as the following:

- Increase the sample size and/or time frame of any of the studies included in this work.

- Test the five *Ws* and how framework for improving e-mail communication in teams using literal replications to allow for testing of results between the teams.
- Examine how different methods of processing e-mail (e.g., achieve inbox zero versus leaving e-mail in the inbox) affect productivity and feelings of stress.
- Determine if there is an alignment between particular processes or strategies in use and different types of roles or personalities.
- Delve more deeply into an investigation of other electronic communication means (e.g., instant messaging, collaboration tools).
- Understand why study participants commit to their strategies and, if not, what keeps them from doing so.
- Develop methods to help users create strategies that work best for their personalities, working styles, and type of role.

REFERENCES

- Adler, R. F., & Benbunan-Fich, R. (2013). Self-interruptions in discretionary multitasking. *Computers in Human Behavior*, *29*, 1441–1449. <https://doi.org/10.1016/j.chb.2013.01.040>
- Albers Mohrman, S., Tenkasi, R. V., Lawler, E. E., & Ledford, G. E. (1995). Total quality management: Practice and outcomes in the largest US firms. *Employee Relations*, *17*(3), 26–41. <https://doi.org/10.1108/01425459510086866>
- Allen, D. (2008). *Making it all work: Winning at the game of work and the business of life*. New York, NY: Penguin Press.
- Bälter, O. (2000). Keystroke level analysis of email message organization. *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems—CHI '00* (pp. 105–112). <https://doi.org/10.1145/332040.332413>
- Barley, S. R., Meyerson, D. E., & Grodal, S. (2011). E-mail as a source and symbol of stress. *Organization Science*, *22*, 887–906. <https://doi.org/10.1287/orsc.1100.0573>
- Bellotti, V., Ducheneaut, N., Howard, M., & Smith, I. (2003). Taking email to task: The design and evaluation of a task management centered email tool. *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems, 2003*, 345–352. <https://doi.org/10.1145/642611.642672>
- Bellotti, V., Ducheneaut, N., Howard, M., Smith, I., & Grinter, R. (2005). Quality versus quantity: E-mail-centric task management and its relation with overload. *Human-Computer Interaction*, *20*, 89–138. <https://doi.org/10.1080/07370024.2005.9667362>
- Belsky, S. (2010). *Making ideas happen: Overcoming obstacles between vision and reality*. New York, NY: Penguin.
- Bennett, S. (2014). *Get it done: From procrastination to creative genius in 15 minutes a day*. Novato, CA: New World Library.
- Bergman, O., & Whittaker, S. (2016). *The science of managing our digital stuff*. Cambridge, MA: MIT Press.
- Bowman, L. L., Levine, L. E., Waite, B. M., & Gendron, M. (2010). Can students really multitask? An experimental study of instant messaging while reading. *Computers & Education*, *54*, 927–931. <https://doi.org/10.1016/j.compedu.2009.09.024>
- Bush, V. (1945). As we may think. *The Atlantic Monthly*, *176*(1), 101–108. Retrieved from <https://www.theatlantic.com/>

- Butts, M. M., Becker, W. J., & Boswell, W. R. (2015). Hot buttons and time sinks: The effects of electronic communication during nonwork time on emotions and work-nonwork conflict. *Academy of Management Journal*, *58*, 763–788. <https://doi.org/10.5465/amj.2014.0170>
- Counts, V. (2016). *Facebook poll: February 26—March 1, 2016*. Retrieved from <https://www.facebook.com/vacounts>
- Counts, V. (2017). De-clutter your inbox: Transform your perspective to see email as a tool. *Proceedings of the Human Factors and Ergonomics Society Annual Meeting*, *61*, 135–139. <https://doi.org/10.1177/1541931213601517>
- Cutrell, E., Czerwinski, M., & Horvitz, E. (2001, July). Notification, disruption, and memory: Effects of messaging interruptions on memory and performance. In M. Hirose (Ed.), *Human-Computer Interaction—INTERACT '01: IFIP TC.13* (pp. 263–269). Washington, DC: IOS Press.
- Czerwinski, M., Cutrell, E., & Horvitz, E. (2000). Instant messaging and interruption: Influence of task type on performance. In C. L. Paris (Ed.), *OzCHI 2000: Interfacing Reality in the New Millennium, The Annual Conference of CHISIG, the Computer-Human Interaction Special Interest Group of the Ergonomics Society of Australia* (pp. 356–361). Sydney, NSW, Australia: CHISIG.
- Czerwinski, M., Horvitz, E., & Wilhite, S. (2004). A diary study of task switching and interruptions. *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems* (pp. 175–182). <https://doi.org/10.1145/985692.985715>
- Dabbish, L. A., & Kraut, R. E. (2006). Email overload at work: An analysis of factors associated with email strain. *Proceedings of the 2006 20th Anniversary Conference on Computer Supported Cooperative Work*, *20*, 431–440. <https://doi.org/10.1145/1180875.1180941>
- Dabbish, L. A., Kraut, R. E., Fussell, S., & Kiesler, S. (2005). Understanding email use: Predicting action on a message. In CHI '05, *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems* (pp. 691–700). <https://doi.org/10.1145/1054972.1055068>
- Davenport, T. H. (2005). *Thinking for a living: How to get better performances and results from knowledge workers*. Boston, MA: Harvard Business Press.
- Denning, P. J. (1982). ACM president's letter: Electronic junk. *Communications of the ACM*, *25*(3), 163–165. <https://doi.org/10.1145/358453.358454>
- Denning, P. J. (2006). Infoglut. *Communications of the ACM*, *49*(7), 15–19. <https://doi.org/10.1145/1139922.1139936>

- Derks, D., & Bakker, A. B. (2015). The impact of e-mail communication on organizational life. *Cyberpsychology: Journal of Psychosocial Research on Cyberspace*, 4(1), Art. No. 4. Retrieved from <https://cyberpsychology.eu/article/view/4233>
- Dietzen, R. (2017, August 25). *Email use 2017—US report*. Retrieved from https://www.slideshare.net/adobe/adobe-consumer-email-survey-report-2017?from_action=save
- Dobbs, R., Madgavkar, A., Barton, D., Labaye, E., Manyika, J., Roxburgh, C., . . . Madhav, S. (2012). *The world at work: Jobs, pay and skills for 3.5 billion people*. Retrieved from <https://www.mckinsey.com/global-themes/employment-and-growth/the-world-at-work>
- DPE/AFL-CIO. (2013, August). *Professional and technical employees in the labor force*. Retrieved from <http://dpeaflcio.org/programs-publications/professionals-in-the-workplace/professional-and-technical-employees-in-the-labor-force/>
- Drucker, P. F. (1959). *Landmarks of tomorrow*. New York, NY: Harper & Row.
- Ducheneaut, N., & Bellotti, V. (2001). E-mail as habitat: An exploration of embedded personal information management. *Interactions*, 8(5), 30–38. <https://doi.org/10.1145/382899.383305>
- Ducheneaut, N., & Watts, L. A. (2005). In search of coherence: A review of e-mail research. *Human-Computer Interaction*, 20, 11–48. <https://doi.org/10.1080/07370024.2005.9667360>
- Facebook. (2018, January 31). *Facebook, Inc. (FB) fourth quarter and full year 2017 results conference call* [Interview transcript]. Retrieved from https://s21.q4cdn.com/399680738/files/doc_financials/2017/Q4/Q4-17-Earnings-call-transcript.pdf
- Faklaris, C., & Hook, S. A. (2016). Oh, snap! The state of electronic discovery amid the rise of Snapchat, WhatsApp, Kik, and other mobile messaging apps. *The Computer & Internet Lawyer*, 33(10), 1–17. Retrieved from <https://scholarworks.iupui.edu/handle/1805/11160>
- Ferriss, T. (2011). *The 4-hour work week: Escape the 9-5, live anywhere and join the new rich*. New York, NY: Random House.
- Fisher, D., Brush, A. J., Gleave, E., & Smith, M. A. (2006). Revisiting Whittaker & Sidner's "email overload" ten years later. *Proceedings of the 2006 20th Anniversary Conference on Computer Supported Cooperative Work*, 20, 309–312. <https://doi.org/10.1145/1180875.1180922>

- Fisher, S. G., Hunter, T. A., & Macrosson, W. D. K. (1997). Team or group? Managers' perceptions of the differences. *Journal of Managerial Psychology*, *12*, 232–242. <https://doi.org/10.1108/02683949710174838>
- Foehr, U. G. (2006, November 30). *Media multitasking among American youth: Prevalence, predictors and pairings*. Retrieved from <https://kaiserfamilyfoundation.files.wordpress.com/2013/01/7592.pdf>
- Foroughi, C. K., Werner, N. E., Nelson, E. T., & Boehm-Davis, D. A. (2014). Do interruptions affect quality of work? *Human Factors*, *56*, 1262–1271. <https://doi.org/10.1177/0018720814531786>
- Fowlkes, J. E., Lane, N. E., Salas, E., Franz, T., & Oser, R. (1994). Improving the measurement of team performance: The TARGET's methodology. *Military Psychology*, *6*(1), 47–61. https://doi.org/10.1207/s15327876mp0601_3
- Friedman, T. L. (2006, July 4). The age of interruption. *The New York Times*, p. 5. Retrieved from <https://www.nytimes.com>
- Fussell, S. R., Kraut, R. E., Lerch, F. J., Scherlis, W. L., McNally, M. M., & Cadiz, J. J. (1998). Coordination, overload and team performance: Effects of team communication strategies. In *Proceedings of the 1998 ACM Conference on Computer Supported Cooperative Work—CSCW '98* (pp. 275–284). <https://doi.org/10.1145/289444.289502>
- Goodhue, D. L., & Thompson, R. L. (1995). Task-technology fit and individual performance. *MIS Quarterly*, *19*, 213–236. <https://doi.org/10.2307/249689>
- Govindarajan, V., & Gupta, A. K. (2001). Building an effective global business team. *MIT Sloan Management Review*, *42*(4), 63–71. Retrieved from <https://sloanreview.mit.edu/>
- Guest, G., Bunce, A., & Johnson, L. (2006). How many interviews are enough? An experiment with data saturation and variability. *Field Methods*, *18*, 59–82. <http://dx.doi.org/10.1177/1525822X05279903>
- Gupta, A., Sharda, R., & Greve, R. A. (2011). You've got email! Does it really matter to process emails now or later? *Information Systems Frontiers*, *13*, 637–653. <https://doi.org/10.1007/s10796-010-9242-4>
- Gwizdka, J. (2002). TaskView: design and evaluation of a task-based email interface. In D. A. Stewart & J. H. Johnson (Eds.), *Proceedings of the 2002 Conference of the Centre for Advanced Studies on Collaborative Research*, 2002, 4. Retrieved from <https://dl.acm.org/citation.cfm?id=782119>

- Gwizdka, J. (2004). Email task management styles: The cleaners and the keepers. *Proceedings of the 2004 Conference on Extended Abstracts on Human Factors in Computing Systems, 2004*, 1235–1238. <https://doi.org/10.1145/985921.986032>
- Gwizdka, J., & Chignell, M. (2004). Individual differences and task-based user interface evaluation: A case study of pending tasks in email. *Interacting with Computers*, 16, 769–797. <https://doi.org/10.1016/j.intcom.2004.04.008>
- Habit. (n.d.). In *Google dictionary*. Retrieved from https://www.google.com/search?rlz=1C1GGRV_enUS758US759&q=Dictionary#dobs=habit
- Hair, M., Renaud, K. V. & Ramsay, J. (2006). “You’ve got e-mail!” . . . shall I deal with it now? Electronic mail from the recipient’s perspective. *International Journal of Human-Computer Interaction*, 21, 313–332. https://doi.org/10.1207/s15327590ijhc2103_3
- Hair, M., Renaud, K. V. & Ramsay, J. (2007). The influence of self-esteem and locus of control on perceived email-related stress. *Computers in Human Behavior*, 23, 2791–2803. <https://doi.org/10.1016/j.chb.2006.05.005>
- Hammond, N., Jørgensen, A., MacLean, A., Barnard, P., & Long, J. (1983). Design practice and interface usability: Evidence from interviews with designers. *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems, 1983*, 40–44. <https://doi.org/10.1145/800045.801577>
- Hanrahan, B. V., & Pérez-Quiñones, M. A. (2015). Lost in email: Pulling users down a path of interaction. *Proceedings of the 33rd Annual ACM Conference on Human Factors in Computing Systems, 33*, 3981–3984. <https://doi.org/10.1145/2702123.2702351>
- Hanrahan, B. V., Pérez-Quiñones, M. A., & Martin, D. (2016). Attending to email. *Interacting with Computers*, 28, 253–272. <https://doi.org/10.1093/iwc/iwu048>
- Hansen, D. L., Shneiderman, B., & Smith, M. (2010). Visualizing threaded conversation networks: Mining message boards and email lists for actionable insights. In A. An, P. Lingras, S. Petty, & R. Huang (Eds.), *International Conference on Active Media Technology, AMT 2010: Active Media Technology* (pp. 47–62). https://doi.org/10.1007/978-3-642-15470-6_7
- Hart, G. (1996). The five W's: An old tool for the new task of task analysis. *Technical Communication*, 43, 139–145. Retrieved from <http://www.ingentaconnect.com/content/stc/tc/1996/00000043/00000002/art00004>

- Hartman, D. B., Bentley, J., Richards, K., & Krebs, C. (2005). Administrative tasks and skills needed for today's office: The employees' perspective. *Journal of Education for Business*, 80, 347–357. <https://doi.org/10.3200/JOEB.80.6.347-357>
- Hartson, R., & Pyla, P. S. (2012). *The UX book: Process and guidelines for ensuring a quality user experience*. Boston, MA: Elsevier.
- Hogan, B., & Fisher, D. (2006). *A scale for measuring email overload*. Retrieved from <https://www.microsoft.com/en-us/research/wp-content/uploads/2016/02/tr-2006-65.pdf>
- Hössjer, A., & Eklundh, K. S. (2008). Making space for a new medium: On the use of electronic mail in a newspaper newsroom. *Computer Supported Cooperative Work (CSCW)*, 18, 1–46. <https://doi.org/10.1007/s10606-008-9082-7>
- Huang, E. Y., Lin, S. W., & Lin, S.-C. (2011). A quasi-experiment approach to study the effect of e-mail management training. *Computers in Human Behavior*, 27, 522–531. <https://doi.org/10.1016/j.chb.2010.09.021>
- Huurdeman, A. A. (2003). *The worldwide history of telecommunications*. Hoboken, NJ: Wiley.
- Iqbal, S. T., & Bailey, B. P. (2008). Effects of intelligent notification management on users and their tasks. *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems* (pp. 93–102). <https://doi.org/10.1145/1357054.1357070>
- Iqbal, S. T., & Horvitz, E. (2007). Disruption and recovery of computing tasks: Field study, analysis, and directions. *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems* (pp. 677–686). <https://doi.org/10.1145/1240624.1240730>
- Iqbal, S. T., & Horvitz, E. (2010). Notification and awareness: A field study of alert usage and preferences. *Proceedings of the 2010 ACM Conference on Computer Support Cooperative Work* (pp. 27–30). <https://doi.org/10.1145/1718918.1718926>
- Jackson, T., Dawson, R., & Wilson, D. (2003). Reducing the effect of email interruptions on employees. *International Journal of Information Management*, 23(1), 55–65. [https://doi.org/10.1016/S0268-4012\(02\)00068-3](https://doi.org/10.1016/S0268-4012(02)00068-3)
- Jerejian, A. C. M., Reid, C., & Rees, C. S. (2013). The contribution of email volume, email management strategies and propensity to worry in predicting email stress among academics. *Computers in Human Behavior*, 29, 991–996. <https://doi.org/10.1016/j.chb.2012.12.037>
- Kanungo, S., & Jain, V. (2008). Modeling email use: A case of email system transition. *System Dynamics Review*, 24, 299–319. <https://doi.org/10.1002/sdr.406>

- Katidioti, I., Borst, J. P., van Vugt, M. K., & Taatgen, N. A. (2016). Interrupt me: External interruptions are less disruptive than self-interruptions. *Computers in Human Behavior*, 63, 906–915. <https://doi.org/10.1016/j.chb.2016.06.037>
- KnowBe4. (2017, January 17). *KnowBe4 warns organizations of false sense of security*. Retrieved from <http://www.prweb.com/releases/2017/01/prweb13986242.htm>
- Kraut, R. E., Sunder, S., Telang, R., & Morris, J. (2005). Pricing electronic mail to solve the problem of spam. *Human-Computer Interaction*, 20(1), 195–223. <https://doi.org/10.1080/07370024.2005.9667365>
- Kushlev, K., & Dunn, E. W. (2015). Checking email less frequently reduces stress. *Computers in Human Behavior*, 43, 220–228. <https://doi.org/10.1016/j.chb.2014.11.005>
- Layman, L., Williams, L., Damian, D., & Bures, H. (2006). Essential communication practices for extreme programming in a global software development team. *Information and Software Technology*, 48, 781–794. <https://doi.org/10.1016/j.infsof.2006.01.004>
- Lee, J., Walker, E., Burleson, W., Kay, M., Buman, M., & Hekler, E. B. (2017). Self-experimentation for behavior change: Design and formative evaluation of two approaches. In *Proceedings of the 2017 CHI Conference on Human Factors in Computing Systems* (pp. 6837–6849). <https://doi.org/10.1145/3025453.3026038>
- Lee, Y. S., Smith-Jackson, T. L., Nussbaum, M. A., Tomioka, K., & Bhatkhande, Y. (2004). Use of product-interactive focus groups for requirements capture and usability assessment. In *Proceedings of the Human Factors and Ergonomics Society Annual Meeting*, 48, 2461–2464. <https://doi.org/10.1177/154193120404802104>
- Leskovec, J., & Horvitz, E. (2008). Planetary-scale views on a large instant-messaging network. *Proceedings of the 17th International Conference on World Wide Web*, 17, 915–924. <https://doi.org/10.1145/1367497.1367620>
- Liker, J. K. (2004). *The Toyota way: 14 management principles from the world's greatest manufacturer*. New York, NY: McGraw Hill.
- Lunt, P., & Livingstone, S. (1996). Rethinking the focus group in media and communications research. *Journal of Communication*, 46(2), 79–98. <https://doi.org/10.1111/j.1460-2466.1996.tb01475.x>
- Mackay, W. E. (1988). Diversity in the use of electronic mail: A preliminary inquiry. *ACM Transactions on Information Systems (TOIS)*, 6, 380–397. <https://doi.org/10.1145/58566.58567>

- Malone, T. W. (1983). How do people organize their desks?: Implications for the design of office information systems. *ACM Transactions on Information Systems (TOIS)*, *1*, 99–112. <https://doi.org/10.1145/357423.357430>
- Mander, R., Salomon, G., & Wong, Y. Y. (1992). A “pile” metaphor for supporting casual organization of information. *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems, 1992*, 627–634. <https://doi.org/10.1145/142750.143055>
- Mann, M. (2007, March 13). *Inbox zero: Action-based email*. Retrieved from <http://www.43folders.com/izero>
- Mano, R. S., & Mesch, G. S. (2010). E-mail characteristics, work performance and distress. *Computers in Human Behavior*, *26*, 61–69. <https://doi.org/10.1016/j.chb.2009.08.005>
- Mansi, G., & Levy, Y. (2013). Do instant messaging interruptions help or hinder knowledge workers’ task performance? *International Journal of Information Management*, *33*, 591–596. <https://doi.org/10.1016/j.ijinfomgt.2013.01.011>
- Mark, G., Gonzalez, V. M., & Harris, J. (2005). No task left behind?: Examining the nature of fragmented work. *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems* (pp. 321–330). <https://doi.org/10.1145/1054972.1055017>
- Mark, G., Iqbal, S. T., Czerwinski, M., Johns, P., Sano, A., & Lutchyn, Y. (2016). Email duration, batching and self-interruption: Patterns of email use on productivity and stress. *Proceedings of the CHI Conference on Human Factors in Computing Systems, 16*, 1717–1728. <https://doi.org/10.1145/2858036.2858262>
- Mark, G., Volda, S., & Cardello, A. (2012). “A pace not dictated by electrons”: An empirical study of work without email. *Proceedings of the CHI Conference on Human Factors in Computing Systems, 12*, 555–564. <https://doi.org/10.1145/2207676.2207754>
- Markus, M. L. (1994). Electronic mail as the medium of managerial choice. *Organization Science*, *5*, 502–527. <https://doi.org/10.1287/orsc.5.4.502>
- Marulanda-Carter, L., & Jackson, T. W. (2012). Effects of e-mail addiction and interruptions on employees. *Journal of Systems and Information Technology*, *14*, 82–94. <https://doi.org/10.1108/13287261211221146>
- McFarlane, D. C. (2002). Comparison of four primary methods for coordinating the interruption of people in human-computer interaction. *Human-Computer Interaction*, *17*, 63–139. https://doi.org/10.1207/S15327051HCI1701_2

- McGrath, J. E. (1984). *Groups: Interaction and performance* (Vol. 14). Englewood Cliffs, NJ: Prentice-Hall.
- McGrue, L. (2015, July 22). *Lesson plan: Who? What? When? Where? Why?*. Retrieved from <https://www.education.com/lesson-plan/who-what-when-where-how/>
- Medina-Mora, R., Winograd, T., Flores, R., & Flores, F. (1993). The action workflow approach to workflow management technology. *The Information Society*, 9, 391–404. <http://dx.doi.org/10.1080/01972243.1993.9960152>
- Microsoft. (n.d.-a). *Desktop notification*. Retrieved from <https://support.office.com/en-us/article/Turn-new-message-alert-pop-up-on-or-off-9940c70e-b306-442e-a856-d94b20318481>
- Microsoft. (n.d.-b). *Icon notification* [Screenshots from personal computer]. Retrieved from <https://www.microsoft.com/en-us/legal/intellectualproperty/trademarks/en-us.aspx>
- Mims, C. (2016, April 11). For Generation Z, email has become a rite of passage. *Wall Street Journal*. Retrieved from <https://www.wsj.com/articles/for-generation-z-email-has-become-a-rite-of-passage-1460347264>
- Morgan, D. L. (1997). *The focus group guidebook* (Vol. 1). Thousand Oaks, CA: Sage.
- Morgenstern, J. (2011). *Never check e-mail in the morning: And other unexpected strategies for making your work life work*. New York, NY: Simon and Schuster.
- Multitasking. (n.d.). In *Merriam-Webster's online dictionary*. Retrieved from <https://www.merriam-webster.com/dictionary/multitasking>
- Musgrove, M. (2007, May 25). E-mail reply to all: “Leave me alone.” *Washington Post*. Retrieved from <http://www.washingtonpost.com/>
- Narang, K., Dumais, S. T., Craswell, N., Liebling, D., & Ai, Q. (2017). Large-scale analysis of email search and organizational strategies. *Proceedings of the 2017 Conference on Computer Human Information Interaction and Retrieval, 2017*, 215–223. <https://doi.org/10.1145/3020165.3020175>
- Nardi, B. A., Whittaker, S., & Bradner, E. (2000). Interaction and outeraction: Instant messaging in action. *CSCW '00: Proceedings of the 2000 ACM Conference on Computer Supported Cooperative Work* (pp. 79–88). <https://doi.org/10.1145/358916.358975>
- Newman, L. C. (2002). Macroergonomic methods: interviews and focus groups. In *Proceedings of the Human Factors and Ergonomics Society Annual Meeting, 46*, 1355–1359. <https://doi.org/10.1177/154193120204601508>

- Newport, C. (2016). *Deep work: Rules for focused success in a distracted world*. New York, NY: Hachette.
- Ophir, E., Nass, C., & Wagner, A. D. (2009). Cognitive control in media multitaskers. In M. I. Posner (Ed.), *Proceedings of the National Academy of Sciences*, *106*, 15583–15587. <https://doi.org/10.1073/pnas.0903620106>
- Paczkowski, W. F., & Kuruzovich, J. (2016). Checking email in the bathroom: Monitoring email responsiveness behavior in the workplace. *American Journal of Management*, *16*(2), 23–39. Retrieved from <http://www.na-businesspress.com/ajmopen.html>
- Pash, A., & Trapani, G. (2011). *Lifehacker: The guide to working smarter, faster, and better* (3rd ed.). Indianapolis, IN: Wiley.
- Patrick, J., & James, N. (2004). Process tracing of complex cognitive work tasks. *Journal of Occupational and Organizational Psychology*, *77*, 259–280. <https://doi.org/10.1348/096317904774202171>
- Pew Research. (2014). Jan. 9–12, 2014—25th anniversary of the web [Database record]. Retrieved from <http://www.pewinternet.org/dataset/january-2014-25th-anniversary-of-the-web-omnibus/>
- Phillips, J. G., & Reddie, L. (2007). Decisional style and self-reported email use in the workplace. *Computers in Human Behavior*, *23*, 2414–2428. <https://doi.org/10.1016/j.chb.2006.03.016>
- Pignata, S., Lushington, K., Sloan, J., & Buchanan, F. (2015). Employees' perceptions of email communication, volume and management strategies in an Australian university. *Journal of Higher Education Policy and Management*, *37*, 159–171. <https://doi.org/10.1080/1360080x.2015.1019121>
- Polyakov, G. (2016, November 8). *50 email best practices for sales teams*. Retrieved from <https://www.linkedin.com/pulse/50-email-best-practices-sales-teams-gleb-polyakov/>
- Powers, W. (2010). *Hamlet's Blackberry: A practical philosophy for building a good life in the digital age*. New York, NY: HarperCollins.
- Professional. (n.d.). In *Merriam-Webster's online dictionary* (11th ed.). Retrieved from <https://www.merriam-webster.com/dictionary/professional>
- Purcell, K., & Rainie, L. (2014, December 30). *Technology's impact on workers*. Retrieved from <http://www.pewinternet.org/2014/12/30/technologys-impact-on-workers/>

- Radicati, S. (2018). *Email statistics report, 2018–2022*. Retrieved from https://www.radicati.com/wp/wp-content/uploads/2018/01/Email_Statistics_Report,_2018-2022_Executive_Summary.pdf
- Radicati, S., & Levenstein, J. (2013). *Email statistics report, 2013–2017*. Retrieved from <https://www.radicati.com/wp/wp-content/uploads/2013/04/Email-Statistics-Report-2013-2017-Executive-Summary.pdf>
- Rainie, L., & Anderson, J. (2017, June 6). *The Internet of things connectivity binge: What are the implications?* Retrieved from <http://www.pewinternet.org/2017/06/06/the-internet-of-things-connectivity-binge-what-are-the-implications/>
- Ramsay, J., & Renaud, K. (2012). Using insights from email users to inform organisational email management policy. *Behaviour & Information Technology*, *31*, 587–603. <https://doi.org/10.1080/0144929x.2010.517271>
- Reimer, J. (2005, December 15). Total share: 30 years of personal computer market share figures. *Ars Technica*. Retrieved from <https://arstechnica.com/features/2005/12/total-share/>
- Reinke, K., & Chamorro-Premuzic, T. (2014). When email use gets out of control: Understanding the relationship between personality and email overload and their impact on burnout and work engagement. *Computers in Human Behavior*, *36*, 502–509. <https://doi.org/10.1016/j.chb.2014.03.075>
- Renaud, K., Ramsay, J., & Hair, M. (2006). “You've got e-mail!” . . . shall I deal with it now? Electronic mail from the recipient's perspective. *International Journal of Human-Computer Interaction*, *21*, 313–332. https://doi.org/10.1207/s15327590ijhc2103_3
- Renaud, K., Ramsay, J., & Hair, M. (2008). Think before you link: Controlling ubiquitous availability. *Interactions*, *15*(6), 65–68. <https://doi.org/10.1145/1409040.1409057>
- Robson, C. (2011). *Real world research: A resource for social scientists and practitioner-researchers* (3rd ed.). Hoboken, NY: Wiley.
- Rosenbaum, S., Cockton, G., Coyne, K., Muller, M., & Rauch, T. (2002). Focus groups in HCI: Wealth of information or waste of resources? In *Proceedings of CHI '02 Extended Abstracts Human Factors in Computing Systems* (pp. 702–703). <https://doi.org/10.1145/506443.506554>
- Ryan, G. W., & Bernard, H. R. (2003). Techniques to identify themes. *Field Methods*, *15*, 85–109. <https://doi.org/10.1177/1525822X02239569>

- Salas, E., Cooke, N. J., & Rosen, M. A. (2008). On teams, teamwork, and team performance: Discoveries and developments. *Human Factors*, *50*, 540–547. <https://doi.org/10.1518/001872008X288457>
- Saldaña, J. (2015). *The coding manual for qualitative researchers* (3rd ed.). Thousand Oaks, CA: Sage.
- Salvador, T., & Howells, K. (1998). Focus troupe: using drama to create common context for new product concept end-user evaluations. In *CHI 98 Conference Summary on Human Factors in Computing Systems* (pp. 251–252). <https://doi.org/10.1145/286498.286734>
- Shirren, S., & Phillips, J. G. (2011). Decisional style, mood and work communication: Email diaries. *Ergonomics*, *54*, 891–903. <https://doi.org/10.1080/00140139.2011.609283>
- Simek, T. (2015, March 14). *Rockin' English lessons* [Video file]. Retrieved from <https://www.youtube.com/watch?v=iZk-WVKOHDw>
- Sinclair, U. (1919). *Jimmie Higgins: A story*. New York, NY: Boni and Liveright.
- Siu, N., Iverson, L., & Tang, A. (2006). Going with the flow: Email awareness and task management. *Proceedings of the 2006 20th Anniversary Conference on Computer Supported Cooperative Work*, *20*, 441–450. <https://doi.org/10.1145/1180875.1180942>
- Small, G., & Vorgan, G. (2008). Meet your iBrain. *Scientific American Mind*, *19*(5), 42–49. <https://doi.org/10.1038/scientificamericanmind1008-42>
- Sobotta, N., & Hummel, M. (2015). A capacity perspective on e-mail overload: How e-mail use contributes to information overload. In 2015 48th Hawaii International Conference on System Sciences (pp. 692–701). <https://doi.org/10.1109/HICSS.2015.89>
- Soucek, R., & Moser, K. (2010). Coping with information overload in email communication: Evaluation of a training intervention. *Computers in Human Behavior*, *26*, 1458–1466. <https://doi.org/10.1016/j.chb.2010.04.024>
- Standss. (2017, June 28). Best practices for creating an email filing system in Outlook [Blog post]. Retrieved from <http://www.standss.com/blog/index.php/practices-creating-email-filing-system-outlook/>
- Steckman, L. M., & Andrews, M. J. (Eds.). (2017). *Online around the world: A geographic encyclopedia of the Internet, social media, and mobile apps*. Santa Barbara, CA: ABC-CLIO.

- Stephens, D. O. (2007). *Records management: Making the transition from paper to electronic*. Overland Park, KS: ARMA International.
- Stevens, S. S. (1946). On the theory of scales of measurement. *Science*, *103*, 677–680. <https://doi.org/10.1126/science.103.2684.677>
- Stone, L. (2009, November 30). Beyond simple multi-tasking: Continuous partial attention [Blog post]. Retrieved from <https://lindastone.net/2009/11/30/beyond-simple-multi-tasking-continuous-partial-attention>
- Strategic. (n.d.). In *Merriam-Webster's online dictionary*. Retrieved from <https://www.merriam-webster.com/dictionary/strategic>
- Sumecki, D., Chipulu, M., & Ojiako, U. (2011). Email overload: Exploring the moderating role of the perception of email as a “business critical” tool. *International Journal of Information Management*, *31*, 407–414. <https://doi.org/10.1016/j.ijinfomgt.2010.12.008>
- Szóstek, A. M. (2011). “Dealing with my emails”: Latent user needs in email management. *Computers in Human Behavior*, *27*, 723–729. <https://doi.org/10.1016/j.chb.2010.09.019>
- Tactical. (n.d.). In *Merriam-Webster's online dictionary* (11th ed.). Retrieved from <https://www.merriam-webster.com/dictionary/tactical>
- Takkinen, J., & Shahmehri, N. (1998). CAFE: A conceptual model for managing information in electronic mail. *Proceedings of the Thirty-First Hawaii International Conference on System Sciences*, *5*, 44–53. <https://doi.org/10.1109/HICSS.1998.648295>
- Takkinen, J., & Shahmehri, N. (2016). Are you busy, cool, or just curious?—CAFE: A model with three different states of mind for a user to manage information in electronic mail. *Human IT*, *2*(2), Art. No. 7. Retrieved from <https://humanit.hb.se/index>
- Taylor, F. W. (1914). *The principles of scientific management*. New York, NY: Harper.
- Teichmann, M., Ilvest, J., Jr., Löhmus, M., Murdvee, M., & Dondon, P. (2013). Monday morning email syndrome in university. In V. Mladenov, T. Tashev, Z. Kolka, V. Pulkov, A. Bekjarski, V. Christofilakis, & N. Bardis (Eds.), *Recent advances in telecommunications and circuit design: Proceedings of the 17th International Conference on Circuits (part of CSCC '13), Proceedings of the 17th International Conference on Communications (part of CSCC '13)*; pp. 169–174). Stevens Point, WI: WSEAS Press.

- Tracy, S. J. (2012). *Qualitative research methods: Collecting evidence, crafting analysis, communicating impact*. Malden, MA: Wiley.
- Tracy, S. J., Lutgen-Sandvik, P., & Alberts, J. K. (2006). Nightmares, demons, and slaves: Exploring the painful metaphors of workplace bullying. *Management Communication Quarterly*, 20, 148–185.
<https://doi.org/10.1177/0893318906291980>
- Turel, O., & Serenko, A. (2010). Is mobile email addiction overlooked? *Communications of the ACM*, 53(5), 41–43. <https://10.1145/1735223.1735237>
- Turkle, S. (2016). *Reclaiming conversation: The power of talk in a digital age*. New York, NY: Penguin.
- Turville, J. (2016, June). A phenomenology of email in the lives of teachers. In M. van der velden, M. Strano, H. Hrachvec, J. Abdelnour Nocera, & C. Ess (Eds.), *Culture, Technology, Communication: Common Worlds, Different Futures? Proceedings of the Tenth International Conference on Culture, Technology, Communication* (pp. 116–124). Retrieved from
http://philo.at/ocs2/index.php/london16/catac_16/
- Tyler, J. R., & Tang, J. C. (2003). When can I expect an email response? A study of rhythms in email usage. In K. Kuutti, E. H. Karsten, G. Fitzpatrick, P. Dourish, & K. Schmidt (Eds.), *ECSCW 2003* (Vol. 3, pp. 239–258).
https://doi.org/10.1007/978-94-010-0068-0_13
- U.S. Census Bureau. (2015). *Table: Full-time, year-round workers and median earnings in the past 12 months by sex and detailed occupation: 2015*. Retrieved from
<https://www2.census.gov/programs-surveys/demo/tables/industry-occupation/time-series/median-earnings-2015-final.xlsx>
- U.S. Postal Service (USPS). (n.d.). *Informed delivery*. Retrieved February 27, 2018, from
<https://informedelivery.usps.com/box/pages/intro/start.action>
- Van Vleck, T. (2012). Electronic mail and text messaging in CTSS, 1965-1973. *IEEE Annals of the History of Computing*, 34(1), 4–6.
<https://doi.org/10.1109/MAHC.2012.6>
- Van Zanten, B. V. (2014, March 17). 10 rules to make email (within teams) more efficient [Blog post]. Retrieved from
<https://thenextweb.com/lifehacks/2014/03/17/10-simple-rules-to-make-email/>
- Venolia, G. D., Dabbish, L., Cadiz, J. J., & Gupta, A. (2001). *Supporting email workflow* (Technical Report No. MSR-TR-2001-88). Retrieved from
<https://www.microsoft.com/en-us/research/wp-content/uploads/2016/02/tr-2001-88.pdf>

- Whittaker, S. (2005). Supporting collaborative task management in e-mail. *Human-Computer Interaction*, 20(1/2), 49–88. <https://doi.org/10.1080/07370024.2005.9667361>
- Whittaker, S. (2011). Personal information management: From information consumption to curation. *Annual Review of Information Science and Technology*, 45, 1–62. <https://doi.org/10.1002/aris.2011.1440450108>
- Whittaker, S., Bellotti, V., & Gwizdka, J. (2006). Email in personal information management. *Communications of the ACM*, 49(1), 68–73. <https://doi.org/10.1145/1107458.1107494>
- Whittaker, S., Bellotti, V., & Moody, P. (2005). Introduction to this special issue on revisiting and reinventing e-mail. *Human-Computer Interaction*, 20(1), 1–9. <https://doi.org/10.1080/07370024.2005.9667359>
- Whittaker, S., & Hirschberg, J. (2001). The character, value, and management of personal paper archives. *ACM Transactions on Computer-Human Interaction (TOCHI)*, 8, 150–170. <https://doi.org/10.1145/376929.376932>
- Whittaker, S., & Sidner, C. (1996). Email overload: Exploring personal information management of email. *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems*, 96, 276–283. <https://doi.org/10.1145/238386.238530>
- Wickens, C. D., Gordon, S. E., & Liu, Y. (2004). *An introduction to human factors engineering* (2nd ed.). Boston, MA: Pearson Prentice Hall.
- Wilson, E. V. (2002). Email winners and losers. *Communications of the ACM*, 45(10), 121–126. <https://doi.org/10.1145/570907.570908>
- Yin, R. K. (2014). *Case study research: Design and methods* (5th ed.). Thousand Oaks, CA: Sage.
- Zhang, J. (2015). Correspondence as a documentary form, its persistent representation, and email management, preservation, and access. *Records Management Journal*, 25, 78–95. <https://doi.org/10.1108/rmj-03-2014-0015>

BIOGRAPHICAL SKETCH

Virginia Counts' academic, professional, and volunteer endeavors have provided a wealth of experiences and skills. As a native Phoenician, Virginia has lived and worked solely in the Phoenix area, a genuine rarity for anyone who knows Arizona well. For her accumulation of successes, Virginia was recognized as one of the "48 Intriguing Women of Arizona" in celebration of the 100th anniversary of statehood for Arizona.

Virginia received a BSE in mechanical engineering, then later, an MSE in industrial engineering, both from Arizona State University. She is licensed as a mechanical engineer in the state of Arizona. In her never-ending pursuit for educational excellence, she returned to ASU again, to seek a PhD in sustainable engineering. Her research and professional goal is to create tools and methodologies for those who stare at computers all day long, so they feel they have accomplished more at the end of their day. For those who "think for a living," Virginia intends to find optimal ways to manage electronic communications, tasks, and project actions, providing knowledgeable workers with more time to work on more creative endeavors.

Virginia began her professional career in a Phoenix-based aerospace company as a project engineer, building and testing gas turbine engines. She then spent a decade in process improvement, earning certification as a Lean Manufacturing Expert and Six Sigma Master Blackbelt. These personal achievements yielded process improvements for teams and significant savings to her company. From the aerospace industry, Virginia moved into the medical device industry, where she now works as a senior program manager. In her current role, as a certified Project Management Professional (PMP), she manages project teams across the operations group manufacturing pacemakers, defibrillators, neurostimulators, and associated leads.

Virginia has maintained a long-standing passion for STEM education and encouraging more women to enter the engineering fields. Virginia is a life member and fellow in the Society of Women Engineers (SWE). She spent a decade on the SWE Board of Directors, culminating in the role of President in 2009.