UNDERSTANDING TECHNOLOGY-MEDIATED INTERRUPTIONS ACROSS WORK AND PERSONAL LIFE

by

JUNWEN (ADELA) CHEN

(Under the Direction of Elena Karahanna)

ABSTRACT

This study examines how technology-mediated interruptions that cross the work and personal life domains affect people's work and nonwork outcomes (i.e., conflict between work and nonwork, work performance, and nonwork performance). Along the dimensions of direction and source, we differentiate between four types of cross-domain technology-mediated interruptions: work-to-nonwork (WTN) other-initiated, WTN self-initiated, nonwork-to-work (NTW) other-initiated, and NTW self-initiated interruptions. Drawing on interruption research and micro-role transition theories, we conceptualize distinct effects of the four interruption types on outcome variables. Data were collected through surveys from 137 knowledge workers. The results reveal asymmetrical effects of technology-mediated interruptions on work and nonwork domains. Despite the commonly held negative connotation of interruptions, the results support a marginally significant inverted U-shaped relationship between NTW self-initiated interruptions and work performance. The results also suggest that WTN other-initiated interruptions affect WTN conflict to a greater extent than self-initiated interruptions. In general, WTN other-initiated interruptions are found to be more detrimental than self-initiated ones. These findings contribute to interruption research by differentiating between four types of interruptions and assessing their

distinct outcomes not at the task level as in prior research but at the domain level. They also enhance our understanding of technology-mediated micro-role transitions by viewing interruptions as moment-to-moment transitions between work and personal life as opposed to institutionalized transitions such as telecommuting or flextime. The study concludes with implications for research and practice.

KEYWORDS: Technology-mediated interruption, WTN conflict, NTW conflict, work performance, nonwork performance, interruption management.

UNDERSTANDING TECHNOLOGY-MEDIATED CROSS-DOMAIN INTERRUPTIONS: THE EFFECTS ON WORK AND PERSONAL LIFE

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CHAPTER 1: INTRODUCTION

1.1 Research Phenomenon

Technologies[1] have wrought profound changes in professional and personal communications, changing our sense of time and location and blurring the boundaries between work and personal life.[2] Mobile devices such as BlackBerry, iPhone and laptop have made the transition between work and nonwork domains increasingly effortless and frequent. Many organizations have institutionalized telecommuting and flextime as alternative work arrangement. However, more and more transitions between work and nonwork domains occur on a moment-to-moment basis through technology-mediated interruptions. In fact, technology-mediated interruptions have become a norm in the life of knowledge workers,[3] whose work is highly autonomous, mobile, and communication-rich.

Considered the number one Human Computer Interaction (HCI) problem of the future (McFarlane 1999), technology-mediated interruptions represent a productivity challenge faced by both individuals and organizations. On average, a knowledge worker experiences more than

[1] In this study, information communication technologies include devices (such as mobile phone, phone, laptop and desktop computers) and applications that can be used on such devices (such as email, instant messenger, texting, and voice mail).

[2] In this study, we use the term "work" to refer to one's life domain associated with a paid job, while we use the term "personal life" to refer to the life domain outside one's paid work. Personal life includes both solitary leisure activities and those involving one's family or friends. And it entails one's interaction with family or friends, involvement in community activities, or engagement in personal leisure. Hereafter we will stick to these terms wherever appropriate. However, in some places, we will also use work/nonwork to refer to the domains of one's work and personal life for the sake of brevity, as in work hours and nonwork hours, work-related and nonwork-related, and so on.

[3] There are many professions where individuals barely have any control over the level of interruptions, such as helpdesk personnel, police dispatchers, and emergency room staff. At the same time, there are also many professionals who should ideally stay focused on one task, such as surgeons. Between the two extremes lies a considerable portion of the work force, many of them knowledge workers who are the focus of this study.

six interruptions an hour (Reuters 1997) and spends about 28% of a typical working day on unnecessary interruptions (Spira et al. 2005). At Intel, lost productivity due to the time spent handling unnecessary email and recovering from interruptions translates into an estimated annual cost of $1 billion (Hemp, 2009). Technology-mediated interruptions can also generate more subtle outcomes. Fragmenting an individual's workday, interruptions have been identified as a creativity killer (Amabile, 1998). Research has also shown that as the human brain is asked to track too many data points in a multitasking-driven environment, it may behave in counterproductive or unproductive manners, causing an individual to develop attention deficit traits (Hallowell, 2005).

Given the prevalence of technology-mediated interruptions and the importance of the phenomenon to both the work and personal lives of knowledge workers, the dissertation focuses on examining the effects of technology-mediated interruptions that cross the domains of one's work and personal lives.

1.2 Research Gaps

To date, three major streams – micro-role transition[4] between one's work and personal life, interruption studies from the HCI field, and individual use of mobile technologies - have addressed this phenomenon. The dissertation draws upon, and makes a contribution to, all three streams.

First, the advancement of mobile devices into the workplace and home has spurred interest in the impact of technologies on micro-role transitions. Micro-role transitions refer to the frequent and recurring switching between roles in general, and between engagement in one's

[4] Micro-role transitions are frequent and recurring daily role transitions (e.g. between different work roles or between work and home roles) as compared to macro-role transitions that refer to infrequent and permanent changes such as promotions and retirement (Ashford et al 2000).

work and personal life roles in this specific case. One's work and personal life[5] represent two different domains – two spheres of life associated with different rules, thinking patterns, and behaviors (Clark 2000). More than three decades ago, organizations largely assumed that work and personal life are separate and mutually exclusive domains. However, technologies have led to fundamental changes in the structure and substance of one's work and personal life through changing our sense of time and location, and blurring the boundary between work and personal life. Mobile capabilities that enable ubiquitous access, and adoption of modern technologies by knowledge workers, have redefined work and personal life as well as the boundaries that define and separate them.

Changes in individual work and nonwork modes have made it increasingly clear that work and personal life are intimately blended. Work and personal life are often associated with different roles. The penetration of technologies into one's work and personal life makes micro-role transition possible literally from anywhere at any time. The spheres of work and personal life are becoming more "integrated" rather than "separated" (Kanter 1977). It is more likely that activities of one's work and personal life are collocated (Michelle et al. 2004) and therefore, more likely to spill over to the purview of each other. For example, while knowledge workers remain physically in the work (nonwork) domain, they can psychologically and behaviorally engage in nonwork (work) activities. Via phone call, email, instant messaging (IM), and texting, people can attend to personal matters remotely from their workplace. Likewise, through these technologies, work has also made inroads into the territory of one's personal life.

Studies on distributed working arrangements enabled by technologies have accumulated in the work-nonwork literature (Golden et al. 2006; Hill et al. 1998; Rau et al. 2002). Flexible

[5] In this study, we use the term "nonwork" to refer to an individual's life domain outside the paid work. It may include both solitary leisure activities and those involving one's family or friends.

working arrangements in the form of telecommuting (Golden et al. 2006), virtual office (Hill et al. 1998), or computer-based supplemental work during off hours (Shamir et al. 1985; Venkatesh et al. 1992) have become widespread practices across organizations. Such distributed working arrangements represent institutionalized forms of *cross-domain* technology use, often with a unidirectional emphasis (i.e., from work to one's personal life in the sense of performing work activities away from workplace). However, they are not the only way that technologies afford individuals extensive mobility between work and personal life. There still lacks a systematic examination of cross-domain technology use that occurs in a more casual or transitory manner (i.e., micro-role transitions) and in the opposite direction (i.e., engaging in nonwork activities during working hours). For example, through communication and social networking technologies they can also stay connected, while at work, with friends and families who are spatially scattered in different locations. Such cross-domain technology use seems almost effortless, often becoming habitual unknowingly. Therefore, the dissertation contributes to this body of research by going beyond examining the effects of technology-enabled institutionalized arrangements and focusing on the effects of technology-enabled micro-role transitions between work and nonwork.

The *second* stream of research that informs this research are HCI studies on technology-mediated interruptions. While there are many studies on technology-mediated interruptions in this domain, most focus primarily on *other-initiated* interruptions at *work* (Russell et al. 2007), which account for only a portion of the interruptions experienced by knowledge workers. According to Czerwinski et al. (2004), about 40% of all interruptions are *self-initiated*. For example, people may occasionally switch to personal email, casual web browsing, or IMing with friends while at work, interrupting their ongoing work tasks in doing so. As such, both other-

initiated and self-initiated interruptions that occur in the work and nonwork domains are considered in this study.

In addition, the extant research on interruptions primarily focuses on work-related interruptions, whereas interruptions are also likely to derive from people's personal life. According to a 2008 AOL survey of 4000 email users in the top-20 US cities (AOL, 2008), 62% check work-related emails over the weekend, 39% check emails in a bar or club, and 25% check emails while on a date. On the other side, there is a heated debate over whether to allow social networking applications in workplace. About 24% of full-time employees in the UK use Facebook at work (Social Networking across the Age Gap - UK, 2009). Due to the growing invasion of work and nonwork tasks into each other's territory, it becomes difficult for studies focusing on a single domain to adequately capture the overall outcomes of technology-mediated interruptions. It is, therefore, important to adopt an integrated perspective to approach the phenomenon of interruption that examines both domains. Specifically, this study is concerned with technology-mediated interruptions that *cross the boundary* between work and nonwork: work interruptions that occur during nonwork hours (what we term work-to-nonwork (WTN) interruptions) and personal interruptions that occur during working hours (what we term nonwork-to-work (NTW) interruptions).

Finally, whereas existing interruption studies mostly assess task-level outcomes (i.e., task performance), our research makes a contribution by examining domain-level outcomes of technology-mediated interruptions (i.e., conflict between work and nonwork, work performance, and nonwork performance) rather than task-level outcomes.

The *third* body or research that informs this dissertation is research on technology use. A rich body of research on technology use has also accumulated in the IS field as it is a topic of

enduring interest to IS researchers. However, most studies tend to focus on use in general, without differentiating between other-initiated or self-initiated use, or between disruptive or non-disruptive use. However, different types of use may generate different outcomes. Collapsing them into one single construct may lose the richness and uniqueness embedded in each distinct type of use. For example, there are three distinct patterns of technological practices among PDA users: work-intensive, nonwork-intensive, and integrated (Golden et al. 2007) each likely associated with distinct individual and organizational outcomes. The lost variability may partly explain the Janus-faced nature of technologies as observed by researchers. By treating technology use as a single, undifferentiated construct, the current literature tends to overlook potentially important distinctions among various ways that people use their technologies.

One important structural distinction that arises from the interruption literature focuses on the source of an interruption (i.e., other-initiated or self-initiated). In response to the call for differentiation between initiators and respondents in technology-mediated communications (Jett et al. 2003), we examine both other-initiated and self-initiated technology-mediated interruptions. Another structural distinction, derived from the micro-role transition literature, deals with the direction of an interruption (i.e., work-to-nonwork interruptions and nonwork-to-work interruptions). Therefore, this study contributes to the technology-use literature by differentiating use along these two structural distinctions.

Further, the limited attention the IS literature has given to the impact of technologies on role boundaries stands in striking contrast to its abundant interest in technology use by individuals and organizations. This study differs from previous studies (Ahuja et al. 2007; Moore 2000), which examine individual role balance of IT professionals (such as IT road warriors), given their unique job nature. This study focuses on knowledge workers in general and the

consequences of technology-mediated interruptions across work and personal life. While some studies acknowledge the negative effects of technologies, they do not elaborate on the mechanisms through which the reported consequences occur. This study is a step in that direction.

In addition, these studies do not typically consider the active role that an individual plays. Rather, individuals are often treated as passive bearers of these typically negative effects. However, rather than determining human behaviors, technologies only create "occasions that trigger social dynamics" (Barley 1986, p. 81). In our specific context, technologies are afforded with attentional, informational, and content-related cues that allow users great discretion over how to respond to these cues by deploying different interruption management strategies. Therefore, the consequences of technologies on people's work and personal life likely vary depending on individual interruption management strategies employed. Though not a primary objective of the study, the dissertation aims to further the understanding of how technologies affect the boundaries between one's work and personal life by examining such interruption management mechanisms. By recognizing users' conscious choices, we call attention to the role played by human agency in deriving different outcomes of technology use. However, fully examining this perspective is not a primary objective of the dissertation. As such, we present the theoretical development and preliminary evidence of the effect of interruption management mechanisms in Appendix B.

While these three streams of research have provided significant insights into different aspects associated with technology-mediated interruptions across work and personal life, taking each perspective alone may prevent us from achieving a fuller understanding of the phenomenon. The extant research has evolved in a fairly fragmented manner over the years. The perspective of

work-nonwork interaction considers both work and personal life, but it tends to focus more on the *institutionalized* forms of technology use (e.g., telecommuting) rather than frequent micro-moment technology-enabled interruptions. Interruptions studies adopt a finely grained approach by categorizing interruptions and differentiating their effects on interrupters and interruptees. However, studies on technology-mediated interruptions predominantly focus on *other-initiated* interruptions in the *workplace*. Further, although the IS literature has examined individual use of a wide variety of technologies both at work and at home, these studies seldom differentiate between various use behaviors, e.g., other-initiated or self-initiated use, or within-domain and cross-domain use. The dissertation addresses these gaps.

1.3 Research Objectives and Questions

The main objective of this dissertation is to provide an integrative perspective to examine technology-mediated interruptions across work and personal life. A cross-domain technology-mediated interruption is defined as a technology-mediated occurrence from a different domain than the current task that impedes or delays the continuity of the current task. Whereas some people enjoy and appreciate the convenience and flexibility provided by technologies, others view the widely touted advantages of these technologies with suspicion, given that such technologies have actually made them work extended hours by facilitating work's intrusion into their personal life. Existing literature has focused on how a single application – for example, IM (Cameron et al. 2005), mobile phone (Arnold 2003), or email (Weber 2004) – transforms the way that one's work and personal life interact. Given that cross-domain interruptions occur via a portfolio of technologies rather than through a single technology, this study focuses on interruptions that occur via a range of technologies commonly used by knowledge workers (email, phone, IM, texting, etc).

Specifically, we draw upon the interruption (Jett et al. 2003) research, micro-role transition theory (Ashforth et al. 2000), and studies on individual technology use to conceptualize (a) different types of cross-domain technology-mediated interruptions and (b) how these technology-mediated interruptions affect the boundary between one's work and personal life through diminishing spatial and temporal constraints. In the Appendix B for the study, we explore how interruption management intensifies or mitigates such effects. First, the study develops a typology of cross-domain technology-mediated interruptions along two dimensions: source of the interruption (i.e., who initiates an interruption) and direction of an interruption (i.e., whether the interruption is from work to personal life or in the opposite direction). We thus classify cross-domain technology-mediated interruptions into four categories: other-initiated and self-initiated work-to-nonwork interruptions and other-initiated and self-initiated nonwork-to-work interruptions. We then theorize the consequences of these technology-mediated interruptions across work and personal life in terms of the performance of and the conflict between one's work and personal life. More specifically, the dissertation addresses the following research question:

What are the consequences of technology-mediated interruptions across work and personal life?

In Appendix B we also elaborate the effects of interruption management on the relationship between technology-enabled interruptions and consequences, focusing on the role of human agency. Specifically, we address the following research question:

How does interruption management influence the relationships between cross-domain technology-mediated interruptions and their consequences?

Thus, the study takes an integrative approach to investigate the consequences of each of the four types of technology-mediated interruptions by drawing upon three different streams of

research that inform the phenomenon. It represents one of the first attempts to provide an integrated framework, accounting for both within-domain (i.e., work performance, and performance in personal life) and cross-domain (i.e., WTN conflict and NTW conflict) *consequences*. Further, we take the research on individual level technology use a step further by differentiating between other-initiated and self-initiated interruptions and their distinct consequences.

Further, to understand the effect of interruption management, it is first important to understand the nature of interruption management. As such, the Appendix B to the dissertation develops a conceptual framework of the various types of interruption management. Guided by interviews with knowledge workers and by prior studies on interruption and technology use, we identify three major stages (i.e., detection, interpretation, and integration of an interruption) [6] of interruption management and distinct interruption management mechanisms and behaviors across each of these stages. This presents another contribution of the research.

1.4 Structure of the Dissertation

The remainder of the dissertation includes five chapters. Chapter 2 reviews the significant prior research on interruption and micro-role transition, which this dissertation draws upon as the theoretical underpinnings. The complementary synergy of the two research streams is discussed. Based on the literature review, a conceptual framework of interruption management is developed as well as the conceptual model for the study. Chapter 3 presents the research model and hypotheses. Chapter 4 describes the research methodology adopted in this research, discussing the overall research design, site selection, choice of the focal technology, questionnaire development and validation, and data collection methods. Results of the empirical study are

[6] Stages of an interruption are discussed in more details in the following section of this dissertation.

presented in Chapter 5. After a discussion of the research findings, the dissertation concludes with implications for research and practice (Chapter 6). The theoretical development and preliminary empirical test of the nature and effects of interruption management are presented in Appendix B.

CHAPTER 2: THEORETICAL BACKGROUND

Interruption and micro-role transition represent important aspects of our work and personal life. The two concepts share some theoretical overlap: an interruption involves *more than one* task while a role transition involves *more than one* role. In other words, interruption and role transition arise during the encounter of multiple (two or more) tasks or roles. The two concepts also differ theoretically. Interruption is a task-level phenomenon. It occurs when one task breaks the continuity of another task, but does not differentiate between the domains of the tasks (e.g., between work tasks and tasks from one's personal life). Micro-role transition is a domain-level phenomenon. It occurs when an individual makes a transition from one role to another. The domain of a role is one of the key dimensions along which roles are differentiated from each other. Although a rich and extensive body of research has accumulated in each field, literatures on interruption and on role transition barely overlap.

Sharing a common phenomenon of interest but differing in some fundamental ways, the two theoretical perspectives – interruption and micro-role transition – can complement each other and jointly generate a richer understanding of technology-mediated cross-domain interruptions. Therefore, this dissertation synergizes both theoretical perspectives to develop a research model. This study represents one of the first attempts to aggregate and assess the consequences of a task-level phenomenon at the domain level.

The remaining of this chapter aims to review the key conceptualizations in both interruption and micro-role transition literatures that inform this study rather than attempting an exhaustive review of both streams of research.

2.1 Interruption

2.1.1 Definition

This study takes a broad view of ***interruption***, which refers to occurrences impeding or delaying the recipient by breaking the continuity of the current activity (Jett et al. 2003). An interruption is a discrete occurrence, with a finite duration and clear starting and ending points. This research focuses on technology-mediated interruptions – interruptions that occur via information communication technologies. Such technologies include both devices (e.g., the BlackBerry, iPhone, Android, and laptop) and applications (e.g., IM, texting, email, web browser, online games, and other smart phone apps). A *technology-mediated* interruption is a technology-based occurrence that breaks the continuity of an ongoing task. The ongoing task is not necessarily technology-based. For example, when people sneak a peek at their BlackBerry to check for work-related emails during family movie night, a technology-mediated interruption occurs, via the email application on the BlackBerry. When people's spouse or friends drop by at their office, an interruption occurs, but it is not mediated by technology.

In order to provide a nuanced view of interruptions, this research identifies two important dimensions along with interruptions differ from each other – the source and the direction of an interruption. It thus differentiates between four types of interruptions (Figure 2-1).

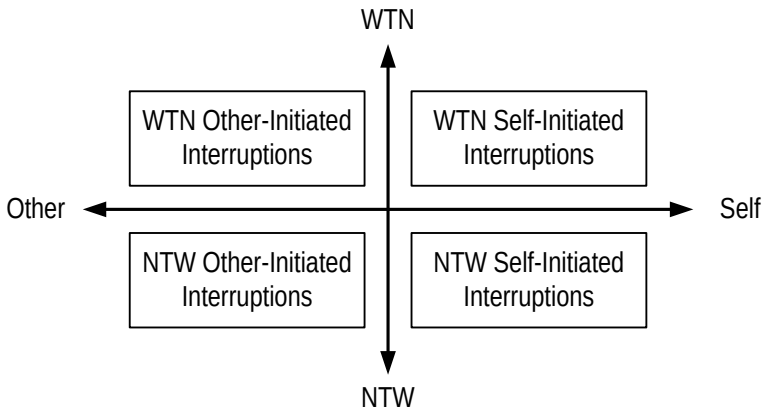


Figure 2-1 Four Types of Technology-Mediated Interruptions

2.1.1.1 Source

Source of an interruption refers to where the interruption comes from. From the standpoint of the focal individual, self and others are the two sources of interruptions. By the definition we adopt in this study, an interruption can be either other- or self-initiated. An other-initiated interruption comes from other people or entities in the environment whereas a self-initiated interruption results from one's own thought processes (Miyata et al. 1986). ***Other-initiated technology-mediated interruption*** refers to an externally generated, discrete occurrence that is presented to an individual via technologies and that breaks the cognitive focus on an ongoing task. ***Self-initiated technology-mediated interruption*** refers to an internally generated, discrete occurrence that is initiated and performed by an individual through technologies and that breaks the cognitive focus on an ongoing task. A self-initiated interruption can also take the forms of daydreams, intrusive thought, mind wandering, spontaneous cognitive events, and stimulus-independent thought (e.g., Antrobus et al. 1966; Gold et al. 1985; Klinger 1977; Klos et al. 1981). Given the dissertation's major interest in *technology-mediated* interruptions, we emphasize on self-initiated interruptions in the form of *actions* rather than thoughts.

Some studies adopt a more restricted view of interruption, focusing only on other-initiated ones (Van Den Berg et al. 1996). And the extant interruption literature is largely built on a paradigm of other-initiated interruptions (Russell et al. 2007). However, self-initiated interruptions are equally important, in terms of volume and consequences. About 40% of all interruptions are self-initiated (Czerwinski et al., 2004). Self-initiated technology-mediated interruptions, as a form of voluntary use of technologies, require knowledge workers' conscious choice and decision in order to generate beneficial outcomes. As discussed, both other- and self-initiated technology-mediated interruptions represent important forms of technology use prevalent in knowledge workers' professional and personal life. Being self-initiated does not necessarily prevent an occurrence from breaking the flow of an ongoing task and thus becoming an interruption. Therefore, this dissertation considers both other- and self-initiated interruptions critical pieces in understanding the interruption phenomenon, and adopts the more inclusive view of interruption (i.e., the definition by Jett and George (2003)).

The distinction between other- and self-initiated interruptions is important, as we believe that source of an interruption affects the extent to which an interruption is disruptive. One of the factors that determine an interruption's effects is the controllability of its timing. Individuals who initiate an interruption often benefit more from it than those on the receiving end due to the different levels of predictability on both sides (Rennecker et al. 2005). Other-initiated interruptions occur randomly as the recipient of the interruption can hardly control the timing of an interruption prior to its occurrence.[7] In many cases, people who are interrupted by others are not aware that an interruption is going to occur prior to its occurrence. However, in general, people are often more prepared mentally when they initiate an interruption than when they are

[7] Some other-initiated interruptions may be more predictable than other other-initiated interruptions. For example, people are interrupted when their colleagues call in for a pre-scheduled teleconference. However, by and large, other-initiated interruptions tend to be unpredictable in terms of their timing.

initiated by others. Self-initiated interruptions can be either planned or spontaneous. For example, people may leave during a TV show to dial in a teleconference with offshore offices at a pre-scheduled time. However, checking for work-related emails during off hours is mostly spontaneous except for some people who consciously regulate their behaviors (e.g., checking for work-related emails only after they wake up and before they go to bed over the weekends). The major difference between the two is how the interruption develops. The former arises from individuals' deliberate thought process, while the latter results from their momentary impulse. But in both cases, people make a conscious decision on whether, how and when to take action on their thoughts (deliberate or spontaneous). Even for an interruption spontaneously initiated by themselves, people make a conscious decision to take action and are therefore mentally prepared.

2.1.1.2 Direction

The study focuses on cross-domain interruptions, where the interruption and the ongoing task come from different domains (i.e., work and personal life). This points to the other dimension along which we make a distinction between interruptions: the direction of an interruption. This research differentiates between work-to-nonwork (WTN) and nonwork-to-work (NTW) interruptions. WTN interruptions are work-related interruptions that occur in people's personal life, while NTW interruptions are personal interruptions that occur in people's work domain.

Within-domain interruptions – WTW (work-related interruptions that occur at work) and NTN (personal interruptions that occur in personal life) interruptions – are outside the scope of this study. Most interruption studies focus on within-domain interruptions with the interruption and the ongoing task belonging to the same domain (i.e., work). Interruption has been widely studied in the workplace (Altmann et al. 2004; Czerwinski et al. 2004; Speier et al. 1999), with

the interruption and ongoing task both being work-related. However, an interruption can also occur across domains, with the interruption and the ongoing task belonging to different domains (i.e., work and personal life). Evidence of cross-domain interruptions has accumulated rapidly. This is partly due to the growing ubiquity of communication technologies, which blurs the boundary between work and personal life.

Cross-domain and within-domain interruptions are different by nature. How cross-domain interruptions are viewed and dealt with is expected to differ dramatically from within-domain interruptions. The work of certain professions, such as emergency room staff, IT support personnel, and police officers, is largely driven by within-domain interruptions. Within-domain interruptions, especially work-related interruptions in the workplace, arise largely due to today's communication-rich and collaborative work environment, largely representing how knowledge workers work. On the contrary, oftentimes cross-domain interruptions are remotely relevant to the ongoing task, and are hardly considered a legitimate component of knowledge workers' job scope. For example, there is a heated debate over whether or not to allow social networking applications (e.g., Facebook and Tweeter) in the workplace. Moreover, a technology-mediated *cross-domain* interruption involves role transition by nature. Due to the pronounced difference between norms, mental models, expectations, and behaviors associated with work and personal life as distinct domains, a transition between work role and personal life role requires greater mental (and physical) efforts than a transition between roles from the same domain (e.g., transition from a colleague to a subordinate) or between tasks from the same domain.

2.1.2 Consequences of Interruptions

Interruptions inherently involve a potentially stressful situation, with contending demands between two tasks. They force people to allocate their personal resources between two sources of

stimuli (i.e., the interrupted task and the interrupting task). Interruptions have important implications for task performance, which can be affected by various task characteristics, such as frequency (Monk 2004), timing (Ho et al. 2005), temporal strain, complexity, similarity (Eyrolle et al. 2000), mental load during task execution, task type (Bailey et al. 2008; Czerwinski et al. 2000), similarity in modality of the interrupted and the interrupting tasks (Latorella 1998).

Prior studies have largely focused on *task-level* consequences of *other-initiated work-related* interruptions within the workplace. Laboratory studies often focus on tasks relevant to organizational context such as individual decision making (Speier et al. 1999) and performing computer tasks (Czerwinski et al. 2000). Likewise, field studies are often conducted to capture outcomes in the work environment, such as indexing customer data by telephone operators (Eyrolle et al. 2000) and radio dispatching by police officers (Kirmeyer 1988a). Tasks in one's personal life, like those in the professional life, are also subject to the influence of technology-mediated interruptions. For example, one may receive a phone call from a coworker during a movie. Some organizations mandate that corporate executives remain accessible through email or mobile phone even on personal vacations. Therefore, much remains to be explored about the consequences of work-related interruptions in people's personal life.

2.1.3 Summary of Interruption Literature

This dissertation aims to make four major contributions to the interruption literature. First, it examines four types of interruptions, extending the single-dimensioned view of interruption that prevails among prior studies. Along the dimensions of source and direction, this study develops a typology of interruptions and assesses the different consequences of each.

Second, this study assesses the *domain-level* consequences of interruptions. To date, interruption research focuses primarily on task-level outcome, i.e., task performance. There are few studies investigating interruptions across domains and examining domain-level outcomes (i.e., conflict between work and nonwork domains, work performance, and nonwork performance), which this study does. Balance between work and nonwork domains has been consistently rated by undergraduates as a top-three career concern (Gerdes 2008). It is important to understand how interruptions as the norm in the life of today's knowledge workers affect their work and personal life.

Third, the study explores the beneficial effects of interruptions. People typically hold a negative perception of interruptions, which are considered disruptive and thus result in productivity drop. The positive aspects of interruptions, however, are largely neglected in the literature. For example, online shopping as a break from a taxing task at work may refresh people's plagued mind and enhance productivity on their return to the ongoing task. Despite the prevalent negative perception of interruptions, researchers increasingly acknowledge the potential benefits of interruptions and call for a shift of attention from eliminating or decreasing interruptions in general to making them more effective (Hudson et al. 2002).

Fourth, the dissertation examines cross-domain interruptions mediated by a portfolio of technologies, which better reflect the reality of today's knowledge workers in both personal and professional settings. With very few exceptions (e.g., Latorella 1996), extant studies focus on interruptions that occur through a single technology such as email or IM (Garrett et al. 2007), rather than multiple technologies. Knowledge workers actually rely on a portfolio of communication technologies such as email, phone call, IM, and texting. Therefore, assessing the

cumulative sum of interruptions that occur through a variety of technologies can lead to a better understanding of how interruptions affect knowledge workers' work and personal life.

2.2 Micro-Role Transition

2.2.1 Role Identity

Role refers to a pattern of expectations applied to a particular social position but persisting independently of the personalities occupying the position (Gross et al. 1958; Merton 1957; Sieber 1974). A life domain (e.g., work or personal life) often hosts a set of roles. For example, people typically assume multiple roles in the work domain, including subordinate, supervisor, peer, engineer, client, and supplier, depending on the interlocutor. In the domain of personal life, people assume the roles of spouse, children, parents, friends, neighbors, or members of a residential community.

Roles can be uniquely identified and differentiated from one another through role identify. ***Role identity*** is a socially constructed definition of who a role occupant is, consisting of such features as the goals, values, norms, beliefs, interaction styles, and time horizons (Stryker 1980; Ashforth et al. 2000). Some of these features represent typical characteristics of the role and are central to the definition of its identity (Perry, 1997), therefore known as the core features.The features that are less important or necessary in defining a role identity are called peripheral features. For example, the familarity with basic programing languages and the passion for coding represent core features that define the role of software engineer, whereas the digital work environment represent a peripheral feature. Roles from the same domain (e.g., parent and spouse) share a greater number of features, especially core features, with each other than with roles from another domain (e.g., parent and subordinate). In other words, the contrast between the roles from the same domain is less significant than between the roles from different domains.

For example, the contrast between the parent and the spouse roles is smaller than that between the parent and the subordinate roles.

2.2.2 Role Boundaries

Role boundaries are intentionally created and maintained as a way to simplify and order the environment (Nippert-Eng 1996; Zerubavel 1991) and thus, to define roles as separate from one another. Role boundaries partition reality into discrete domains (e.g., work and nonwork), crossing which requires efforts. At the same time, by circumscribing domains, boundaries help people concentrate more on the currently salient domain and less on other domains (Ashforth et al., 2000). The concept of boundaries has been widely used in many disciplines to refer to the physical, temporal, cognitive, emotional, and/or relational limits that demarcate different role domains. Time and location are two characteristics that define work and nonwork roles and differentiate them from each other. For most knowledge workers, workplace and weekdays are associated with work and the roles entailed in the work domain, while home and weekends are related to personal life and the associated roles.

Flexibility and permeability are two important properties of role boundaries (Hall et al. 1988). The former refers to the degree to which the temporal and spatial boundaries of a role are pliable (i.e., flexible boundaries imply that a role is not tied to a specific setting or time), while the latter refers to the degree to which an individual can be psychologically (and behaviorally) engaged in one role while physically located in the domain of another role (i.e., permeable boundaries allow cross-role interruptions). High flexibility and permeability enable people to cross the role boundaries when necessary and thus reduce inter-role conflict (Ashford et al 2000). However, highly flexible and permeable boundaries can also lead to the blurring between roles

and cause confusion among individuals and people around them as to which role should be more salient, resulting in higher inter-role conflict.

2.2.3 Micro-Role Transition

Role transition refers to the move from one role to another, crossing the psychological (and physical, when necessary) boundaries (Ashforth et al. 2000). The greater the "contrast" (number of core and peripheral features that differ) (Louis 1980; Ashforth et al. 2000) between two roles, the greater the magnitude and potential difficulty of the transition (physical, psychological or both) between them, and thus the greater the efforts (physical, mental, or both) required by the transition.

Role transition can occur within the same domain (i.e., within-domain role transition) or across domains (i.e., cross-domain role transition). Given the interest in technology-mediated cross-domain interruptions, this dissertation focuses on cross-domain role transition. Switching between roles within the same domain is easier than across domains, as roles belonging to the same domain share more similarity with each other than with those from other domains. People can easily switch between the role of a parent and the role of a spouse. However, transition from a parental role to a professional role such as a subordinate requires greater efforts.

By transcending temporal and locational boundaries, information communication technologies have transformed how people communicate within and across life domains. Making within-domain role transitions is commonplace in knowledge workers' personal and professional life. For example, they almost constantly juggle the roles of colleague, subordinate, and supervisor in the workplace. However, cross-domain role transition is often discouraged or prohibited. For example, some organizations resort to email surveillance to ensure that employees focus solely on work roles in the workplace. Cross-domain role transition is central to

this study. So hereafter the term “role transition” will refer to cross-domain role transition unless otherwise specified.

2.2.4 The Impact of Technology on Role Boundary and Role Transition

First, information communication technologies facilitate role transition by making the role boundaries more flexible and permeable. As previously discussed, flexibility is the extent to which a role’s temporal and locational boundaries are pliable. Technologies (such as the BlackBerry, email, and texting) enable knowledge workers to attend to work-related and personal tasks from any place at any time. The ubiquity of modern technologies has transformed both professional and personal communications by overcoming temporal and locational constraints. Permeability is concerned with the extent to which a role permits people to be physically located in its domain, but psychologically and/or behaviorally engaged in another role (Pleck 1977; Richter 1992). In this digital era, most tasks faced by knowledge workers are technology-based. Technology-mediated communication does not necessarily depend on the synchrony or the physical presence of the communicating partners. These role boundaries are more permeable than boundaries of a surgeon’s role. The permeability of role boundary epitomizes role conflict – during the individual’s involvement in one role, another role can be introduced and the two roles compete against each other for people’s attention simultaneously.

Second, information communication technologies reduce the barriers to role transition by making role identities less contrasting across work and personal life. They reduce the contrast between a pair of roles by diminishing their temporal and/or locational differences. For example, from the conventional perspective of work-life interactions, an important demarcation between work and personal life lies in the fact that work-related and personal tasks typically occurred in different locations at different times. Nowadays time and location are no longer the defining

features of work and personal life. Although temporal and locational features may not be core to the contrast between work and family roles, the blurring of the boundaries reduces the number of features on which the two role identities differ and, thus, reduces the magnitude of transition from one role to the other. For example, modern communication devices such as the BlackBerry make it increasingly difficult for people to draw a clear line between work and personal life. People can stay connected with work contacts through BlackBerry even on vacation or during off hours.

The use of technologies also has important implications for role transition through its impact on role boundaries and role contrast. Role transition costs time, attention, and energy as finite resources that people allocate to the domains of work and personal life. The extent to which crossing the boundary would be free of difficulty is an important factor in people's decision-making about role transition. Therefore, people are more likely to cross the boundaries between work and personal life when such transition is relatively free of effort and have been made easier by technologies. When it gets easier to repeatedly cross the boundaries, working not to do so becomes more difficult for us (Nippert-Eng, 1996). The ease of role transition across work and personal life could now make boundary erection and maintenance a new challenge for knowledge workers.

Role boundaries (flexibility and permeability) and role identity (contrast) define the extent to which people's roles are integrated or segmented across work and personal life (Ashford et al 2000; Nippert-Eng, 1996). Segmentation is denoted by roles that are tied to specific places and times (inflexible boundary), inhibit cross-role interruptions (impermeable boundary), and are strongly differentiated (high contrast between role identities) (Ashforth et al., 2000). For example, assembly line workers have highly segmented roles across work and

personal life – their work roles are closely tied to the factories and the pre-scheduled shifts; it is difficult for them to attend to work in their personal life; and there are pronounced differences between their roles from work and personal life, in both the core features (e.g., expectation, mental models, skills, and norms) and the peripheral features (e.g., time and location). On the contrary, college professors typically have highly integrated roles across work and personal life – there is no fixed time or location for many of their work activities such as research; it is feasible for them to handle personal tasks at work through technologies; and the significance of time and location in differentiating the roles from work and personal life is ever diminishing, although the distinction on the core features largely remain. In general, high segmentation makes role transitions more difficult with a wider psychological and physical (if any) gap to bridge. On the contrary, high integration leads to role transitions of lower magnitude – there is less of a psychological and physical (if any) gap to bridge (Ashforth et al., 2000). Role integration and role segmentation represent two ends of the same continuum. In reality, it is hard to find two roles that are completely segmented or completely integrated. In most situations, roles overlap with one another to some extent. Such overlap depends on the number of core and peripheral features shared and the flexibility and permeability of the role boundaries.

As discussed above, technologies render the boundaries between work and personal life to be more flexible and permeable, enabling higher role integration. Technologies also diminish the temporal and locational distinction between what belongs to work and what belongs to personal life, reducing role contrast. In contrary to their transformative effects on the boundaries between work and personal life, technologies have a limited impact on role contrast, as time and location often represent the *peripheral* features of role identity. Roles of one's work and personal life still differ significantly on other dimensions, especially the core features of role identity (e.g.,

expectations, mental models, norms, behaviors etc.). Even though technologies render crossing the physical boundary unnecessary, switching cognitive gears is still a challenge as it costs personal resources such as time, attention, and energy to disengage psychologically from one role and re-engage in the dissimilar identity implied by a second role (Louis & Sutton, 1991).

2.2.5 Summary of Micro-role Transition Literature

This dissertation aims to make two major contributions to the role transition literature. First, this study attempts to provide a nuanced view of micro-role transition by focusing on both the source and the direction of a transition. Some studies have started to differentiate between domain-level constructs based on the direction (e.g., work-to-nonwork conflict and nonwork-to-work conflict). However, the importance of the source (i.e., other- and self-initiated) has not been recognized. There is task-level evidence from the interruption literature that interruptions benefit the interrupter and the interruptee differently. Therefore, one of the objectives in this research is to explore the different domain-level consequences induced by the source.

Second, the research expands the arena of micro-role transition research by examining technology-mediated cross-domain interruptions as a newly-established form of micro-role transition that prevails among knowledge workers. Despite the proliferation of studies on cross-domain relationship (e.g., work-life balance or conflict, spillover), technology-mediated cross-domain interruptions, which represent an increasingly popular and prevailing way that work and personal life interact, have not been systematically studied as a significant source of cross-domain effects. Therefore, we will draw upon both the interruption literature and the micro-role transition studies to gain an in-depth understanding of technology-mediated cross-domain interruptions.

2.3 Summary

Our research draws upon and extends the interruption literature to identify four different types of interruptions. It also draws from both the interruption literature and micro-role transition theory to identify the domain level consequences of such interruptions. By viewing cross-domain technology-mediated interruptions as micro-role transitions we identify the consequences of such interruptions at the domain level (i.e., work-to-nonwork conflict, nonwork-to-work conflict, work performance, and nonwork performance) and further explore the asymmetrical effects of interruptions in work-to-nonwork and nonwork-to-work directions. Conversely, by viewing micro-role transitions between work and personal life as interruptions we differentiate micro-role transitions based on the source (i.e., other-initiated and self-initiated) and identify the task-level mechanisms that aggregate to account for the domain-level consequences.

In the next chapter, we present the research model and hypotheses that derive from integrating these two perspectives. In addition, we view interruption management as an important strategy to enhance the positive effects of interruptions and mitigate any negative effects. Appendix B presents our theoretical development with respect to the interruption management behaviors that are enabled by various types of interruption management mechanisms across the three stages (i.e., detection, interpretation, and integration) of an interruption. More specifically, we empirically test the moderating effects of interruption management on the relationship between technology-mediated cross-domain interruptions and the consequences.

CHAPTER 3: RESEARCH MODEL AND HYPOTHESES

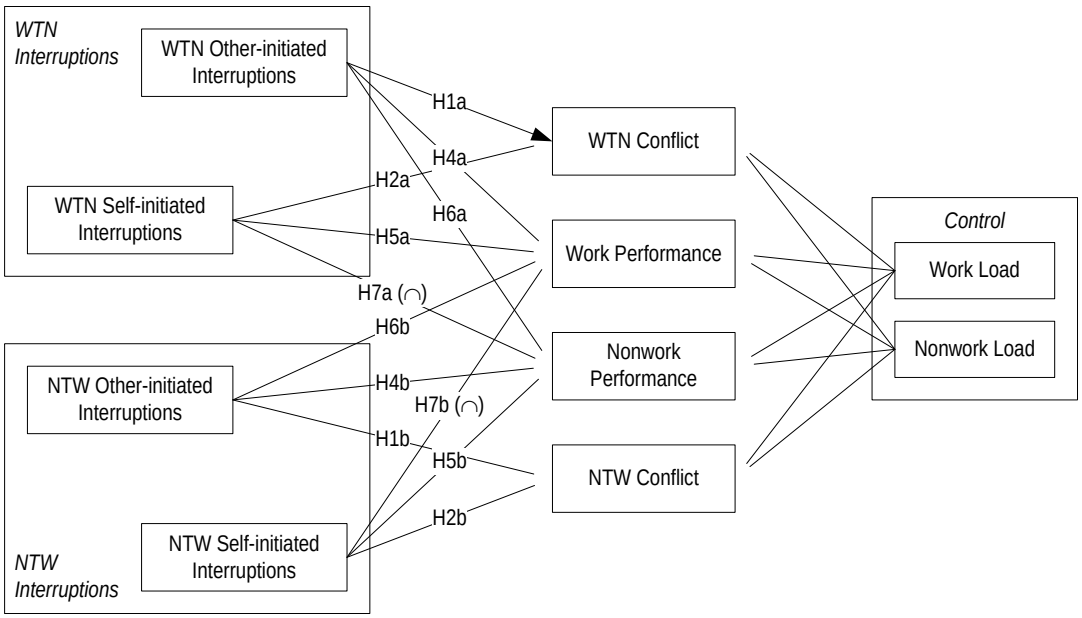
This chapter elaborates on the research model (Figure 3.1) that is empirically tested in the following chapters. Key constructs used in this dissertation are summarized in Table 3.1. Then the research hypotheses are presented.

3.1 Research Model

Given the research interest in technology-mediated interruptions that *cross the boundaries between work and nonwork*, this study assesses important outcomes both at the holistic level (i.e., WTN conflict and NTW conflict as outcomes *across* domains) and at the atomistic level (i.e., work performance and nonwork performance as outcomes *within* each domain). Although we develop parallel hypotheses for both WTN and NTW interruptions (Figure 3.1), for brevity we present the rationale only for WTN interruptions here. The rationale for the NTW interruptions is similar. Hypotheses for both WTN and NTW interruptions are summarized in Table 3.2 at the end of this section. Key constructs used in this study are summarized in Table 3.1.

Table 3.1 Definitions of key constructs

Constructs	Definitions
Technology-mediated cross-domain interruptions	Technology-mediated interruptions across work and personal life refer to occurrences through technologies that impede or delay individuals by breaking the continuity of an ongoing task, with the occurrence and the ongoing task belonging to different domains (i.e., work and personal life) (Jett et al. 2003).
WTN conflict	WTN conflict is a form of inter-role conflict due to the incompatible demands from people's work and personal life in some respect so that the participation in work makes participation in personal life activities more difficult (Greenhaus & Beutell, 1985).
NTW conflict	NTW conflict is a form of inter-role conflict due to the incompatible demands from people's work and personal life in some respect so that the participation in personal life activities makes participation in work more difficult (Greenhaus & Beutell, 1985).
Work performance	Work performance refers to the fulfillment of the general demands and responsibilities associated with one's work (Frone et al. 1997).
Nonwork performance	Personal life performance refers to the fulfillment of the general demands and responsibilities associated with one's personal life (Frone et al. 1997).



H3a: WTN other-initiated interruptions > WTN self-initiated interruptions (effects on WTN conflict)
H3b: NTW other-initiated interruptions > NTW self-initiated interruptions (effects on NTW conflict)

Figure 3.1 Research Model

3.2 Hypotheses

3.2.1 Conflict between Work and Personal Life

Conflict between work and personal life is a form of inter-role conflict due to the incompatible demands from people's work and personal life in some respect so that the participation in one makes participation in the other more difficult (Greenhaus & Beutell, 1985). It occurs when the general demands of, time allocated to, and strain produced by one's work and personal life are mutually incompatible (Greenhaus et al. 1985; Netemeyer et al. 1996). The conflict between work and personal life is bidirectional by nature, so we differentiate between WTN conflict and NTW conflict. WTN conflict occurs when the general demands of, time allocated to, and strain produced from *work* domain interferes with one's engagement in *nonwork* domain. NTW conflict occurs when the general demands of, time allocated to, and strain produced from *nonwork* domain interferes with one's engagement in *work* domain (Greenhaus et al. 1985; Pleck et al. 1980). Antecedents of WTN and NTW conflict each fall into three categories – work factors, nonwork factors, and individual characteristics (Byron 2005). Given the increasingly blurred boundaries between work and personal life, interruptions of one's personal life by work (WTN interruptions) represent an important antecedent not included in these three categories – they originate in the work domain but occur in the nonwork domain. WTN interruptions only influence WTN conflict. As such, we present only the hypotheses related to WTN conflict here. A parallel set of hypotheses is developed for the effects of NTW interruptions on NTW conflict. These are summarized in Table 3.2.

Crossing the boundary between work and personal life entails psychological (and physical,[8] if any) transitions. Two important underlying sources of conflict between work and personal life are time-based and strain-based conflicts (Greenhaus et al. 1985), which directly result from the consumption of personal resources such as time and effort (i.e., mental and physical effort). First, both other-initiated and self-initiated WTN interruptions can foster time-based conflict. These interruptions force people to devote their personal time to work, making it more difficult for them to engage in nonwork tasks. Second, both other-initiated and self-initiated WTN interruptions can also create strain-based conflict. They can make people more mentally preoccupied with work when they are in the nonwork domain. When people attend to WTN interruptions, they make a transition from the nonwork to the work domain, incurring transition costs – the mental efforts in adapting to norms and expectancies associated with work. For example, people activate different mental models, use different vocabularies, and behave in different manners during their interaction with family versus with colleagues. Each time they make a transition from nonwork to work and momentarily assume work roles, they have to show work-appropriate behaviors, which significantly differ from what is considered appropriate in nonwork domain. When such transitions happen overly frequently, they will give rise to elevated levels of physical or psychological fatigue, undermining people's involvement in nonwork domain.

H1a: Frequency of other-initiated WTN interruptions will be positively related to WTN conflict.

[8] This study focuses on *technology-mediated* interruptions, which require psychological but not necessarily physical transitions.

H2a: Frequency of self-initiated WTN interruptions will be positively related to WTN conflict.

Although the above discussion also applies to self-initiated interruptions, two distinctions between self-initiated and other-initiated interruptions suggest slightly different effects of self-initiated WTN interruptions as hypothesized below. First, self-initiated interruptions do not necessarily involve two communicating partners as other-initiated interruptions do. For example, people can interrupt the nonwork domain with solitary work-related tasks such as booking a conference room, writing a report, or remotely checking the results of an experiment that is left running on a company server. As a result, a self-initiated interruption allows people greater control over its nature as well as its duration. Second, people can decide the timing of self-initiated interruptions, whereas other-initiated interruptions can occur any time in the nonwork domain. Specifically, people can choose an opportune time to initiate an interruption, taking into consideration its expected duration among other factors. For example, people are more likely to check work emails on a BlackBerry when they are waiting for a table at a restaurant than when they are talking with their children's schoolteachers. The foregoing discussion suggests that while both other-initiated and self-initiated WTN interruptions lead to WTN conflict, the level of conflict is tempered in the self-initiated cases.

H3a: Frequency of self-initiated WTN interruptions has a weaker effect on WTN conflict than frequency of other-initiated WTN interruptions.

3.2.2 Work and Nonwork Performance

Cross-domain interruptions, involving concurrent tasks from work and personal life, affect performance in both domains through accumulated task-level effects. Performance refers

to the fulfillment of the general demands and responsibilities associated with a particular domain (Frone et al. 1997). Interruptions provide an opportunity of reshuffling of personal resources across work and nonwork domains. A WTN interruption, when attended to, shifts personal resources such as time and attention from nonwork to work. Therefore, we expect different performance outcomes for work (i.e., domain that gains resources) and personal life (i.e., domain that loses resources).

3.2.2.1 Work Performance

Both other-initiated and self-initiated WTN interruptions can contribute to work performance by allowing people to handle work-related tasks in the nonwork domain rather than waiting until they are physically at work. For example, people can get extra work done such as responding to colleagues' email inquiries or scheduling a client meeting before bedtime instead of waiting until the following morning after they get to the office. Thus people can shorten the turnaround time on their end, and project themselves as responsive and proactive individuals by staying updated and connected with work domain. The above discussion points to potential gains in work performance due to acquiring additional time and energy resources from one's personal life.

H4a: Frequency of other-initiated WTN interruptions will be positively related to work performance.

In addition to the benefits discussed above, self-initiated interruptions, when used properly, can be an effective time management tool. Through self-initiated interruptions, people can use personal resources such as time and attention more productively by adapting to their own circadian rhythms (Baltes, Briggs, Huff, Wright, & Neuman, 1999) and not being constrained by

the boundaries between work and nonwork. For example, nocturnal people may intersperse some work-related tasks with nighttime activities such as watching TV or casual reading. Moreover, self-initiated interruptions enable people to pick up short in-between times through "time slicing", which refers to people using very small portions of time to be productive (Govindaraju et al. 2005)

H5a: Frequency of self-initiated WTN interruptions will be positively related to work performance.

3.2.2.2 Nonwork Performance

Concurrent tasks can mutually influence task performance through structural interference and capacity interference (Kahneman 1973). Structural interference arises when an other-initiated WTN interruption and the ongoing task in nonwork domain compete for the same channel of processing, e.g., a phone call from clients when people are reading a bedtime story to their children. Capacity interference arises when the combined demands of WTN interruptions exceed the total capacity of nonwork domain. At an aggregate level, other-initiated WTN interruptions will negatively influence nonwork performance (i.e., meeting personal life demands) through both types of interference.

H6a: Other-initiated WTN interruptions will be negatively related to nonwork performance.

Self-initiated WTN interruptions undermine nonwork performance through only capacity interference. When people initiate an interruption, they can easily avoid any structural interference. For example, individuals are very unlikely to call a colleague when they are engaged in a conversation with family members.

Despite the negative connotation often associated with interruptions, self-initiated interruptions can generate positive performance gains in two ways. Self-initiated WTN interruptions can facilitate individuals' task closure. They allow individuals, while engaging in the nonwork domain, to bring to closure their lingering thoughts about work and fully concentrate on the nonwork domain. Work and nonwork represent two interdependent domains, across the boundary of which people unknowingly carry emotions. Although being physically involved in one domain prevents individuals from *physically* engaging in another domain, they can be *emotionally* engaged through such lingering thoughts. For example, people may find it difficult to concentrate on nonwork activities such as a movie or a family dinner when they keep worrying about work such as the results of budget review or grant application. Task closure represents an important factor that motivates individuals' communication need and media choice (Straub & Karahanna, 1998). Moreover, lack of closure is associated with negative moods such as anxiety (Colbert, Peters, & Garety, 2006; Freeman et al., 2006), which can undermine cognitive functioning, jeopardize task activity, and reduce positive interaction with others (Staw, Sutton, & Pelled, 1994). The foregoing discussion applies to only self-initiated interruptions, as others can hardly detect one's lingering thoughts and resolve them through interruptions. Therefore, we expect nonwork performance to benefit from a reasonable amount of self-initiated WTN interruptions.[9]

As frequency of self-initiated WTN interruptions increases, the associated benefits will diminish and these interruptions will start to engender counterproductive effects on nonwork domain due to capacity interference. The foregoing discussion points to a nonlinear relationship

[9] Similarly, self-initiated NTW interruptions also provide the flexibility that enables people to control the rhythm of the work domain, and take a rest when they truly need. Self-initiated NTW interruptions can serve as a refreshing break to individual who will then return to their work tasks more recharged and refreshed (Jett & George, 2003). For example, after a recreational web browsing, people can become more productive when resuming work.

between frequency of self-initiated WTN interruptions and nonwork performance: low frequency of self-initiated interruptions can actually enhance non-work performance but as their frequency increases they erode needed resources in the nonwork domain leading to lower nonwork performance.

H7a: There will be an inverted U-shaped relationship between self-initiated WTN interruptions and nonwork performance.

The foregoing conceptualization focuses on WTN interruptions. Similarly, this research develops parallel hypotheses for NTW interruptions (i.e., H1b – H7b). For the sake of brevity and since the rationale is the same, we do not elaborate on the hypothesis development for H1b-H7b, but summarize all hypotheses in Table 3.2.

Table 3.2 Summary of Hypotheses

	Work-to-Nonwork	**Nonwork-to-Work**
Conflict between Work and Nonwork	H1a: Frequency of other-initiated WTN interruptions will be positively related to WTN conflict.	H1b: Frequency of other-initiated NTW interruptions will be positively related to NTW conflict.
	H2a: Frequency of self-initiated WTN interruptions will be positively related to WTN conflict.	H2b: Frequency of self-initiated NTW interruptions will be positively related to WTN conflict.
	H3a: Frequency of self-initiated WTN interruptions has a weaker effect on WTN conflict than frequency of other-initiated WTN interruptions.	H3b: Frequency of self-initiated NTW interruptions has a weaker effect on NTW conflict than frequency of other-initiated NTW interruptions.
Performance	H4a: Frequency of other-initiated WTN interruptions will be positively related to work performance.	H4b: Frequency of other-initiated NTW interruptions will be positively related to nonwork performance.
	H5a: Frequency of self-initiated WTN interruptions will be positively related to work performance.	H5b: Frequency of self-initiated NTW interruptions will be positively related to nonwork performance.
	H6a: Other-initiated WTN interruptions will be negatively related to nonwork performance.	H6b: Other-initiated NTW interruptions will be negatively related to nonwork performance.
	H7a: There will be an inverted U-shaped relationship between self-initiated WTN interruptions and nonwork performance.	H7b: There will be an inverted U-shaped relationship between self-initiated NTW interruptions and work performance.

CHAPTER 4: METHODOLOGY

This chapter discusses the research methodology used in the study. Specifically, it includes a discussion of the overall research design, choice of study site and subjects, instrument development and validation, and data collection method.

4.1 Research Design

The research was conducted in two stages. During the first stage, interviews were conducted with 16 knowledge workers from six organizations and yielded approximately 16 hours of audio data. Table 4.1 provides details on the interviews. The qualitative data gathered through these interviews informed our conceptualization of the research model and hypotheses, helped us in our scale development, and helped us identify both ways in which these individuals experience interruptions (e.g., via what technologies and what applications) and their effects as well as the various techniques they use to manage these interruptions.

Table 4.1 Demographic information of respondents

	Position	Industry	Gender	Age	Country
1	Consultant	Consulting	Male	40-50	US
2	Engineer	Internet information provider	Male	30-40	US
3	Engineer	Internet information provider	Male	30-40	US
4	Engineering director	Internet information provider	Male	50-60	US
5	Engineer	Personal computers	Female	20-30	US
6	Associate	Business services	Male	30-40	US
7	Associate	Business services	Female	30-40	US
8	Manager	Business services	Female	30-40	US
9	Engineer	Semiconductor	Male	30-40	US
10	Enterprise solutions architect	Hospitality	Male	30-40	US
11	Analyst	Market research	Female	20-30	Singapore
12	IT manager	Government	Male	30-40	Singapore
13	Business analyst	Logistics	Male	20-30	China

14	HR manager	Pharmaceutical	Female	30-40	China
15	Lecturer	Education	Female	30-40	Australia
16	Sales manager	Sales	Female	30-40	US

During the second stage, a questionnaire-based, cross-sectional field study in an organization was conducted to test the research model (Figure 3.1). The reasons for a field study are twofold. First, the organizational context juxtaposes work and personal life as two distinct, institutionalized domains. These domains represent two of the most central spheres of adult life (Frone et al. 1992). This is particularly true in an organizational context, where salient institutionalized distinctions between work and personal life have generated competing demands for individuals. Second, given the nature of technology-mediated interruptions across work and personal life, it is important to capture them and assess their consequences in the natural setting instead of an experimental setting that manipulates their occurrence since an experimental setting has limitations in realistically simulating the phenomenon. The realistic setting of the field study increases the external validity of this research.

The study was conducted in a single organization in order to eliminate the potential confounding effects of organizational level factors. As discussed in chapter 2, macro level variables such as organizational culture, norms, expectations, and policies regarding how to handle work-related tasks during off hours and how to deal with personal matters at work will affect the consequences of technology-mediated interruptions across work and personal life. If multiple organizations are involved in the study, we will have to measure these variables to account for their effects. A single organization design, however, eliminates a great number of organizational level effects from the error terms, making the effects of the variables of interest more likely to be detected.

4.2 Site Selection

The selection of the study site is based on two major considerations. First, we need an organization where knowledge work is prevailing and dominant, because knowledge work is less programmed than other types of work (e.g., manufacturing, service) and therefore more prone to interruptions. Given our research interest in technology-mediated interruptions across work and personal life, it is crucial to conduct the study within an organization where such interruptions can occur frequently enough so that there is variability in our independent variables. This would mean that technology use across work and personal life is not prohibited by organizations, or prevented by the nature of the respondents' job (e.g., as in the case of certain professions such as blue-collar workers). Second, due to the consideration of statistical power, we need an organization, where we have access to a large number of knowledge workers engaging in technology-mediated interruptions across work and personal life.

A Fortune-1000 technology company,[10] headquartered in the Midwest, met both these requirements. It has revenues of approximately $1.76 billion and employs a total of 6600 employees. Initial contact with the Chief Marketing Officer of the firm was established in a brief discussion where the study objectives and required resources were presented to solicit participation. During the subsequent email correspondence, a detailed plan of how to administer the survey within the company was developed.

4.3 Sample Selection

The unit of analysis in this study is the individual who uses information and communication technologies and thus experiences technology-mediated interruptions across work and personal life. The criteria can be easily met by the population of today's knowledge

[10] This company is not one of the six organizations where interviews were conducted during the first stage.

workers, who tend to frequently monitor for changes in information environments and intermittently communicate with others.

A web-based survey was administered to employees in the Marketing department of the organization described above. Collecting data from a single function within the study site further eliminates the potential confounding effects of factors such as job nature and subculture within the group, which can render the relationships of interest more difficult to detect.

All communications with the (potential) subjects, including email invitations and reminders to solicit participation in the research, were sent through our contact person in the Marketing department. First, an email invitation to a web-based survey was sent through an internal mailing list to 300 associates.[11] One week later, a reminder was sent to the same group of employees and a second reminder two weeks later. As shown in Table 4.2, 137 out of the sample population of 300 employees actually attempted responding to the survey, yielding a response rate of 45.7%. Due to missing data in some of the questionnaires, the analyses were performed on about 119 usable responses.

Table 4.2 Number of respondents

	Number of Responses
After initial invitation	55
After reminder #1	34
After reminder #2	48
Sum	137

4.4 Selection of Technologies

A wide variety of technologies, such as smartphone (e.g., BlackBerry, iPhone, Android), computer, email, video calling, text messenger, and social media are typically used in today's

[11] The email invitation with the web-based survey URL attached was sent to 181 employees in Marketing department on 16 March 2010, and was sent to another 119 employees in the same department on 17 March 2010.

organizations. All these organizational technologies can engender or facilitate interruptions across work and personal life, although each has its distinct attributes.

This research focuses on a portfolio of technologies (both devices [e.g., phone] and applications [e.g., email]) that knowledge workers typically use on daily basis. The reasons are twofold. First, as compared to a single technology, a portfolio of technologies better approximate the reality of knowledge workers in the workplace and at home. Multiple devices and applications collectively and seamlessly constitute the technology environment of today's knowledge workers, who constantly switch across multiple technologies. Second, an interruption can occur across multiple devices. For example, one can receive an email on the BlackBerry and respond to it on a laptop.

The study focuses on five communications applications such as phone call, email, texting, IM, and other applications (such as web browsing, Google map, etc). These applications are commonly supported by various platforms such as the BlackBerry, iPhone, or laptop, which are the devices typically used by knowledge workers. Knowledge workers are typically equipped with a laptop and a smartphone. Smartphones (i.e., the BlackBerry and iPhone) do not significantly differ in terms of functionality and features. Therefore, this study population is not confined to the users of a particular device. The selection of the applications was informed by the interviews we conducted with 15 knowledge workers prior to the web-based survey. The interviews identified these focal technologies as the primary applications used in interruptions in both professional and personal settings.

4.5 Construct Operationalization and Measurement

This section focuses on the questionnaire development process, presenting the scales for the different constructs of the study (Table 4.3). Multiple items are used to measure a construct so that construct reliability can be assessed. Where possible, existing validated scales are used to measure the constructs of the study. The instrument development and validation processes are described later in this chapter,

Table 4.3 Constructs and Measurement

Construct	Definition	Items[a]
Work-to-Nonwork		
Frequency of WTN technology-mediated interruptions	Work-related technology-mediated interruption refers to an occurrence through a technology device or application that comes from one's work and breaks the cognitive focus on an ongoing task.	[WTN-overall] During nonwork hours, how frequently do you experience work-related interruptions (via phone call, email, IM, texting or other technology)? These interruptions include both those initiated by yourself (e.g., sending an email to a colleague during dinner) and those initiated by others in your work domain (e.g., receiving a call by a colleague at home in the evening).
		[WTN-ratio] On average, what percentage of these are initiated by colleagues/other work contacts rather than yourself? (a sliding bar scale ranging from 0 to 100%)
		Frequency of WTN Other-initiated Interruptions During nonwork hours, how frequently are you interrupted by colleagues/other work contacts about work-related matters - [WTNO-overall] overall through technologies such as phone call, email, IM, texting etc.? - [WTNO-phone] via phone call only - [WTNO-email] via email only - [WTNO-IM] via IM only - [WTNO-texting] via texting only
		Frequency of WTN Self-initiated Interruptions To what extent do you initiate interruptions yourself during nonwork hours to handle work-related matters - [WTNS-overall] overall through technologies such as phone call, email, IM, texting etc.? - [WTNS-phone] via phone call only - [WTNS-email] via email only - [WTNS-IM] via IM only - [WTNS-texting] via texting only - [WTNS-other] via other applications to work during nonwork hours
WTN conflict	WTN conflict occurs when the general demands of, time allocated to, and strain produced by the work interferes with one's	[WTNC1] The demands of my work interfere with my personal life.
		[WTNC2] The amount of time my work takes up makes it difficult to fulfill nonwork responsibilities.
		[WTNC3] My work produces strain that makes it difficult to fulfill my nonwork responsibilities.

	engagement in nonwork activities (Greenhaus et al. 1985; Pleck et al. 1980).	[WTNC4] Due to work-related duties, I frequently have to make changes to my plans for nonwork activities.
Work performance	Work performance refers to the fulfillment of the general demands and responsibilities associated with work (Frone et al. 1997)	[WP1] I am viewed by my supervisor as an exceptional performer.
		[WP2] I am viewed as an exceptional performer in this organization.
		[WP3] I have a reputation in this organization for doing my work very well.
		[WP4] My colleagues think my work is outstanding.
Nonwork-to-Work		
Frequency of NTW technology-mediated interruptions	Nonwork-related technology-mediated interruption refers to an occurrence through a technology device or application that comes from one's personal life and breaks the cognitive focus on an ongoing task.	[NTW-overall] During work hours, how frequently do you experience nonwork-related interruptions (via phone call, email, IM, texting or other technology)? These interruptions include both those initiated by yourself (e.g., texting a friend during a meeting) and those initiated by others in your personal life (e.g., receiving a call by a family member while working on a report).
		[NTW-ratio] On average, what percentage of these are initiated by family/friends/other nonwork contacts rather than yourself? (a sliding bar scale ranging from 0 to 100%)
		Frequency of NTW Other-initiated Interruptions During work hours, how frequently are you interrupted by family/friends/other nonwork contacts about nonwork-related matters: - [NTWO-overall] overall through technologies such as phone call, email, IM, texting etc. - [NTWO-phone] via phone call only - [NTWO-email] via email only - [NTWO-IM] via IM only - [NTWO-other] via texting only
		Frequency of NTW Self-initiated Interruptions To what extent do you initiate interruptions yourself during work hours to handle nonwork-related matters: - [NTWS-overall] overall through technologies such as phone call, email, IM, texting etc. - [NTWS-phone] via phone call only - [NTWS-email] via email only - [NTWS-IM] via IM only - [NTWS-testing] via texting only - [NTWS-other] via other applications such as Fecebook, Twitter, Google maps, web browsing, etc.
NTW conflict	Nonwork-to-work conflict occurs when the general demands of, time allocated to, and strain produced by the nonwork interferes with one's engagement in work activities (Greenhaus et al. 1985; Pleck et al. 1980).	[NTWC1] The demands of my personal life interfere with my work.
		[NTWC2] My personal life produces strain that makes it difficult to fulfill my work responsibilities.
		[NTWC3] My personal life interferes with my work responsibilities such as getting to work on time and accomplishing daily tasks.
		[NTWC4] Due to the demands in my personal life, I frequently have to make changes to my work plans.
Nonwork performance	Nonwork performance refers to the fulfillment of	[NP1] My family thinks that I fulfill my family responsibilities very well.

	the general demands and responsibilities associated with nonwork (Frone et al. 1997)	[NP2] My friends think that I fulfill the demands of my personal life very well.
		[NP3] My family thinks that I fulfill my family demands very well
		[NP4] I am viewed by my family/friends as fulfilling the responsibilities in my personal life very well
Control Variables		
Work load	Work role overload refers to an individual's perception of having too much work to do, but without enough working time to do them.	[WL1] I never seem to have enough time to get all of my work done during work hours.
		[WL2] It often seems that I have too much work during work hours for one person to do.
Nonwork load	Nonwork role overload refers to an individual's perception of having too much nonwork to do, but without enough nonwork time to do them.	[NL1] I never seem to have enough time to get every nonwork task done during nonwork hours.
		[NL2] It often seems that I have too many nonwork-related demands for one person to do during nonwork hours.
Work flexibility	Work flexibility refers to one's ability to take time off work during work hours to address nonwork responsibilities.	[WF1] I have the flexibility I need to manage personal/family responsibilities during work hours.
		[WF2] My supervisor grants me enough flexibility to fulfill any personal/family responsibilities during work hours.
Work orientation	Work orientation refers to how critical work is to an individual's self-identity. (CWO)	[WO1] The major satisfactions in my life come from my work.
		[WO2] The most important things that happen to me involve my work.
Nonwork flexibility	Nonwork flexibility refers to one's ability to take time off nonwork during nonwork hours to address work responsibilities.	[NF1] I have the flexibility I need to manage work
		[NF2] My family/significant others grant me enough flexibility to fulfill any work
Nonwork orientation	Nonwork orientation refers to how critical family or nonwork is to an individual's self-identity. (CNO)	[NO1] The major satisfactions in my life come from my family/personal life.
		[NO2] The most important things that happen to me involve my family /personal life.
Polychronic attitude	Polychronic time use is a personality trait with which individuals prefer to get involved with multiple tasks within the same time block. (CPA)	[POLY1] I like to juggle several activities at the same time.
		[POLY2] I think People should try to do many things at once.
Personal desire for segmentation	Personal desire for segmentation refers to one's desire for the separation of work and nonwork activities.	[PSW1] I personally prefer not to work at all during nonwork hours.
		[PSW2] I personally prefer to be able to forget work during nonwork hours.
		[PSN1] I personally prefer not to deal with personal matters during work hours.
		[PSN2] I personally prefer to be able to forget personal matters during work hours.
Actual segmentation	Actual amount of segmentation refers to the amount of segmentation	[AS1] Please indicate below the actual extent of Separation/integration between your work and personal life.

	of work and nonwork that one actually has.	

[a]. Items measuring the four independent variables (i.e., frequency of WTN other- and self-initiated interruptions, and frequency of NTW other- and self-initiated interruptions) are 7-point Likert scales, ranging from 1=very rarely, 4=occasionally, to 7=very frequently. All other items, unless noted otherwise, are 7-point Likert scales, ranging from 1=strongly disagree, 4=neutral, to 7=strongly agree.

4.5.1 Technology-Mediated Interruption across Work and Personal Life

Drawing upon the studies on technology use among individuals, we developed items to capture other-initiated and self-initiated technology-mediated interruptions in both directions – from work to personal life (WTN) and from personal life to work (NTW). In total, there are four independent variables: frequency of WTN other-initiated interruptions, frequency of WTN self-initiated interruptions, frequency of NTW other-initiated interruptions, and frequency of NTW self-initiated interruptions. Items of the four constructs capture perceived frequency of overall interruptions across technologies, and of interruptions via each technology (i.e., via phone call, email, IM, texting, and other applications such as web browsing), asking respondents to indicate how frequently each type of interruptions occur on a 7-point Likert format, with 1 representing *very rarely* and 7 representing *very frequently*. We also capture the frequency of overall interruptions in each direction, namely, WTN and NTW. And two sliding-bar items (0% to 100%) are used to capture the ratio of other- versus self-initiated interruptions for two directions (i.e., WTN and NTW) respectively.

4.5.2 Conflict between Work and Personal Life

As discussed in the previous chapter, the conflict between work and personal life is bidirectional by nature, entailing work-to-nonwork (WTN) conflict and nonwork-to-work (NTW) conflict. We adapt the scales developed by Netemeyer et al. (1996) to measure both WTN and NTW conflicts. Each scale consists of five items, asking respondents to indicate the

degree to which they agree with the statements on a 7-point Likert format, with 1 representing *strongly disagree* and 7 representing *strongly agree*.

4.5.3 Work and Nonwork Performance

Work performance is assessed by modifying the items developed by Kossek et al. (2001) and Williams et al. (1991). Sample items include "I am viewed by my supervisor/coworker as an exceptional performer," and "I always adequately complete assigned duties at work."

Nonwork performance is assessed by modifying the items developed by Kossek et al. (2001) and Williams et al. (1991). Sample items include "I am viewed by my family/significant others as doing an exceptional job at home," and "My friends thinks what I do outside work is outstanding."

4.5.4 Control Variables

4.5.4.1 Work and Nonwork Flexibility

Workplace flexibility is often operationalized as perceived flexibility, i.e., respondents' subjective assessment of the extent to which the flexibility afforded at the workplace allows them to meet their needs. A frequently used scale is a single-item binary measure developed by Civian et al. (Civian et al. 2008), with 1 indicating that respondents feel that they have the flexibility they need at work and with 0 indicating the opposite. Sample items to be used in this study include: "I have the flexibility I need to manage personal/family responsibilities", and "My supervisor grants me enough flexibility to meet my personal/family responsibilities" (Civian et al. 2008). In this study, we adapted the items by replacing the binary scale with a 7-point Likert scale.

4.5.4.2 Work and Nonwork Load

Work load is assessed with items developed by Schaubroeck et al. (1989) and Beehr et al. (1976). Sample items include “The amount of work at work I am expected to do is too great,” “I never seem to have enough time to get everything done at work,” and “It often seems that I have too much work at work for one person to do.”

Nonwork load is also assessed with items developed by Schaubroeck et al. (1989) and Beehr et al. (1976), with the same anchors. Sample items include “The amount of work at home I am expected to do is too great,” “I never seem to have enough time to get everything done at home,” and “It often seems that I have too much work at home for one person to do.”

4.5.4.3 Personal Desire for Segmentation

One’s desire for segmentation between work and personal life are measured with Edwards and Rothbard’s (1999) four-item scale. Prior research (Bagozzi et al. 1998; Edwards et al. 1999; Pryor 1991) has demonstrated good psychometric properties for this scale. It emphasizes acceptable rather than ideal amounts of segmentation in order to avoid ceiling effects (Edwards et al. 1999). A 7-point Likert scale, ranging from “not at all” to “very much”, was used to capture individual desires for four different job characteristics: being required to work while at home, being able to forget work while I am at home, having to think about work once I leave the workplace, and being expected to take work home.

4.6 Questionnaire Development and Validation

Before developing measurement instruments for any constructs in this dissertation, a literature search was used to identify previously validated scales for the focal constructs. Following Moore and Benbasat (1991), development of the measurement instruments was

carried out in two stages. The first stage, *item generation*, aimed to create item pools for each interruption management construct by identifying items from prior studies on technology use and generating new items based on our interviews with knowledge workers. The stage of item generation aims to ensure content validity. First, all items identified in the existing scales or generated based on the literature and interviews were organized according to the constructs which they were intended to measure. This created an initial pool of items for each construct. After the item pool was created, items from the existing scales were re-assessed and adapted to the context of this research. The resulting items were then compared to the theoretical definition of the construct to assure correspondence between theoretical and operational definition as well as content validity (Bagozzi 1980; Churchill, 1979; Netemeyer et al 2003).

The second stage was *scale development*, which was an iterative process. The objectives of the second stage were to evaluate the construct validity (convergent and discriminant validity) of the instruments that were adapted or created, and to identify any ambiguous or inappropriately worded items. Two panels of judges (round 1 and round 2) were provided with definitions of all the constructs and then asked to sort the pool of items into separate categories based on the definitions. Placement of items in the right category is an indication of convergent and discriminant validity. An item was considered to demonstrate convergent validity with the corresponding construct and discriminant validity with other items when it was consistently sorted into the correct construct category by the judges.

Specifically, the judges were instructed to sort the items based on the underlying constructs and were allowed to ask questions about the procedure. A web-based document or an MS Excel spreadsheet was presented to each judge. There were three sections in the document: instructions, construct definitions, and all the items in a randomized order. The judges chose the

construct that they thought the item was intended to measure from a drop-down list of all constructs at the end of each item. At the end of the sorting exercise, the judges were also encouraged to provide any comments on item wording and clarity of the construct definitions.

This research took two rounds of sorting to arrive at the final set of scales, with acceptable level of agreement among the judges. A different set of judges was used in each sorting round. A panel of eight judges consisting of doctoral students from various business disciplines sorted the *initial* pool of items into construct categories based on the construct definition provided. Then the items were examined based on their placement to identify the one(s) with ambiguous or inappropriate wording as candidate for modification or elimination. Items with either low inter-rater agreement or low hit ratio were culled or reworded. Items not applicable to our empirical context were also removed. For example, the item – "I am viewed by my clients as an exceptional partner" – from the work performance pool was removed because the potential respondents from the study site do not typically deal with clients. Then a different panel of six judges consisting of one doctoral student, one knowledge worker, and four faculty sorted the *revised* pool of items into construct categories based on the same construct definitions. Results of the two rounds of sorting are presented in Tables 4.4, 4.5, 4.6, and 4.7. As shown in Tables 4.4 and 4.5, the overall hit ratios are 77.8% for the first round of card sorting (ranging from 67.5% to 100%), and 89.2% for the second round (ranging from 54.2% to 100%).

An indicator of the reliability of the sorting procedure was inter-rater reliability. For both sorting rounds, the level of agreement among each panel of judges was assessed using Cohen's Kappa (Cohen, 1960). The average value of Cohen's Kappa is 0.65 for the first round of card sorting (ranging from 0.44 to 0.90), and is 0.81 for the second round (ranging from 0.74 to 0.91). Despite the lack of general authority regarding the Kappa criteria, some studies consider 0.65 or

larger scores to be acceptable (e.g. Vessey 1984; Jarvenpaa 1989; Todd and Benbasat 1989). The frequency of each item being placed by the panel of judges in the originally intended construct category was also provided as an indicator of the reliability (Table 4.6 and Table 4.7).

After item sorting, a web-based questionnaire was prepared. This resulting questionnaire was pretested with three knowledge workers, who were asked to provide feedback on any aspect of the questionnaire, e.g., wording, effort, length, clarity of instructions, formatting, and so on. Based on their feedback, the questionnaire was further revised. For example, the duration measures of the independent variables were eliminated due to the difficulty of recall in responding to this question as consistently reported by the interviewees. The items shown in Table # represent the items used in the web-based questionnaire.

Table 4.4 Results of card sorting (round #1)

		1	2	3	4	5	6	7	8	9	10	11	Total	% Hit
Theoretical Constructs	Freq. of WTN tech-mediated interruptions	34	0	14	0	0	0	0	0	0	0	0	48	70.8%
	WTN interruption mgmt	1	27	1	0	0	0	2	0	0	5	4	40	67.5%
	WTN conflict	0	0	28	1	1	7	3	0	0	0	0	40	70.0%
	Work perf.	0	0	0	40	0	0	0	0	0	0	0	40	100.0%
	Nonwork perf.	0	0	0	1	38	0	0	1	0	0	0	40	95.0%
	Nonwork load	0	0	0	0	0	24	0	0	0	0	0	24	100.0%
	Nonwork flexibility	0	0	0	0	0	0	15	1	0	0	0	16	93.8%
	Nonwork orientation	0	0	0	0	0	0	0	16	0	0	0	16	100.0%
	Polychronic attitude	0	0	0	0	0	0	0	0	24	0	0	24	100.0%
	Personal desire for segmentation	0	0	0	0	0	0	4	0	0	17	3	24	70.8%
	Actual segmentation	0	0	7	0	0	0	6	0	0	18	17	48	35.4%

Item placements: 360 Hits: 280 Overall "hit" ratio: 77.8%

1-Freq. of WTN tech-mediated interruptions
2-WTN interruption mgmt
3-WTN conflict
4-Work performance
5- Nonwork performance
6- Nonwork load
7- Nonwork flexibility
8- Nonwork orientation
9- Polychronic attitude
10- Personal desire for segmentation
11- Actual segmentation

Table 4.5 Hit ratio of card sorting (round #2)

		1	2	3	4	5	6	7	8	9	10	11	Total	% Hit
Theoretical Constructs	Freq. of WTN tech-mediated interruptions	34	0	1	0	0	0	0	0	0	0	1	36	94.4%
	WTN interruption mgmt	0	20	0	0	0	0	0	0	0	2	8	30	66.7%
	WTN conflict	0	0	13	0	1	5	1	0	0	0	4	24	54.2%
	Work perf.	1	0	0	23	0	0	0	0	0	0	0	24	95.8%
	Nonwork perf.	0	0	0	0	24	0	0	0	0	0	0	24	100.0%
	Nonwork load	0	0	0	0	0	12	0	0	0	0	0	12	100.0%
	Nonwork flexibility	0	0	0	0	0	0	12	0	0	0	0	12	100.0%
	Nonwork orientation	0	0	0	0	0	0	0	12	0	0	0	12	100.0%
	Polychronic attitude	0	0	0	0	0	0	0	0	12	0	0	12	100.0%
	Personal desire for segmentation	0	0	0	0	0	0	0	0	0	30	0	30	100.0%
	Actual segmentation	0	0	0	0	0	0	0	0	0	0	6	6	100.0%

Item placements: 222 Hits: 198 Overall "hit" ratio: 89.2%

1-Freq. of WTN tech-mediated interruptions
2-WTN interruption mgmt
3-WTN conflict
4-Work performance
5- Nonwork performance
6- Nonwork load
7- Nonwork flexibility
8- Nonwork orientation
9- Polychronic attitude
10- Personal desire for segmentation
11- Actual segmentation

Table 4.6 Results of card sorting (round #1)

Items	1	2	3	4.	5	6	7	8	9	10	11
Freq. of WTN tech-mediated interruptions 1	CDE FG		ABH								
Freq. of WTN tech-mediated interruptions 2	CDE FGH		AB								
Freq. of WTN tech-mediated interruptions 3	CDE FGH		AB								
Freq. of WTN tech-mediated interruptions 4	CDE FGH		AB								
Freq. of WTN tech-mediated interruptions 5	CDE FG		ABH								
Freq. of WTN tech-mediated interruptions 6	CDE FGH		AB								
WTN interruption mgmt 1	G	BEF					CD			H	A
WTN interruption mgmt 2		ABEFG H									CD
WTN interruption mgmt 3		ABDEF GH									C
WTN interruption mgmt 4		ADEFG	H							CD	
WTN interruption mgmt 5		ABEFG H								CD	
WTN conflict 1			ACEFG H			B	D				
WTN conflict 2			AEFGH	D		BC					
WTN conflict 3			AEFH		C	BG	D				
WTN conflict 4			ABDEF G			CH					

WTN conflict 5			ACDEFGH				B				
Work perf. 1				ABCDEFGH							
Work perf. 2				ABCDEFGH							
Work perf. 3				ABCDEFGH							
Work perf. 4				ABCDEFGH							
Work perf. 5				ABCDEFGH							
Nonwork perf. 1					ABCDEFG			H			
Nonwork perf. 2					ABCDEFGH						
Nonwork perf. 3					ABCDEFGH						
Nonwork perf. 4					ABCDEFGH						
Nonwork perf. 5				F	ABCDEGH						
Nonwork load 1						ABCDEFGH					
Nonwork load 2						ABCDEFGH					
Nonwork load 3						ABCDEFGH					
Nonwork flexibility 1							ABCDEFGH				
Nonwork flexibility 2							ABCEFGH	D			
Nonwork orientation 1								ABCDEFGH			
Nonwork orientation 2								ABCDEFGH			
Polychronic attitude 1									ABCDEFGH		

Polychronic attitude 2									ABCDE FGH		
Polychronic attitude 3									ABCDE FGH		
Personal desire for seg. 1							BC			AEFGH	D
Personal desire for seg. 2							B			ACEFG H	D
Personal desire for seg. 3							B			ACEFG H	D
Actual seg. 1			BC							H	ADEFG
Actual seg. 2			CGH				B				ADEF
Actual seg. 3			GH				B				ACDEF

Eight judges are represented by A, B, C, D, E, F, G, and H.

1-Freq. of WTN tech-mediated interruptions
2-WTN interruption mgmt
3-WTN conflict
4-Work performance
5- Nonwork performance
6- Nonwork load
7- Nonwork flexibility
8- Nonwork orientation
9- Polychronic attitude
10- Personal desire for segmentation
11- Actual segmentation

Table 4.7 Results of card sorting (round #2)

	1	2	3	4	5	6	7	8	9	10	11
Freq. of WTN tech-mediated interruptions 1	ABCDE		F								
Freq. of WTN tech-mediated interruptions 2	ABCDEF										
Freq. of WTN tech-mediated interruptions 3	ABCDEF										
Freq. of WTN tech-mediated interruptions 4	ABCDEF										
Freq. of WTN tech-mediated interruptions 5	BCDEF										A
Freq. of WTN tech-mediated interruptions 6	ABCDEF										
WTN interruption mgmt 1		BD								A	CEF
WTN interruption mgmt 2		ABCD									EF
WTN interruption mgmt 3		ABCDF									E
WTN interruption mgmt 4		ABCEF								D	
WTN interruption mgmt 5		ACDF									BE
WTN conflict 1			CDEF								AB
WTN conflict 2			CDE			BF					A
WTN conflict 3			CDE		A	BF					
WTN conflict 4			CDE			F	A				B
Work perf. 1				ABCD							

				EF							
Work perf. 2				ABCD EF							
Work perf. 3				ABCD EF							
Work perf. 4	C			ABDEF							
Nonwork perf. 1					ABCD EF						
Nonwork perf. 2					ABCD EF						
Nonwork perf. 3					ABCD EF						
Nonwork perf. 4					ABCD EF						
Nonwork load 1						ABCD EF					
Nonwork load 2						ABCD EF					
Nonwork flexibility 1							ABCD EF				
Nonwork flexibility 2							ABCD EF				
Nonwork orientation 1								ABCDE F			
Nonwork orientation 2								ABCDE F			
Polychronic attitude 1									ABCDEF		
Polychronic attitude 2									ABCDEF		
Personal desire for segmentation 1										ABCDE F	
Personal desire for segmentation 2										ABCDE F	
Personal desire for segmentation 3										ABCDE F	
Personal desire for segmentation 4										ABCDE F	

Personal desire for segmentation 5										ABCDEF	
Actual segmentation											ABCDEF

Six judges are represented by A, B, C, D, E, and F.

1-Freq. of WTN tech-mediated interruptions
2-WTN interruption mgmt
3-WTN conflict
4-Work performance
5- Nonwork performance
6- Nonwork load
7- Nonwork flexibility
8- Nonwork orientation
9- Polychronic attitude
10- Personal desire for segmentation
11- Actual segmentation

CHAPTER 5: DATA ANALYSIS AND RESULTS

This chapter presents the data analysis performed to assess the hypotheses developed in Chapter 3. First, analysis of non-response bias is addressed. Second, demographic characteristics of the sample are described. Third, descriptive statistics of the data are presented. Finally, results of assessment of the psychometric properties of the scales and hypothesis testing are presented.

5.1 Non-Response Bias

To assess non-response bias, we followed the procedure suggested by Armstrong and Overton (1977) where responses received after a reminder (representing non-respondents) are compared with responses received prior to the reminder. Results of unpaired t-tests on all the constructs in our research model and on demographics suggested no significant differences between individuals who responded before the first reminder, those who responded between the first and the second reminders, and those who responded after the second reminder alleviating to some extent concerns about non-response bias.

5.2 Demographic Characteristics

Demographic characteristics of the respondents are summarized in Table 5-1. These data allow us to assess how representative the sample is of the target population. As shown in Table 5.1, respondents are fairly distributed across gender and age; most are not single; and the majority use a device provided by the company. A t-test was conducted to assess whether the single group significantly differs from the relationship group (i.e., married or significant other), and whether those who use a company-provided device significantly differ from those who do

not across the variables in our research model. The non-significant results across all constructs suggest that the two groups based on relationship status or company-provided device do not differ in terms of the variables included in the model.

Table 5.1 Demographic characteristics

Age	**Percentage**
Below 50	53.5%
Over 50	46.5%
Gender	**Percentage**
Female	59.4%
Male	40.6%
Relationship Status	**Percentage**
Single	15.0%
Spouse /Significant Other	85.0%
With Children <18 Years Old	**Percentage**
No	67.2%
Yes	32.8%
Company-provided device	**Percentage**
No	15.6%
Yes	84.4%

The company where we collected the data is quite typical of many organizations with knowledge workers. Our discussions with members of the organization did not reveal any signs that may suggest that the study site is atypical or that the respondents significantly deviate from average knowledge workers. In fact, discussions with members of the study site suggested that the organization was like the six other organizations where we conducted our qualitative interviews.

5.3 Descriptive Statistics

Descriptive statistics for the items and constructs are presented in Tables 5.2 and 5.3.

Table 5.2 Descriptive Statistics (items)

		N	Mean	Std. Dev.	Max	Min
Freq. of WTN Other-initiated Interruptions	Overall[a]	114	3.76	1.547	7	1
	Composite[b]	118	2.69	1.089	6	1
	via phone	118	2.7	1.392	6	1
	via email	118	4.08	1.597	7	1
	via IM	114	1.95	1.268	6	1
	via texting	114	1.85	1.305	7	1
Freq. of WTN Self-initiated Interruptions	Overall	110	3.62	1.526	7	1
	Composite	118	2.39	1.032	7	1
	via phone	115	2.23	1.377	7	1
	via email	117	3.99	1.54	7	1
	via IM	110	1.57	0.962	4	1
	via texting	112	1.68	1.187	7	1
	via other applications	110	2.15	1.602	7	1
Freq. of NTW Other-initiated Interruptions	Overall	116	3.36	1.212	6	1
	Composite	118	2.53	0.927	5	1
	via phone	118	3.17	1.276	6	1
	via email	117	3.15	1.458	7	1
	via IM	112	1.46	0.889	5	1
	via texting	113	2.25	1.449	6	1
Freq. of NTW Self-initiated Interruptions	Overall	115	3.23	1.338	6	1
	Composite	117	2.42	0.873	5	1
	via phone	114	2.99	1.244	6	1
	via email	117	3.18	1.406	7	1
	via IM	110	1.48	0.916	6	1
	via texting	111	2.1	1.314	6	1
	via other applications	110	2.35	1.358	7	1
WTN Conflict 1		119	3.76	1.944	7	1
WTN Conflict 2		119	3.81	1.847	7	1
WTN Conflict 3		119	3.45	1.817	7	1
WTN Conflict 4		119	3.87	1.818	7	1
NTW Conflict 1		119	2.5	1.604	7	1
NTW Conflict 2		119	2.13	1.461	7	1
NTW Conflict 3		119	2.12	1.491	6	1
NTW Conflict 4		119	2.34	1.451	7	1
Work Performance 1		117	5.63	1.243	7	2
Work Performance 2		118	5.64	1.151	7	1
Work Performance 3		118	6.15	0.948	7	4
Work Performance 4		118	5.74	0.947	7	2
Nonwork Performance 1		117	5.48	1.418	7	1
Nonwork Performance 2		118	5.31	1.317	7	2
Nonwork Performance 3		118	5.47	1.394	7	1
Nonwork Performance 4		118	5.43	1.368	7	1

Work Load 1	118	4.47	1.805	7	1
Work Load 2	117	4.63	1.71	7	1
Nonwork Load 1	118	4.26	1.79	7	1
Nonwork Load 2	118	3.49	1.843	7	1

Notes: All items except the items that measure frequency of interruptions are measured on seven-point scales with the anchors 1 = Strongly disagree to 7 = Strongly agree. All items that measure frequency of interruptions are measured on seven-point scales with the anchors 1 = Very rarely, 4 = Occasionally, 7 = Very frequently.

[a] The four items labeled "overall" measure the collective frequency of all interruptions received via phone call, email, IM, texting, and other applications (the latter only for self-initiated interruptions) for the four types of interruptions.

[b] The four items labeled "composite" are calculated by averaging the frequency of interruptions via different technologies for the four types of interruptions (4 technologies for other-initiated interruptions: phone, email, IM, and texting; 5 technologies for self-initiated interruptions: phone, email, IM, texting, and other applications).

Table 5.3 Descriptive Statistics (constructs)

Construct[a]	N	Mean	Std. Dev.	Max	Min
Freq. of WTN Other-initiated Interruptions	118	2.69	1.089	6	1
Freq. of WTN Self-initiated Interruptions	118	2.39	1.032	7	1
Freq. of NTW Other-initiated Interruptions	118	2.53	0.927	5	1
Freq. of NTW Self-initiated Interruptions	117	2.42	0.873	5	1
WTN Conflict	119	3.81	1.695	7	1
NTW Conflict	119	2.32	1.246	5.67	1
Work Performance	119	5.78	0.926	7	2.5
Nonwork Performance	118	5.41	1.265	7	1.25
Work Load	118	4.55	1.659	7	1
Nonwork Load	118	3.88	1.611	7	1

Notes: All scales except those that measure frequency of interruptions are seven-point scales with the anchors 1 = Strongly disagree to 7 = Strongly agree. All scales that measure frequency of interruptions are seven-point scales with the anchors 1 = Very rarely, 4 = Occasionally, 7 = Very frequently.

[a] The frequency of interruptions constructs are each based on the average of two items: the overall frequency of interruptions and the composite index that is the average of the frequency of interruptions via each technology.

As can be seen from Table 5.2, email represents the most intrusive technology, while IM is the least intrusive technology, based on the frequency of interruptions that occur via each technology. One way ANOVA and Tukey's HSD post-hoc tests suggest that WTN interruptions

occur most frequently via email (means being 4.08 and 3.99 for WTN other-initiated and WTN self-initiated interruptions respectively). NTW interruptions occur almost equally frequently via phone and email (NTW other-initiated interruptions: mean difference=0.034, t=0.270, p=0.788, and NTW self-initiated interruptions: mean difference=0.211, t=1.895, p=0.061), significantly higher than via other technologies. All NTW interruptions occur least frequently via IM (means being 1.46 and 1.48 for NTW other-initiated and NTW self-initiated interruptions respectively). Other-initiated WTN interruptions occur significantly least frequently via IM and texting (the mean difference between IM and texting is non significant; mean difference=0.106, t=0.904, p=0.368).

Table 5.3 presents the descriptive statistics for all the constructs in our research model: four independent variables, four dependent variables, and two control variables. In both directions (i.e., WTN and NTW), the frequency of other-initiated interruptions (2.69 for WTN and 2.53 for NTW) is significantly higher than the frequency of self-initiated interruptions (2.39 for WTN and 2.42 for NTW) (WTN: t=4.38 p=0.000; NTW: t=2.39 p=0.02). Further, individuals experience significantly higher work load than nonwork load (4.55 for work load and 3.88 for nonwork load) (t=3.63 p=0.000) and significantly higher WTN conflict than NTW conflict (3.81 for WTN conflict and 2.32 for NTW conflict) (t=9.61 p<0.0001), implying that work interferes with their personal life rather than the other way around.

5.4 Measurement Model

We used SmartPLS to assess the psychometric properties of the scales and to test the research model. Identification issues and the small sample size precluded the use of covariance-

based SEM techniques.[12] The research model was also tested using multiple regression and these results are presented in Appendix A. The results are highly consistent with the results of the PLS analysis.

To assess the psychometric properties of the scales, we examined the scales' internal consistency reliability and their convergent and discriminant validity. Composite reliability scores (Table 5.4) suggest that all the constructs have good reliabilities. The composite reliability coefficients of the four independent variables range from 0.89 to 0.93, and those of the four dependent variables and two control variables range from 0.86 to 0.95. All these internal consistency score are above the recommended 0.7 guideline and thus our scales exhibit good reliabilities (Fornell and Larcker 1981).

We assessed discriminant validity through confirmatory factor analysis (CFA) and the average variance extracted (AVE) following Chin (1998). First, square root of the AVE (see Table 5.4) is compared to inter-construct correlation coefficients. The constructs exhibit good discriminant validity when they share more variance with their indicators (i.e., square root of AVE) than with each other (i.e., inter-construct correlation). As shown by Table 5.4, the square root of AVE (shaded leading diagonal) for every construct is larger than the inter-construct correlation (coefficients in the same row and in the same column). Second, indicator loadings on the intended constructs are compared to their loadings on other constructs in the model. Evidence of good discriminant validity is demonstrated when loadings are higher than cross-loadings. As shown by the of CFA results (Table 5.5), all the indicators load more strongly on their corresponding constructs than on other constructs. However, the measures of NTW self-initiated

[12] We tried running our models in Mplus, but they did not converge due to the identification issues. Furthermore, the sample size of 119 is small for conducting covariance-based SEM analyses.

interruptions though having a higher loading on their own factor, also have a high cross loading on NTW other-initiated interruptions. This cross loading is less than then recommended 0.20 difference between the substantive loading and cross-loading (Gefen and Straub, 2005). Therefore, collectively these results point to adequate convergent and discriminant validity of most constructs in our model except for NTW self-initiated and NTW other-initiated interruptions.

Table 5.4 Inter-construct correlations

	Reliability	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
1. Freq. of WTN Other-initiated Interruptions[a]	0.93	0.94									
2. Freq. of WTN Self-initiated Interruptions	0.89	0.66	0.90								
3. Freq. of NTW Other-initiated Interruptions	0.90	0.20	0.25	0.91							
4. Freq. of NTW Self-initiated Interruptions	0.91	0.23	0.30	0.83	0.92						
5. WTN Conflict	0.90	0.56	0.40	0.11	0.10	0.90					
6. NTW Conflict	0.86	0.10	0.10	0.23	0.22	0.36	0.82				
7. Work Performance	0.91	-0.09	0.02	-0.18	-0.10	-0.08	-0.13	0.85			
8. Nonwork Performance	0.95	-0.41	-0.19	-0.04	-0.06	-0.44	-0.28	0.42	0.91		
9. Work Load	0.94	0.42	0.38	0.02	0.03	0.57	0.14	0.09	-0.31	0.95	
10. Nonwork Load	0.88	0.17	0.09	0.38	0.31	0.25	0.38	-0.01	-0.16	0.24	0.89

[a] The frequency of interruptions constructs are each based on the average of two items: the overall frequency of interruptions and the composite index that is the average of the frequency of interruptions via each technology.

Table 5.5 Items loadings and cross loadings

		Freq. of WTN Other-initiated Interruptions	Freq. of WTN Self-initiated Interruptions	Freq. of NTW Other-initiated Interruptions	Freq. of NTW Self-initiated Interruptions	WTN Conflict	NTW Conflict	Work Perf.	Nonwork Perf.	Work Load	Nonwork Load
Freq. of WTN Other-initiated Interruptions	overall	0.937	0.572	0.160	0.181	0.523	0.102	-0.097	-0.403	0.362	0.194
	composite	0.933	0.671	0.211	0.245	0.532	0.079	-0.061	-0.359	0.418	0.121
Freq. of WTN Self-initiated Interruptions	overall	0.567	0.888	0.262	0.274	0.346	0.064	-0.046	-0.162	0.350	0.073
	composite	0.624	0.908	0.188	0.269	0.376	0.107	0.070	-0.176	0.339	0.085
Freq. of NTW Other-initiated Interruptions	overall	0.182	0.216	0.983	0.796	0.119	0.261	-0.203	-0.045	0.023	0.373
	composite	0.203	0.292	0.828	0.741	0.068	0.088	-0.062	-0.021	0.025	0.328
Freq. of NTW Self-initiated Interruptions	overall	0.213	0.283	0.777	0.939	0.139	0.230	-0.101	-0.038	0.049	0.309
	composite	0.203	0.271	0.740	0.892	0.023	0.158	-0.089	-0.071	0.006	0.256
WTN Conflict 1		0.476	0.365	0.101	0.109	0.905	0.404	-0.152	-0.489	0.564	0.238
WTN Conflict 4		0.542	0.360	0.102	0.065	0.897	0.250	0.014	-0.306	0.464	0.207
NTW Conflict 1		0.127	0.099	0.203	0.150	0.392	0.867	-0.073	-0.265	0.215	0.343
NTW Conflict 3		0.028	0.007	0.127	0.117	0.218	0.837	-0.174	-0.194	0.010	0.365
NTW Conflict 4		0.082	0.143	0.252	0.292	0.284	0.755	-0.058	-0.241	0.104	0.213
Work Performance 1		-0.027	0.055	-0.200	-0.130	-0.074	-0.058	0.839	0.298	0.033	0.023
Work Performance 2		-0.069	-0.021	-0.178	-0.084	-0.012	-0.082	0.915	0.279	0.115	0.006
Work Performance 3		-0.145	-0.036	-0.114	-0.110	-0.184	-0.195	0.811	0.494	0.040	0.007
Work Performance 4		-0.063	0.055	-0.098	-0.028	-0.020	-0.115	0.833	0.409	0.110	-0.082
Nonwork Performance 1		-0.340	-0.156	-0.071	-0.039	-0.374	-0.257	0.375	0.931	-0.289	-0.157
Nonwork Performance 2		-0.320	-0.148	-0.007	-0.020	-0.403	-0.151	0.378	0.848	-0.312	-0.044
Nonwork Performance 3		-0.411	-0.205	-0.036	-0.093	-0.429	-0.288	0.340	0.943	-0.303	-0.163
Nonwork Performance 4		-0.408	-0.175	-0.038	-0.048	-0.409	-0.321	0.446	0.926	-0.231	-0.209
Work Load 1		0.450	0.400	0.046	0.041	0.586	0.125	0.032	-0.323	0.954	0.203
Work Load 2		0.330	0.319	-0.003	0.020	0.487	0.134	0.145	-0.257	0.937	0.263

Nonwork Load 1	0.260	0.162	0.308	0.281	0.262	0.314	0.007	-0.198	0.273	0.899
Nonwork Load 2	0.027	-0.015	0.376	0.271	0.171	0.364	-0.028	-0.082	0.153	0.874

To address the issue we did the following. Recall that the four types of interruptions (WTN other- and self- initiated; NTW other- and self-initiated) were measured using two items each: an item capturing overall frequency of interruptions and a composite index formed by averaging frequency of interruptions through phone call, email, IM, texting, and other applications (such as web browsing in the case of self-initiated interruptions). Due to the concern of discriminant validity, we replaced these reflective measures with formative indicators. Each formative indicator captures the frequency of interruptions caused by a specific technology. Specifically, they capture the frequency of interruptions (1) via phone call, (2) via email, (3) via IM, (4) via texting, and (5) via other applications (in the case of self-initiated interruptions). Collectively, these interruptions form the overall number of interruptions an individual experiences. These indicators meet the criteria for formative measurement suggested by Jarvis et al (2003) in that independent the individual items measuring the construct do not necessarily covary, and changes in the individual items cause changes in the underlying construct.

We then proceeded to evaluate this new measurement model. An important concern for formative indicators is multicollinearity among the indicators (Diamantopoulos et al. 2001; Petter et al. 2007). The resulting negative weights of frequency of interruptions via IM and frequency of interruptions via texting on their construct (for all the four interruption constructs) indicate that multicollinearity is indeed a concern. Therefore, we followed the procedure suggested by Cenfetelli and Bassellier (2009) to address the concern. First, we tried collapsing interruptions via IM and via texting into a single indicator (named interruptions via messenging) as both represent a messenging-based communication. However, multicollinearity persisted as suggested again by the negative weights of the new formative indicator (i.e., interruptions via messenging) when we ran the revised model. Therefore, as recommended, we created a

composite index by averaging all the formative dimensions and used the composite index as the single indicator of interruptions in the model testing. Therefore, in our structural model, the four types of interruptions were each measured using a single composite index based on their formative items.

Below we present the results of our scale validation based on the single-item composite measures of each interruption construct. Table 5.6 shows the descriptive statistics of the constructs, with the four independent interruption variables each measured by a composite index. An assessment of the square root of AVE compared to inter-construct correlations (Table 5.7) and of the CFA results (Table 5.8) and suggests that the constructs exhibit adequate convergent and discriminant validity.

Table 5.6 Descriptive Statistics (constructs)

	N	Mean	Std. Dev.	Max	Min
Freq. of WTN Other-initiated Interruptions	118	2.69	1.089	6	1
Freq. of WTN Self-initiated Interruptions	118	2.39	1.032	7	1
Freq. of NTW Other-initiated Interruptions	118	2.53	0.927	5	1
Freq. of NTW Self-initiated Interruptions	117	2.42	0.873	5	1
WTN Conflict	119	3.81	1.695	7	1
NTW Conflict	119	2.32	1.246	5.67	1
Work Performance	119	5.78	0.926	7	2.5
Nonwork Performance	118	5.41	1.265	7	1.25
Work Load	118	4.55	1.659	7	1
Nonwork Load	118	3.88	1.611	7	1

Notes: All scales except those that measure frequency of interruptions are seven-point scales with the anchors 1 = Strongly disagree to 7 = Strongly agree. All scales that measure frequency of interruptions are seven-point scales with the anchors 1 = Very rarely, 4 = Occasionally, 7 = Very frequently.

Table 5.7 Inter-construct correlations

	Reliability	1	2	3	4	5	6	7	8	9	10
1. Freq. of WTN Other-initiated Interruptions	1	n/a									
2. Freq. of WTN Self-initiated Interruptions	1	0.70	n/a								
3. Freq. of NTW Other-initiated Interruptions	1	0.27	0.28	n/a							
4. Freq. of NTW Self-initiated Interruptions	1	0.26	0.29	0.81	n/a						
5. WTN Conflict	0.90	0.53	0.38	0.07	0.02	0.90					
6. NTW Conflict	0.86	0.08	0.10	0.09	0.15	0.36	0.82				
7. Work Performance	0.91	-0.06	0.07	-0.06	-0.09	-0.08	-0.13	0.85			
8. Nonwork Performance	0.95	-0.36	-0.17	-0.02	-0.07	-0.44	-0.28	0.43	0.91		
9. Work Load	0.94	0.42	0.34	0.03	0.01	0.57	0.13	0.09	-0.31	0.95	
10. Nonwork Load	0.88	0.12	0.09	0.33	0.26	0.25	0.38	-0.01	-0.16	0.24	0.89

Table 5.8 Items loadings and cross loadings

	1	2	3	4	5	6	7	8	9	**10**
Freq. of WTN Other-initiated Interruptions	1	0.700	0.270	0.259	0.532	0.077	-0.061	-0.360	0.418	0.121
Freq. of WTN Self-initiated Interruptions	0.700	1	0.283	0.290	0.376	0.104	0.071	-0.175	0.339	0.085
Freq. of NTW Other-initiated Interruptions	0.270	0.283	1	0.808	0.068	0.085	-0.060	-0.023	0.025	0.328
Freq. of NTW Self-initiated Interruptions	0.259	0.290	0.808	1	0.023	0.154	-0.090	-0.072	0.006	0.256
WTN Conflict 1	0.446	0.339	0.049	0.031	0.906	0.402	-0.156	-0.489	0.564	0.238
WTN Conflict 4	0.514	0.338	0.074	0.009	0.896	0.247	0.011	-0.306	0.464	0.207
NTW Conflict 1	0.097	0.105	0.041	0.090	0.392	0.867	-0.076	-0.264	0.215	0.343
NTW Conflict 3	0.010	0.011	0.034	0.079	0.218	0.848	-0.173	-0.190	0.010	0.365
NTW Conflict 4	0.094	0.163	0.164	0.247	0.284	0.741	-0.061	-0.240	0.104	0.213
Work Performance 1	-0.041	0.098	-0.096	-0.128	-0.074	-0.062	0.839	0.298	0.033	0.023
Work Performance 2	-0.056	0.049	-0.081	-0.058	-0.012	-0.086	0.904	0.276	0.115	0.006
Work Performance 3	-0.105	-0.024	-0.044	-0.115	-0.185	-0.195	0.816	0.491	0.040	0.007
Work Performance 4	-0.011	0.105	0.024	-0.002	-0.020	-0.116	0.841	0.406	0.110	-0.082
Nonwork Performance 1	-0.318	-0.129	-0.036	-0.051	-0.374	-0.255	0.381	0.933	-0.289	-0.157
Nonwork Performance 2	-0.298	-0.126	-0.015	-0.059	-0.404	-0.149	0.387	0.851	-0.312	-0.044
Nonwork Performance 3	-0.373	-0.188	-0.033	-0.105	-0.429	-0.286	0.346	0.944	-0.303	-0.163
Nonwork Performance 4	-0.317	-0.191	0.005	-0.041	-0.409	-0.321	0.452	0.920	-0.231	-0.209
Work Load 1	0.451	0.347	0.052	0.032	0.587	0.122	0.030	-0.325	0.954	0.204
Work Load 2	0.332	0.290	-0.009	-0.025	0.488	0.132	0.143	-0.260	0.937	0.263
Nonwork Load 1	0.234	0.152	0.328	0.266	0.262	0.317	0.004	-0.196	0.273	0.899
Nonwork Load 2	-0.033	-0.009	0.250	0.183	0.171	0.365	-0.028	-0.079	0.153	0.873

1-Freq. of WTN Other-initiated Interruptions	5- WTN Conflict	9- Work Load
2-Freq. of WTN Self-initiated Interruptions	6- NTW Conflict	10-Nonwork Load
3- Freq. of NTW Other-initiated Interruptions	7- Work Performance	
4- Freq. of NTW Self-initiated Interruptions	8- Nonwork Performance	

5.5 Hypothesis Testing

We used partial least squares (PLS),[13] a structural equation modeling (SEM) tool, to test the research model because of sample size and identification issues. We adopted SmartPLS with a 250 sample bootstrapping technique for model assessment. All statistical tests were assessed with one-tailed t-tests because of the unidirectional nature of our hypotheses and corollaries. Table 5.9 and Figures 5.1 and 5.2 (which includes quadratic effects) present the results of various PLS models. All the path coefficients are summarized in Table 5.10. Power calculation suggests that our sample size is sufficient for us to detect the effects on nonwork performance, WTN conflict, and NTW conflict. The average observed power is 0.9 for the models without and with quadratic terms (at the significance level of 0.05). The observed power is 0.7 for the model without quadratic terms and 0.6 for the model with quadratic terms to detect effects on work performance. Therefore, some of the non-significant effects on work performance may be due to this lower statistical power.

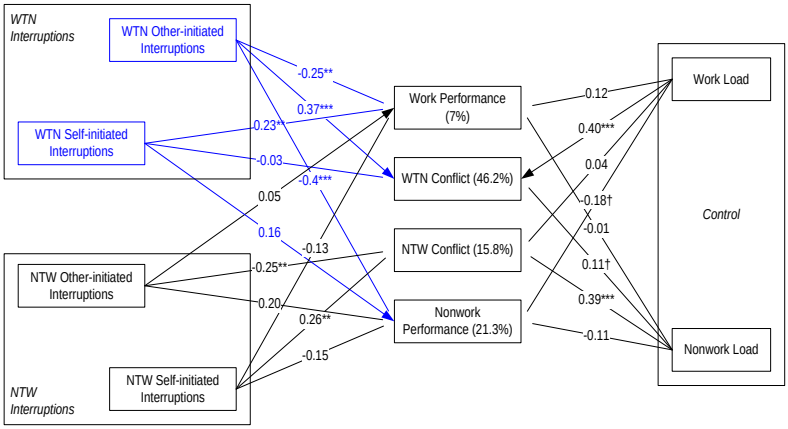
Table 5.9 PLS Results for Model Testing

Work-to-Nonwork Interruptions	Model 1 (Figure 5.1)	Model 2 (Figure 5.2)
H1a: freq. of other-initiated WTN interruption → WTN conflict	**0.37 (0.122)****	**0.37 (0.117)*****
H2a: freq. of self-initiated WTN interruption → WTN conflict	-0.03 (0.09) NS	-0.03 (0.084) NS
H3a: freq. of other-initiated > self-initiated	**24.2*** (t-value)**	**25.4*** (t-value)**
H4a: freq. of other-initiated WTN interruptions → work performance	**-0.25 (0.142)***	**-0.24 (0.154) †**
H5a: freq. of self-initiated WTN interruptions → work performance	**0.23 (0.126)***	**0.19 (0.139) †**
H6a: freq. of other-initiated WTN interruptions → nonwork performance	**-0.4 (0.147)****	**-0.4 (0.146)****
H7a (main): freq. of self-initiated WTN interruptions → nonwork performance	0.16 (0.16) NS	0.12 (0.175) NS

[13] Ordinary least square (OLS) was also used as an analytical strategy for hypothesis testing. Patterns of the results based on OLS analysis largely remain the same as those based on the PLS analysis. Results of the OLS regressions are shown in Appendix A.

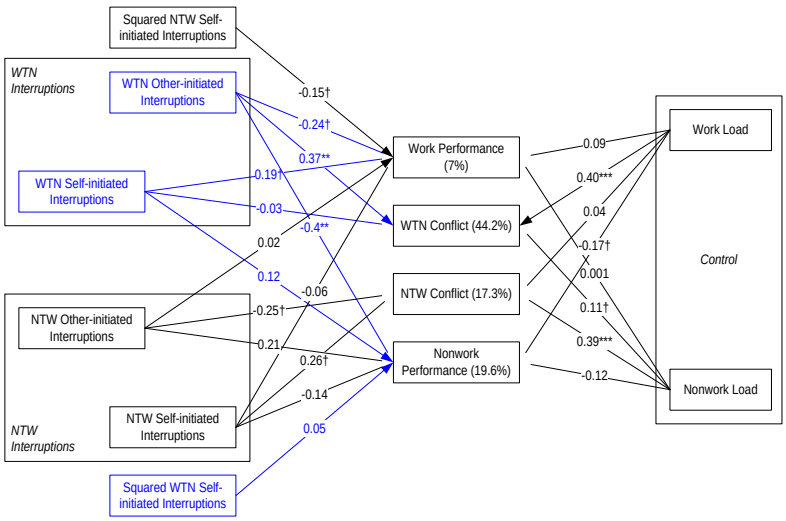
H7a (quadratic): [freq. of self-initiated WTN interruptions]^2 → nonwork performance		0.05 (0.108) NS
Nonwork-to-Work Interruptions	Model 1 (Figure 5.1)	Model 2 (Figure 5.2)
H1b: freq. of other-initiated NTW interruption → NTW conflict	**-0.25 (0.14)***	**-0.25 (0.165) †**
H2b: freq. of self-initiated NTW interruption → NTW conflict	**0.26 (0.141)***	**0.26 (0.167) †**
H3b: freq. of other-initiated > self-initiated	0.54 NS (t-value)	0.46 NS (t-value)
H4b: freq. of other-initiated NTW interruptions → nonwork performance	0.2 (0.18) NS	0.21 (0.172) NS
H5b: freq. of self-initiated NTW interruptions → nonwork performance	-0.15 (0.145) NS	-0.14 (0.15) NS
H6b: freq. of other-initiated NTW interruptions → work performance	0.05 (0.176) NS	0.02 (0.171) NS
H7b (main): freq. of self-initiated NTW interruptions → work performance	-0.13 (0.172) NS	-0.06 (0.168) NS
H7b (quadratic): [freq. of self-initiated NTW interruptions]^2 → work performance		**-0.15 (0.106) †**

Path coefficient (standard error)
***p<0.001 **p<0.01 *p<0.05 † p<0.1 NS – non-significant



*** p<0.001 ** p<0.01 * p<0.05 † p<0.1
Blue color indicates the effects of WTN interruptions.

Figure 5.1 PLS Results for Model Testing



*** p<0.001 ** p<0.01 * p<0.05 † p<0.1

Blue color indicates the effects of WTN interruptions.

Figure 5.2 PLS Results for Model Testing (with Quadratic Terms Included)

Table 5.10 PLS Results for Model Testing

Independent Variables	Dependent Variables			
	WTN Conflict	NTW Conflict	Work performance	Nonwork performance
freq. of other-initiated WTN interruptions	**0.37 *** (0.117) [0.001]**		**-0.24 † (0.154) [0.061]**	**-0.4 ** (0.146) [0.003]**
freq. of self-initiated WTN interruptions	-0.03 NS (0.084) [0.360]		**0.19 † (0.139) [0.087]**	0.12 NS (0.175) [0.247]
[quadratic] freq. of self-initiated WTN interruptions				0.05 NS (0.108) [0.322]
freq. of other-initiated NTW interruptions		**-0.25 † (0.165) [0.066]**	0.02 NS (0.171) [0.453]	0.21 NS (0.172) [0.112]
freq. of self-initiated NTW interruptions		**0.26 † (0.167) [0.061]**	-0.06 NS (0.168) [0.360]	-0.14 NS (0.150) [0.176]
[quadratic] freq. of self-initiated NTW interruptions			**-0.15 † (0.106) [0.079]**	
work load	**0.40 *** (0.080) [0.000]**	0.04 NS (0.100) [0.344]	0.09 NS (0.130) [0.245]	**-0.17 † (0.100) [0.045]**
nonwork load	**0.11 † (0.070) [0.059]**	**0.39 *** (0.110) [0.000]**	0.001 NS (0.110) [0.496]	**-0.12 † (0.090) [0.092]**

Path coefficient (standard error) [one-tailed p-value]

***p<0.001 **p<0.01 *p<0.05 † p<0.1 NS – non-significant

Given the relatively high inter-construct correlations between WTN other- and self-initiated interruptions (0.70), and between NTW other- and self-initiated interruptions (0.81),

multi-collinearity in the structural model can be a concern. As such, we examined collinearity statistics to assess the concern. First, we obtained latent variable scores for each of our constructs in the research model. Then, we ran multiple regressions – one for each dependent variable – and examined the collinearity statistics. With the maximum VIF being 3.21, none of the four models (with WTN conflict, NTW conflict, work performance, and nonwork performance as the respective dependent variables) produced a VIF value that exceeds 3.3 as recommended by Diamantopoulos and Siguaw (2006). Likewise, the condition indices are all below 10, with the largest being 3.807. This indicates that, though our independent variables may be highly correlated, multi-collinearity is not a serious concern. To further ensure that multi-collinearity does not influence our results, for each dependent variable, we ran three separate models: the research model that included both self- and other-initiated interruptions; one with just self-initiated interruptions; and one with only other-initiated interruptions. If multi-collinearity is a concern then the results of the self- and the other-initiated models will deviate from those of the research model. That is, the total number of significant paths, as well as what paths are significant, when each type of interruption is entered separately will be higher and different than when both interruptions are entered together. Our results show that the pattern of significant and non-significant paths remains consistent, which again indicates that though self- and other-initiated interruptions are highly correlated they also do have distinct effects and our results do not suffer from multi-collinearity.

We also checked for the presence of suppression effects. Tabachnick and Fidell (2007, p. 155) state that "If the beta weight is significantly different from zero, either one of the following two conditions signals the presence of a suppressor variable: (1) the absolute value of the simple correlation between the independent variable and the dependent variable is substantially smaller

than the beta weight for the independent variable, or (2) the simple correlation and beta weight have opposite signs. There is as yet no statistical test available to assess how different a regression weight and a simple correlation need to be to identify suppression."

Therefore, we compared all significant beta coefficients with their corresponding zero-order correlation with the dependent variable. The results are shown in Table 5.11 below. The table only shows the beta coefficients that were significant. We highlighted in yellow instances that match the first criterion and in pink instances that match the second criterion. Four instances (in two regressions) were identified as potential suppression effects.

Table 5.11 Significant Beta coefficients and the corresponding zero-order correlation coefficients

Independent Variables	Dependent Variables			
	WTN Conflict	NTW Conflict	Work performance	Nonwork performance
freq. of other-initiated WTN interruptions	0.37 *** (0.117) [0.001] Correlation: 0.53 [.000]		**-0.24 † (0.154) [0.061] Correlation: -0.06 [.511]**	-0.4 ** (0.146) [0.003] Correlation: -0.36 [.000]
freq. of self-initiated WTN interruptions			**0.19 † (0.139) [0.087] Correlation: 0.07 [.442]**	
freq. of other-initiated NTW interruptions		**-0.25 † (0.165) [0.066] Correlation: 0.09 [.357]**		
freq. of self-initiated NTW interruptions		**0.26 † (0.167) [0.061] Correlation: 0.15 [.095]**		
[quadratic] freq. of self-initiated NTW interruptions			-0.15 † (0.106) [0.079] Correlation: -0.192 [0.018]	
work load	0.40 *** (0.080) [0.000] Correlation: 0.572 [.000]			-0.17 † (0.100) [0.045] Correlation: -0.312 [.001]
nonwork load	0.11 † (0.070) [0.059] Correlation: 0.247 [.007]	0.39 *** (0.110) [0.000] Correlation: 0.383 [.000]		-0.12 † (0.090) [0.092] Correlation: -0.158 [.085]

Both path coefficient and correlation coefficient are reported in each cell:
(1) Path coefficient (standard error) [one-tailed p-value], followed by
(2) Correlation coefficient [two-tailed p-value]
***p<0.001 **p<0.01 *p<0.05 † p<0.1 NS – non-significant

According to Tabatchnick and Fidell (2007), once suppression effects are identified, the next step is to attempt to identify the suppressor among the independent variables. Candidate suppressor variables are those that are congruent, that is, their zero-order correlation with the dependent variable and their beta coefficients are consistent in size and direction. The strategy they recommend is "to systematically leave each congruent independent variable out of the equation and examine the regression coefficients for the independent variable(s) with inconsistent regression coefficients and correlations in the original equation" (p. 155).

We did this for the two regressions where possible suppression effects were identified.

For the NTW conflict regression, the suppressor variable was the control variable nonwork load. Once nonwork load was removed from the equation, the suppression effects on both the independent variables exhibiting these disappeared. Therefore, nonwork load suppresses variance that is irrelevant to the prediction of NTW conflict and enhances the effects of both frequency of NTW other- and NTW self-initiated interruptions on NTW conflict.[14]

For the work performance regression, we tried removing one variable, two and three variables at a time from the model. However, this did not rectify the issue as the beta coefficients of WTN other- and self-initiated interruptions stayed approximately at the same levels. The beta

[14] A suppressor variable suppresses variance that is irrelevant to the prediction of the dependent variable. It enhances the effects of other variables in the equation. It is only a suppressor for the variables whose regression weights (or path coefficients) are increased (Cohen et al 2003; Conger 1974).

coefficients for WTN other- and self-initiated interruptions became consistent to the corresponding correlation coefficients only when all the other variables were removed (of course).

There are two possible explanations for this. First, multiple suppressors may affect the WTN interruptions collectively. But suppression effects jointly caused by multiple variables are not the typical form of suppression. Second, the observed pattern may occur due to other factors, e.g., multicolliearity. However, we also tested for multicollinearity by examining VIF, condition index, and variance portion. These diagnostic statistics are within the suggested range (VIF smaller than 5, condition index lower than 15, and less than two variance portions over 0.5 when the condition index is over 15). This suggests that multicollinearity is unlikely an issue. Therefore we conclude that suppression effects are likely not present for the work performance model, and that the differences between the independent variables (i.e., other- and self-initiated WTN interruptions) and their correlation coefficients may be due to other factors.

5.6 Discussion of Results

5.6.1 Control Variables

Performance and conflict can be affected by a wide variety of factors. In the context of this study, we identified important variables that may affect the dependent variables of interest. We controlled for work flexibility, personal life flexibility, work orientation, personal life orientation, work norm, personal life norm, polychronicity, and personal preference for segmentation/integration. None of the control variables had a statistically significant effect, and were then eliminated from the subsequent model testing. We also controlled for work load and nonwork load. These had significant effects and were retained in the model.

Age, gender, and device (whether or not one's primary communication device is provided by company) were also included in the model as control variables. Though these were significant predictors for some of the dependent variables, due to our smaller sample size and for power considerations, they were removed from the models as reported here. As suggested by a comparison of models with the three control variables included and excluded, their inclusion or exclusion does not significantly change the pattern of the results.

5.6.2 Work-to-Nonwork (WTN) Interruptions

5.6.2.1 Work-to-Nonwork (WTN) Conflict

The model explains 46.2% of the variance in WTN conflict with the following significant predictors: WTN other- (γ=0.37, t=3.17, p=0.001) and the control variables of work load (γ=0.40, t=5.07, p<0.0001) and nonwork load (γ=0.11, t=1.48, p=0.07). Full support was found for Hypothesis 1a. The results of this analysis are presented in Figure 5.2 and in Table 5.9. Frequency of WTN other-initiated interruptions has a positive relationship with WTN conflict, supporting H1a. However, support for H2a was not found, as the main effect of WTN self-initiated interruptions is non-significant.

This suggests that other-initiated interruptions have a stronger effect on WTN conflict than self-initiated interruptions. To statistically compare the effects of other-initiated WTN interruptions to self-initiated ones, a t-statistic was calculated using the formula[15] below and found to be significant (t=25.4, p<0.0001), providing statistical support that other-initiated WTN interruptions have a stronger effect on WTN conflict than self-initiated WTN interruptions. Therefore, H3a was supported.

[15] Chin, W. W., (2000). Frequently Asked Questions – Partial Least Squares & PLS-Graph. http://disc-nt.cba.uh.edu/chin/plsfaq.htm (accessed on 6 April 2011).

$$t = \frac{\gamma_1 - \gamma_2}{\sqrt{\frac{s_1^2}{n_1} + \frac{s_2^2}{n_2}}},$$

where the denominator is the pooled standard error of the path coefficients (γ_1 and γ_2).

5.6.2.2 Performance

The study tests the effects of WTN interruptions (other-initiated and self-initiated) on both work performance (the interrupting domain) and nonwork performance (the interrupted domain). First, we tested the direct effects of other-initiated and self-initiated WTN interruptions on *work performance* (i.e., performance of the interrupting domain). Figure 5.2 and Table 5.9 show the results of this analysis. The results show that frequency of other-initiated WTN interruptions (γ=-0.25, t=1.75, p=0.04) is negatively related to work performance, in the opposite direction to what H4a hypothesizes. Thus H4a was not supported. The frequency of self-initiated WTN interruptions (γ=0.23, t=1.82, p=0.04) is positively related to work performance, supporting H5a. Collectively, the model explains 7% of the variance in work performance.

Second, the study also tests the direct effects of other-initiated WTN interruptions and the nonlinear effects of self-initiated WTN interruptions on *nonwork performance* (i.e., performance of the interrupted domain). Figure 5.2 and Table 5.9 show the results of this analysis. The results show that frequency of other-initiated WTN interruptions (γ=-0.40, t=2.74, p=0.004) is negatively related to nonwork performance, supporting H6a. Given the non-significant quadratic term of *frequency of self-initiated WTN interruptions* × *frequency of self-initiated WTN interruptions* (γ=0.05, t=0.51, p=0.31), support was not found for H7a, which posit an inverted-U

relationship between frequency of self-initiated WTN interruptions and nonwork performance. Collectively, the model explains 19.6% of the variance in non-work performance.

5.6.3 Nonwork-to-Work Interruptions

5.6.3.1 Nonwork-to-work (NTW) Conflict

The model explains 15.8% of the variance in NTW conflict with the following significant predictors: frequency of NTW other- (γ=-0.25, t=1.53, p=0.06), self-initiated (γ=0.26, t=1.54, p=0.06) interruptions, and nonwork load (γ=0.39, t=3.67, p=0.0002). The results of the analysis are presented in Figure 5.2 and Table 5.9. The frequency of NTW self-initiated interruptions has a positive relationship with NTW conflict, supporting H2b. The results, however, show that frequency of NTW other-initiated interruptions is negatively related to NTW conflict, in the opposite direction to that hypothesized in H1b. A comparison of the path coefficients of NTW other- and self-initiated interruptions on NTW conflict suggests no significant difference between the two (t=0.46) failing to support H3b.

5.6.3.2 Performance

The study tests the effects of NTW interruptions (other-initiated and self-initiated) on both work performance (performance of interrupted domain) and nonwork performance (performance of interrupting domain). First, we tested the direct effects of other-initiated and self-initiated NTW interruptions on work performance (i.e., performance of the interrupting domain). Figure 5.2 and Table 5.9 show the results of this analysis. No support was found for H4b and H5b since the effects of other-initiated (γ=0.21, t=1.23, p=0.11) and self-initiated NTW

interruptions (γ=-0.14, t=0.95, p=0.17) on work performance were both non-significant. Collectively, the model explains 19.6% of the variance in non-work performance.

Second, the study also tests the direct effects of other-initiated NTW interruptions and the nonlinear effects of self-initiated NTW interruptions on work performance (i.e., performance of the interrupted domain). Figure 5.2 and Table 5.9 show the results of this analysis. The quadratic term *frequency of self-initiated NTW interruptions* $\times$ *frequency of self-initiated NTW interruptions* (γ=-0.15, t=1.42, p=0.08) is only marginally significant at the 0.1 significance level. This suggests the possible presence of an inverted U-shaped relationship between frequency of self-initiated NTW interruptions and work performance. Therefore, H7b was only weakly supported (at the 0.1 significance level). This marginal significant effect may be due to the lack of sufficient power. Though only marginally supported, because it is theoretically interesting, we explore the inverted U-shaped relationship graphically in Figure 5.3. Given the non-significant main effects of other-initiated NTW interruptions (γ=0.02, t=0.14, p=0.44), support was not found for H6b. This non-significant path coefficient may also be due to the lack of sufficient power. Collectively, the model explains 19.6% of the variance in work performance.

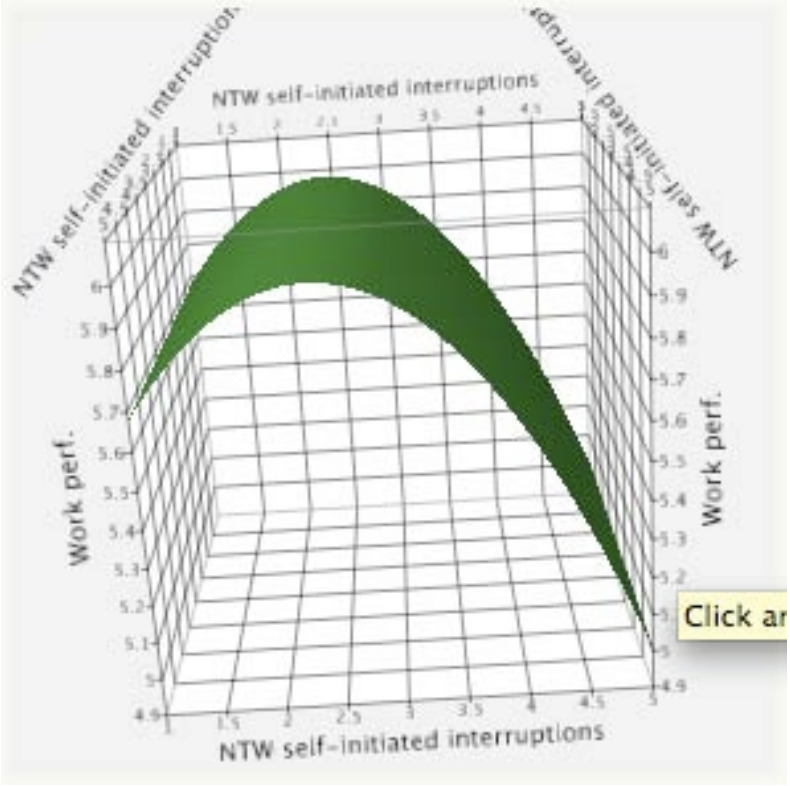


Figure 5.3 Inverted U-shaped Relationship between NTW Self-initiated Interruptions and Work Performance

5.6.4 Summary

This study makes three premises: (1) the interrupting domain gains performance while the interrupted domain loses performance, (2) the source of an interruption matters, and (3) the direction of an interruption matter. This section summarizes the results of hypothesis testing (Table 5.12) and examines the results along the three premises. Particularly, the same data as presented in the preceding section are discussed from different perspectives – (1) performance impact in the interrupting domain vs. in the interrupted domain, (2) effects of other-initiated vs. self-initiated interruptions, and (3) effects of WTN interruptions vs. NTW interruptions.

Table 5.12 Hypothesis Testing Results

Work-to-Nonwork Interruptions	Support
H1a: other-initiated WTN interruption → WTN conflict	**Yes**
H2a: self-initiated WTN interruption → WTN conflict	No
H3a: other-initiated > self-initiated	**Yes**
H4a: other-initiated WTN interruptions → work performance	No
H5a: self-initiated WTN interruptions → work performance	**Yes**
H6a: other-initiated WTN interruptions → nonwork performance	**Yes**
H7a (main): self-initiated WTN interruptions → nonwork performance	
H7a (quadratic): [self-initiated WTN interruptions]^2 → nonwork performance	No
Nonwork-to-Work Interruptions	Support
H1b: other-initiated NTW interruption → NTW conflict	No
H2b: self-initiated NTW interruption → NTW conflict	**Yes**
H3b: other-initiated > self-initiated	No
H4b: other-initiated NTW interruptions → nonwork performance	No
H5b: self-initiated NTW interruptions → nonwork performance	No
H6b: other-initiated NTW interruptions → work performance	No
H7b (main): self-initiated NTW interruptions → work performance	
H7b (quadratic): [self-initiated NTW interruptions]^2 → work performance	**Yes (marginal)**

5.6.4.1 Summary of Performance Gains and Losses

Cross-domain interruptions represent an opportunity for individuals to re-allocate finite personal resources such as time, attention, and energy across the domains of work and personal life. In discussing the effects of interruptions on work and personal life, this research makes a distinction between the interrupting and the interrupted domains. A premise of the study is that the interrupting domain will experience performance improvement due to the resource gains, whereas the interrupted domain will experience performance drop due to resource losses. In the preceding section, we presented our results in terms of how work-to-nonwork and nonwork-to-work interruptions affect performance. Here we present the same results but from a different perspective. Particular, we juxtapose the findings for the interrupting domain with those for the

interrupted domain, so that patterns as to whether the interrupting domain gains performance and the interrupted domain loses performance become obvious.

Does the interrupting domain experience performance gains?

Four hypotheses (H4a, H5a, H4b, and H5b) assess whether the interrupting domain gains performance. Particularly, H4a and H5a examine whether WTN other- and self-initiated interruptions are associated with improvement of work performance, while H4b and H5b examine whether NTW other- and self-initiated interruptions are associated with improvement in nonwork performance. As shown in Tables 5.9 and 5.10, NTW interruptions do not significantly affect nonwork performance – thus there is no performance gain in the nonwork domain when personal interruptions occur in the work domain. Further, frequency of other-initiated WTN interruptions is negatively associated with work performance (γ=-0.24, t=1.75, p=0.061), in the opposite direction to our expectation – thus, there is a performance loss not a performance gain. However, frequency of self-initiated WTN interruptions is significantly related to performance gains in the work domain (γ=0.19, t=1.83, p=0.087), supporting H5a. Therefore, our premise that the interrupting domain experiences performance improvement due to resource gains appears to require a more nuanced treatment. It is clear that the interrupting domain experiences performance gains in some instances and performance losses or no effects in others. Thus, both direction and source of interaction seem to be material sources of this variation. Future research should further examine the conditions under which the interrupting domain experiences performance gains and losses.

Does the interrupted domain experience performance loss?

Four hypotheses (H6a, H7a, H6b, and H7b) assess whether the interrupted domain loses performance. Particularly, H6a and H7a examine whether WTN other- and self-initiated interruptions are associated with performance loss in personal life, while H6b and H7b examine whether NTW other- and self-initiated interruptions are negatively related to work performance. As shown in Tables 5.9 and 5.10, other-initiated NTW interruptions do not significantly affect work performance and neither do self-initiated WTN interruptions affect nonwork performance. The results show that frequency of other-initiated WTN interruptions (γ=-0.40, t=2.74, p=0.003) is negatively related to nonwork performance, supporting H6a – and thus in this case the interrupted domain experiences a performance reduction due to resource losses. Moreover, the marginal significance of the quadratic term, squared frequency of self-initiated NTW interruptions (γ=-0.15, t=1.42, p=0.079), provides weak support for an inverted U-shaped relationship between frequency of self-initiated NTW interruptions and work performance. This may suggest that a reasonable amount of self-initiated NTW interruptions can be positively associated with work performance, but after a certain point such interruptions start to be detrimental to work performance. Given that the relationship is only marginally supported but theoretically interesting, future research should explore this to obtain additional empirical evidence on the existence of this non-linear effect.

In summary, our premise that the interrupting domain gains performance is partially supported. Only WTN self-initiated interruptions may be positively related to work performance. The other three paths, i.e., between WTN other-initiated interruptions and work performance, and between NTW interruptions (other-initiated and self-initiated) and nonwork performance, are non-significant. The other premise that the interrupted domain loses performance is also

partially supported. Only WTN other-initiated interruptions undermine nonwork performance. The marginally significant inverted U-shaped relationship between NTW self-initiated interruptions and work performance shows that interruptions may not always be associated with performance loss. Work, as the interrupted domain, only loses performance after the frequency of such interruptions passes a certain point. These results point to the need for additional research in this domain to determine the conditions under which performance gains and losses occur for both the interrupted and interrupting domains, and calls for the future research based on a larger sample size.

5.6.4.2 Summary of Other-initiated vs. Self-initiated Interruptions

One important distinction in terms of interruptions is the source of the interruption – other-initiated and self-initiated. When people interrupt themselves via technology, they have better control over the nature and timing of such interruptions than when they are interrupted by others such as colleagues or friends. The nature and timing of an interruption can then directly affect how much disruption the interruption causes in the interrupted domain. Therefore, we expect other-initiated interruptions to more strongly affect WTN/NTW conflict and the performance in the interrupted domain than self-initiated interruptions. In other words, although both other- and self-initiated interruptions can be detrimental (in terms of elevated conflict between work and personal life, and performance loss in the interrupted domain), the control that people have over self-initiated interruptions seems to mitigate the negative effects. Again, we present here the same results discussed in the preceding section, but from a different perspective. Particular, we juxtapose the findings for other-initiated interruptions with those for self-initiated interruptions, so that patterns as to whether the source of an interruption matters become obvious.

Does the source of an interruption matter?

As expected, in general, other-initiated interruptions are more detrimental than self-initiated interruptions (see Tables 5.9 and 5.10). In particular, other-initiated WTN interruptions represent the type of interruption that is associated with the most negative consequences, such as WTN conflict (γ=-0.37, t=3.16, p=0.001) and performance losses in personal life (γ=-0.40, t=2.74, p=0.003). And other-initiated WTN interruptions affect WTN conflict more strongly than self-initiated ones (t=25.4). Although both other- and self-initiated interruptions are expected to be positively related to the performance of the interrupting domain, only self-initiated WTN interruptions are found to be significantly associated with work performance (γ=0.19, t=1.82, p=0.087).

This pattern of other-initiated interruptions being more detrimental than self-initiated interruptions is less pronounced with NTW interruptions. Other-initiated NTW interruptions are negatively associated with NTW conflict (γ=-0.24, t=1.56, p=0.061), whereas self-initiated ones are positively associated with NTW conflict (γ=0.26, t=1.56, p=0.061). Although self-initiated NTW interruptions seem to be more detrimental than other-initiated ones in influencing NTW conflict, the marginal significance of the quadratic term (i.e., squared frequency of self-initiated NTW interruptions) (γ=-0.15, t=1.42) suggests an inverted U-shaped relationship between frequency of self-initiated NTW interruptions and work performance. This is suggestive of potential benefits of self-initiated NTW interruptions in terms performance gains in the interrupted domain.

The results show that the source of an interruption does make a difference – other-initiated interruptions, by and large, are more detrimental than self-initiated interruptions. It

seems that the control over the nature and timing of an interruption allows people to mitigate the negative outcomes to some extent.

5.6.4.3 Summary of Work-to-Nonwork (NTW) vs. Nonwork-to-Work (NTW) Interruptions

The other important distinction between interruptions is the direction – work-to-nonwork (WTN) and nonwork-to-work (NTW). Although we develop parallel hypotheses for both WTN and NTW interruptions, one of the objectives of this study is to explore whether WTN and NTW interruptions have equivalent effects. This question can be answered by examining whether interruptions have asymmetrical or symmetrical effects in the domains of work and personal life.

Does the direction of an interruption matter?

The patterns of results as shown in Tables 5.9 and 5.10 are asymmetrical in work and personal life. WTN other-initiated interruptions are positively associated with WTN conflict (γ=0.37, t=3.17, p=0.001), whereas NTW other-initiated interruptions are negatively associated with NTW conflict (γ=-0.25, t=1.79, p=0.066). WTN self-initiated interruptions do not significantly affect WTN conflict, whereas NTW self-initiated interruptions are positively associated with NTW conflict (γ=0.26, t=1.56, p=0.061). WTN other-initiated interruptions negatively affect both work performance (γ=-0.25, t=1.75, p=0.061) and nonwork performance (γ=-0.40, t=2.74, p=0.003), whereas NTW other-initiated interruptions do not significantly affect work performance or nonwork performance. While WTN self-initiated interruptions are positively related to work performance (γ=0.19, t=1.37, p=0.087), NTW self-initiated interruptions have a marginally significant inverted U-shaped relationship with work performance (γ=-0.15, t=1.42, p=0.079).

The results show that WTN and NTW interruptions have asymmetrical effects across work and personal life, suggesting that the direction of an interruption does matter. WTN interruptions do not affect people's work and personal life the same way that NTW interruptions do.

5.7 Common Method Variance

Given that both dependent and independent variables were collected from the same participant, at the same time, using the same method common method bias may be a concern due to social desirability and consistency motif (Podsakoff, MacKenzie, Lee, & Podsakoff, 2003). We assessed the effect of common method bias in a number of ways.

First, by simultaneously loading all items in an unrotated factor analysis, we conducted a Harman's single-factor test (Podsakoff & Organ, 1986) on the ten constructs in the theoretical model including WTN other-initiated interruptions, WTN self-initiated interruptions, NTW other-initiated interruptions, NTW self-initiated interruptions, WTN conflict, NTW conflict, work performance, nonwork performance, work load, and nonwork load. Results from the test showed that the most variance explained by one factor is 28.7%, indicating that common method bias is likely not a concern.

Second, we assessed common method bias by using covariance-based SEM (in AMOS). Specifically, we conducted a CFA analysis with and without a common method factor. For the model to be identified we had work-related interruptions loading on a single factor and nonwork-related interruptions on another. That is, we had two interruption constructs instead of four single-item constructs. This was necessary because the model with the single item constructs could not be identified. Though not ideal in terms of accurately representing our measurement

model, this nonetheless allowed us to assess common method bias, which was the main objective of this exercise. Although the model with common method factor yielded an improved model fit (CFI=0.956 and RMSEA=0.060) than the one without the common method factor (CFI=0.926 and RMSEA=0.073), loadings on the common method factor were all non-significant and the average variance extracted by the common method factor is only 14.4% compared to 33.2%-83.5% for trait factors (all but one trait factor have AVEs greater than 50% -see Table 5.13).

Table 5.13 Average Variance Extracted by Trait Factors and Method Factor

Average Variance Extracted	
Freq. of WTN interruptions	0.743
Freq. of NTW interruptions	0.835
WTN conflict	0.602
NTW conflict	0.504
Work performance	0.332
Nonwork performance	0.513
Work load	0.794
Nonwork load	0.572
Common Method Factor	0.144

However, given the possible presence of common method bias indicated by the improved fit, we assessed the effect of common method bias on the structural model. Specifically, we ran a modified version of the structural model with and without the common method factor to assess the effect of common method bias on the path coefficients. Identification issues required that we use a single construct for all four types of interruptions (i.e., all four interruptions were modeled as indicators of the same construct). Though this is not the structural model of the study (where each type of interruption has a separate effect on the dependent variables) it does provide an indication of the extent to which common method bias may be influencing the results. Comparison of significant effects across the model with and without the method factor indicates that the pattern of significant and non-significant effects results remains the same. Therefore,

although some level of common method bias may exist, it does not appear to influence the results of hypothesis testing.

5.8 Endogeneity Test

To assess endogeneity concerns on our results, we conducted an endogeneity test following the two-step econometric procedure developed by Heckman (1979). In the first step, we divided our respondents into two groups: individuals with scores above the mean on the frequency of interruptions coded as one, and individuals with scores below the mean on the same variable coded as zero. As there are four different types of interruptions, we divided our sample into two groups in four different ways. We estimated a probit model in SPSS to examine the effects of age, gender, and organization-provided device, which were expected to influence the level of interruptions that people may experience. Parameter estimates from the logistic regression were used to compute the individual probit scores. Lambda (i.e., the inverse Mill's ratio) was calculated based on the individual probit scores using the formula $\lambda_i = \phi(\gamma_i \omega_i)/\Phi(\gamma_i \omega_i)$, where γ_i represents the vector of independent variables and parameter estimates from the probit model, and Φ represents the standard normal distribution function (Greene, 2003). We calculated four lambda variables based on the formula.

In the second step, we entered the lambda variables as a correction factor into the multiple regression models (i.e., the same OLS models as those presented in Appendix A) to account for endogeneity. We entered the four lambda variables simultaneously into the models for WTN conflict, NTW conflict, and nonwork performance. Due to multi-collinearity, we couldn't examine the effects of the four lambda variables simultaneously in the model for work

performance. Therefore, we assessed three lambda variables each time. For all the four models, the inclusion of the lambda as an additional predictor in the models does not change the pattern of our results, and none of the lambda variables was statistically significant in predicting our dependent variables. This alleviates concerns of endogeneity as a threat to the validity of our results.

CHAPTER 6: DISCUSSION AND CONCLUSIONS

This chapter provides a discussion of the results and limitations of the study. The chapter concludes with implications for theory and practice.

6.1 Limitations

Implications of our findings need to be interpreted in light of the limitations of the study. The research employed a survey methodology as the main method of data collection. Self-report questionnaires were used to collect data on both the independent and dependent variables. This methodology was selected because it is more viable than alternative methodologies in enabling us to study technology-mediated interruptions across work and personal life. First, it allowed us to examine both WTN and NTW interruptions in their natural contexts. Other methods of collecting data in a natural setting had practical limitations. For example, observation is not feasible due to the concern for privacy (especially since observing interruptions in the respondents' personal life domain would entail following respondents around in their home or other personal activities) and social desirability. Obtaining objective interruption data through phone logs, email logs, texting logs, and IM logs was not viable since it would be very difficult to retrospectively assess which communications were interruptions and which were not without respondents reviewing such logs. Further, there are privacy concerns with reviewing such personal communication. Second, the survey methodology allowed us to assess the effects of a portfolio of technologies. Manipulating interruptions through multiple applications and across devices in a controlled environment such as experiments was not practical. Despite its strengths, the methodology also has limitations.

First, the performance variables in this study demonstrate a ceiling effect, a concern shared by most studies that employ self-reported measures of performance. This may be due to the performance measures being self-reported. Respondents may overrate their own performance due to social desirability. Future research can adopt an objective measure of performance (e.g., HR assessment records) or triangulate with measures reported by others (e.g., spouse, supervisor, colleagues). Further, future research is also needed to explore alternative measures of performance. This study captured performance at an aggregate level. The non-significant effects on performance may well be a function of measuring performance at too high a level of abstraction since one's overall work performance is influenced by many other factors. Future research should identify more granular measures of performance by focusing on those aspects of performance most likely to be influenced by technology-mediated cross-domain interruptions (e.g., responsiveness, accessibility, and communication effectiveness).

Second, collecting data on independent and dependent variables from the same respondent at a single point in time is subject to common method bias. Given the concern for common method bias, we conducted an assessment of the extent of common method bias present in our study and its effect on our results. Our analysis suggests that our results are robust.

Third, though the statistical power for detecting large size effects was 0.9 for WTN and NTW conflict and nonwork performance, it was only 0.6 for work performance. Therefore, some non-significant findings with respect to work performance may be due to statistical power considerations. In particular, out of the four hypothesized effects on the work performance, three are marginally significant (at the 0.1 level), and the other is non-significant. This may be due to the lack of sufficient power.

Fourth, given the cross-sectional nature of research design, causality statements are based on our theoretical development and not time-ordering of our measurement. Future studies can take a longitudinal approach to more fully assess causality.

Finally, our model was tested within a single organization. Though this has the advantage of eliminating the potential confounding effects of many organizational level variables (e.g., organizational culture) and though the research site was not an atypical organization in terms of its culture or nature of knowledge workers, generalizability of the results requires replication across different organizations and industries. Furthermore, the study was conducted in the United States where there is a lot of emphasis on instrumental values and more blurring of work and personal life. An interesting direction for future research is to examine these relationships in cultures where there is a higher separation between work and non work domains (e.g., more feminine cultures such as in the Scandinavian countries). This will test the generalizability of the findings across cultures.

6.2 Discussion

The study provides a nuanced conceptualization of technology-mediated cross-domain interruptions, and categorizes them into four types along the dimensions of direction (i.e., work-to-nonwork and nonwork-to-work) and source (i.e., other-initiated and self-initiated). Drawing on the interruption studies in HCI and the micro-role transition literature, we developed a research model that examines how these four types of interruptions affect conflict between work and personal life and people's performance in each domain. Results based on survey responses from 137 knowledge workers from a single organization indicate that both source and direction

of an interruption are consequential as reflected by the distinct outcomes associated with each type of interruption.

By and large, *self-initiated* interruptions are associated with less negative outcomes than other-initiated interruptions – weaker negative effects on WTN conflict and beneficial effects on work performance. Frequency of *other-initiated* interruptions has a stronger effect on WTN conflict than frequency of *self-initiated* interruptions. Self-initiated WTN interruptions may be positively related to work performance, and self-initiated NTW interruptions up to a certain level may also be positively associated with work performance (i.e., the inverted U-shaped relationship that is weakly supported). As we discussed earlier, this may be due to people having greater latitude to control the timing and duration of self-initiated interruptions than other-initiated ones. As a result, they significantly reduce the probability that occurrences of such interruptions create a tension between work and nonwork domains. This is consistent with the notion that people who initiate an interruption often benefit more from it than people who receive the interruption (Rennecker et al. 2005).

Work interruptions at home (WTN) and personal interruptions at work (NTW) have distinct effects on the corresponding outcomes, suggesting asymmetrical effects in work and nonwork domains. Whereas frequency of other-initiated WTN interruptions is positively related to WTN conflict, frequency of other-initiated interruptions negatively influences NTW conflict. Frequency of self-initiated WTN interruptions is not a significant predictor to WTN conflict, but frequency of self-initiated positively affects NTW conflict. WTN other-initiated interruptions negatively affect people's performance in both work and personal life, whereas NTW interruptions are not negatively related to performance in either domain. Frequency of WTN interruptions being significantly higher than that of NTW interruptions also suggests that the

boundaries between work and nonwork is more permeable in the WTN direction than in the NTW direction – it is easier for work to interrupt nonwork than for nonwork to interrupt work.

Despite the negative connotation that is often associated with interruptions in both academic literature and popular media, our data provide some support for an inverted U-shaped relationship between frequency of self-initiated NTW interruptions and work performance. As frequency of self-initiated NTW interruptions increases, work performance improves; but after a certain level, work performance starts to decline. To some extent, this may suggest that not all interruptions are counterproductive. Like all other interruptions, self-initiated NTW interruptions are disruptive in that they break the continuity of work tasks. However, they can be disruptive for a good reason such as creating a productivity-boosting arousal, easing people's lingering concerns over some important personal matters (e.g., checking on a sick child who is at home) so that they can concentrate on their work, or by providing a break restoring to a prior level people's domain engagement that is diminishing over time. On the contrary, other-initiated interruptions are associated with performance loss in the domain that receives these interruptions.

One important finding of the study is that the domain that gains resources through interruptions does not benefit, except that self-initiated WTN interruptions are positively related to work performance. One explanation for this lack of support may be that the duration of technology-mediated interruptions is generally not long enough for people to accomplish anything substantial, especially for personal interruptions at work. Although interruptions represent a way of shifting resources from one domain to another, the resources are moved in a piecemeal manner. Even if interruptions collectively claim a significant portion of people's resources allocated to the work or nonwork domain, most interruptions are communicative or

information seeking in nature. For example, people can check their friends' Facebook updates or respond to a colleague's inquiry through interruptions. But they often carve out a block of time to work on a major task such as shopping for a birthday party or preparing for a presentation to the Board. It is the latter that are expected to bring about significant improvement to performance. Another explanation is that our measures of performance were not granular enough to capture such performance gains since they focused on overall performance. Clearly, many other factors influence one's overall performance at work and at home. Future research should examine this relationship by identifying and measuring specific aspects of performance that may be affected by such interruptions (e.g., responsiveness, meeting deadlines, etc).

6.3 Contributions

This study contributes to research and practice in several ways and presents several avenues for future research.

6.3.1 Contributions to Research

The study contributes to research in two ways. First, it represents one of the first studies that offer a nuanced view of technology-mediated interruptions. The increasingly pronounced consequences associated with ubiquitous technologies have generated a body of research on technology-mediated interruptions. However, prior research focuses predominantly on interruptions that are generated and occur in the work domain. We differentiate between four types of interruptions based on their direction and source. Although the distinction between other-initiated and self-initiated interruptions has been theoretically recognized (Miyata et al. 1986), there is a paucity of empirical research on it. In particular, this study provides empirical evidence of the distinct outcomes associated with different types of interruptions. Moreover,

making the distinction between direction and source also enriches the research on individuals' technology use in that diverse outcomes can emerge from using the same technology across these four different situations. Future research, through diary studies for example, should examine in more detail the four different types of interruptions and identify the mechanisms via which they influence work and nonwork domains.

Second, the research contributes to the literature on micro-role transitions by examining technology-mediated interruptions as a transitory form of role transition as opposed to institutionalized ones such as telecommuting and flextime. Modern technologies have greatly shaped how knowledge workers define work and nonwork and how they demarcate boundaries between the two domains. Although telecommuting and flextime represent important arenas where work and nonwork interact, more and more such interaction occurs during transitions between work and personal life that occur on the fly through such technology-mediated interruptions. Therefore it is critical to understand technology-mediated interruptions in the context of how the new generation of knowledge workers dynamically interweaves their work and nonwork domains. Moreover, this research also represents one of the first that differentiate between micro-role transitions based on their source (i.e., other-initiated and self-initiated). Although the micro-role transition literature recognizes the direction-based difference in cross-domain relationships (e.g., WTN conflict and NTW conflict), the distinction based on the source has not been theorized or tested, which our study does.

6.3.2 Future Research

The research model and the hypotheses developed in this study provide avenues for future research. First, further research is needed to provide in-depth understanding of the

observed results. In particular, a follow-up study should be conducted to identify the factors that account for the asymmetrical effects of technology-mediated interruptions in work and personal life. This will enable researchers to understand how use of communication technologies can generate distinct outcomes in work and personal life, and allow practitioners to develop different sets of tools and norms that enable knowledge workers to optimize their experience in both domains.

Second, future studies can identify and examine additional outcome variables. The dissertation focuses on several consequences of interruptions, namely WTN conflict, NTW conflict, work performance, and nonwork performance. The selection of these constructs is based on their theoretical and practical importance. The scope of this study does not include other instrumental or psychological outcomes, such as involvement, stress, satisfaction, well-being, and burnout associated with work and personal life respectively. Examining the effects of cross-domain interruptions on these and other outcome variables provides fruitful directions for future research. Moreover, this research identifies beneficial effects of self-initiated NTW interruptions on work performance. Future research is needed to explore other potentially beneficial effects of interruptions.

Third, future research is needed to examine antecedents of technology-mediated cross-domain interruptions. As shown by this research, the four types of interruptions are not created equal. They are very likely to be associated with different antecedents. Identification of the antecedents will allow us to better interpret the observed results and will provide additional insights to the nature of cross-domain interruptions.

Fourth, researchers can further extend this dissertation by investigating moderators of the relationships between technology-mediated cross-domain interruptions and outcome variables. For example, we empirically tested the research model within a single organization in order to eliminate any potential confounding effects of organizational factors. However, organizational factors such as organizational norms and culture are expected to significantly affect how interruptions are viewed and dealt with by knowledge workers. A cross-organizational study would be useful in understanding the effects of organizational factors. Likewise, knowledge workers' communication styles, which also affect how they view and handle interruptions, vary across countries. For example, people from a collectivistic culture would view an interruption to be less disruptive and more likely to handle it immediately due to the relational outcomes than people from an individualistic culture. As such, a cross-country study would be helpful to understanding the influence of national culture on interruptions.

Fifth, as technologies have become an integral component of knowledge workers' life, it is critical to understand the role of technologies in the interruption phenomenon through follow-up research. This study has found that interruptions occur most frequently through phone calls (the most intrusive technology) and email (the least intrusive technology). This may suggest that interruptions across different technologies may be used differently and may have differential effects. It is important for future research to understand whether and how different technologies account for the observed differences among the four types of interruptions. Particularly, some interesting research questions for future studies include whether interruptions mediated by a specific technology are more beneficial or harmful than those mediated by another technology, and what features of technology (e.g., synchronicity and reviewability) account for the

difference. This will inform practice in terms of technological design and productive use of technologies.

Last, future research is also needed to understand how knowledge workers can manage interruptions. Technology-mediated interruptions are an unavoidable outcome of today's technologies. The seemingly effortless use of these technologies has brought a challenge – how to maintain the proper focus on the tasks while responding to the demands delivered via a large diversity of devices and applications. Therefore, how to manage the constant technology-mediated interruptions represents a major challenge faced by knowledge workers. Interruption management mechanisms can be based on technologies, social norms, and self-discipline and each of these may be differentially efficacious in mitigating negative effects of interruptions. Future research on this topic would be beneficial. Appendix B is a step in this direction by providing theoretical development and preliminary empirical support of the role of interruption management in mitigating some of the negative effects of technology-mediated cross-domain interruptions.

6.3.3 Implications for Practice

Our study has important implications for practice. First, organizations should provide knowledge workers with both scheduling flexibility and tools to manage interruptions. Schedule flexibility allows knowledge workers to legitimately blur the boundary between work and personal life, giving rise to cross-domain interruptions (both other-initiated and self-initiated). Despite the observed negative impact of self-initiated interruptions when abused, scheduling flexibility as a form of job autonomy is still a useful tool to motivate knowledge workers. Unlike monetary incentive as a contingent reward for a task, job autonomy taps into employees'

intrinsic motivation and motivates creativity. Organizations should build a workplace appealing to the modern knowledge workers who value workplace flexibility and the option to work remotely (Hewlett, Sherbin, & Sumberg, 2009). However, they should do so with a good understanding of the effects boundary blurring and interruptions can yield. They should also be aware of possible ways to enhance the resulting positive effects and ameliorate the resulting negative effects. Some interesting findings from the study are highlighted below.

There are good and bad interruptions. Interruptions often carry a negative connotation. However, to some extent, this study suggests that interruptions are not necessarily bad. In particular, self-initiated interruptions in moderation can bring about beneficial effects. Taking care of personal matters during work, such as paying bills online or making a doctor's appointment, should not always be frowned upon. Instead of causing productivity losses, it can boost performance by refreshing one's mind (same as taking a short break) and easing one's worry (i.e., by taking a moment to deal with something important in their personal life they are no longer pre-occupied and can better focus on the task at hand).

Most interruptions occur via phone call and email, the most and the least intrusive technologies. This calls for further research and development efforts in building technological aids that support more productive and healthy use of phone calls and emails, such as voice-to-text applications and color-coding on mobile platforms.

Second, equally importantly, knowledge workers, who are also more prone to technology-mediated interruptions, should have interruption management tools available to erect boundaries when they deem necessary. Knowledge workers should also be made aware of different ways in which interruptions can be managed and organizational norms surrounding technology-mediated interruptions should consciously be developed. Identifying effective

interruption management mechanisms would be an important direction for future research in this domain.

Individuals and organizations should not take the least intrusive technology, email, for granted. The study has found that interruptions via email occur most frequently. People often turn to the least intrusive technology in order to reduce the disruptive effects of an interruption. However, quantity matters, and an email-based interruption is still an interruption. The sheer volume of emails can be overwhelming, resulting in information overload; and the cumulative effects of several emails can beat the disruptiveness of a phone call (the most intrusive technology studied in this research). It requires the efforts of both email senders and recipients to mitigate the negative effects of emails. The former should minimize the number of unnecessary emails (e.g., combining related topics to generate fewer emails and flagging emails with exclamation marks or red flags only when necessary). The latter should resort to some interruption management techniques to keep emails under control (e.g., color-coding the senders as a filter tool or simply resisting the temptation to read emails every time there is a new message alert).

Individuals, organizations, and developers should make technology a more powerful tool in interruption management. Given its rapid development, technological solutions hold great potential in interruption management. Individuals need to know their everyday devices and applications to make full use of and have full control over it. Many voice-to-text applications such as ReQall enable individuals to better manage their communications and make better use of their limited cognitive resources. In addition, developers need to enable advanced features on knowledge workers' everyday devices, such as the features of contact management and account management.

Third, the study also highlights the detrimental effects of other-initiated interruptions. It requires the efforts of both communication partners to mitigate such negative effects. People who initiate interruptions should minimize the number of unnecessary communications (e.g., combining related topics to generate fewer messages, or flagging emails with exclamation marks or red flags only when necessary). People who receive interruptions should actively engage in some interruption management techniques to keep interruptions under control (e.g., color-coding email senders as a filter tool, or simply resisting the temptation to check IM messages every time there is a new message alert).

6.4 Conclusion

This research aims to provide an in-depth understanding of technology-mediated cross-domain interruptions. First, it develops a typology of such interruptions along two dimensions – the source (other- and self-initiated) and direction (work-to-nonwork and nonwork-to-work) of an interruption. It differentiates between four types of interruptions: WTN other-initiated, WTN self-initiated, NTW other-initiated, and NTW self-initiated interruptions. Second, the study examines the consequences of these interruptions through an empirical study.

Based on a sample of 137 knowledge workers from a single organization, the analysis reveals asymmetrical effects of cross-domain interruptions on one's work and personal life. Despite the commonly held negative connotation of interruptions, the results weakly support an inverted U-shaped relationship between NTW self-initiated interruptions and work performance, meaning that work performance improves as NTW self-initiated interruptions increase to a certain point but drops afterwards. The results also suggest that WTN other-initiated interruptions have stronger effects on WTN conflict than self-initiated interruptions.

These findings contribute to research by differentiating between four types of interruptions and assessing their distinct consequences not at the task level as in prior research but at the domain level. The study also informs practices (e.g., organizational intervention, development of workplace norms and culture) by providing a multi-dimensioned view of interruptions and shedding some light on the outcomes on one's work and personal life.

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APPENDIX A. RESULTS OF OLS REGRESSIONS FOR FOUR MODELS

A.1 Work-to-Nonwork Interruptions

Table A1 OLS Regression Results (WTN conflict)

DV: WTNC (42.8%)	Beta	Std Error	Std Beta	t-value	p-value[16]
WTN other-initiated interruptions	**0.58*** **	0.16	0.37	3.55	0.000
WTN self-initiated interruptions	-0.05	0.17	-0.03	-0.33	0.371
Work load	**0.42*** **	0.08	0.41	5.09	0.000
Nonwork load	**0.12†**	0.08	0.11	1.55	0.062
F Ratio	22.51***				
Model df	4				

*** p<0.001 ** p<0.01 * p<0.05 † p<0.1

A.2 Nonwork-to-Work Interruptions

Table A2 OLS Regression Results (NTW conflict)

DV: NTWC (14.1%)	Beta	Std Error	Std Beta	t-value	p-value
NTW other-initiated interruptions	**-0.38***	0.21	-0.28	-1.84	0.034
NTW self-initiated interruptions	**0.43***	0.21	0.30	2.05	0.021
Work load	0.05	0.07	0.06	0.72	0.236
Nonwork load	**0.29*** **	0.07	0.37	3.86	0.000
F Ratio	5.73***				
Model df	4				

*** p<0.001 ** p<0.01 * p<0.05 † p<0.1

A.3 Work-to-Nonwork and Nonwork-to-Work Interruptions

Table A3 OLS Regression Results (work performance)

DV: WP (0%)	Beta	Std Error	Std Beta	t-value	p-value
WTN other-initiated interruptions	**-0.19†**	0.12	-0.23	-1.61	0.055
WTN self-initiated interruptions	**0.17†**	0.12	0.19	1.35	0.090
NTW other-initiated interruptions	-0.02	0.17	-0.02	-0.13	0.448
NTW self-initiated interruptions	-0.08	0.17	-0.08	-0.48	0.316
Work load	0.08	0.06	0.14	1.25	0.107
Nonwork load	0.01	0.06	0.01	0.11	0.456
F Ratio	0.88NS				
Model df	6				
DV: WP (0.9%)	Beta	Std Error	Std Beta	t-value	p-value
WTN other-initiated interruptions	**-0.18†**	0.12	-0.22	-1.53	0.064
WTN self-initiated interruptions	0.13	0.13	0.14	0.99	0.162

[16] One-tailed p-values are reported in Appendix A.

NTW other-initiated interruptions	-0.05	0.16	-0.05	-0.28	0.390
NTW self-initiated interruptions	0.00	0.17	0.00	0	0.500
[quadratic] NTW self-initiated interruptions	**-0.15†**	0.09	-0.17	-1.64	0.052
Work load	0.07	0.06	0.13	1.14	0.128
Nonwork load	0.01	0.06	0.02	0.15	0.441
F Ratio	1.15NS				
Model df	7				

*** p<0.001 ** p<0.01 * p<0.05 † p<0.1

Table A4 OLS Regression Results (nonwork performance)

DV: NP (13.4%)	Beta	Std Error	Std Beta	t-value	p-value
WTN other-initiated interruptions	**-0.40****	0.15	-0.37	-2.78	0.003
WTN self-initiated interruptions	0.17	0.15	0.14	1.09	0.139
NTW other-initiated interruptions	0.11	0.20	0.08	0.53	0.299
NTW self-initiated interruptions	-0.11	0.21	-0.08	-0.51	0.306
Work load	**-0.14***	0.07	-0.19	-1.88	0.031
Nonwork load	-0.06	0.07	-0.08	-0.83	0.204
F Ratio	3.90**				
Model df	6				
DV: NP (12.6%)	Beta	Std Error	Std Beta	t-value	p-value
WTN other-initiated interruptions	**-0.40****	0.15	-0.37	-2.74	0.004
WTN self-initiated interruptions	0.14	0.19	0.12	0.73	0.233
NTW other-initiated interruptions	0.12	0.21	0.09	0.57	0.285
NTW self-initiated interruptions	-0.10	0.21	-0.08	-0.5	0.309
[quadratic] WTN self-initiated interruptions	0.02	0.06	0.03	0.28	0.390
Work load	**-0.14***	0.08	-0.19	-1.77	0.040
Nonwork load	-0.07	0.08	-0.09	-0.87	0.193
F Ratio	3.33**				
Model df	7				

*** p<0.001 ** p<0.01 * p<0.05 † p<0.1

Table A5 Testing of Quadratic Term

DV: Work Performance	Model 1	Model 2
WTN other-initiated interruptions	-0.19† (0.12)	-0.18† (0.12)
WTN self-initiated interruptions	0.17† (0.12)	0.13 (0.13)
NTW other-initiated interruptions	-0.02 (0.17)	-0.05 (0.16)
NTW self-initiated interruptions	-0.08 (0.17)	0 (0.17)
[quadratic] NTW self-initiated interruptions		-0.15† (0.09)
Work load	0.08 (0.06)	0.07 (0.06)
Nonwork load	0.01 (0.06)	0.01 (0.06)
R-square	0.0%	0.9%
Delta R-square		0.9%

F-value		2.68†
Beta (Std Error)		

*** p<0.001 ** p<0.01 * p<0.05 † p<0.1

The results of hypothesis testing through OLS are summarized in Tables A1 to A5. The results in terms of which hypotheses are supported and which are not remain consistent with those based on PLS analysis, except for the effects of interruptions on work performance which are non-significant. In particular, the F-value for the model predicting work performance is non-significant. The power for detecting hypothesized effects on work performance is very low (0.08 compared to .70 for the PLS analysis), which likely accounts for the non-significant F-value. This consistency suggests that our results are stable regardless of the estimation methods used during analysis. Parameter estimates are presented in Table A6 and the results of hypothesis testing are summarized in Table A7.

Table A.6 Hypothesis Testing Results

Work-to-Nonwork Interruptions	Model 1	Model 2
H1a: freq. of other-initiated WTN interruption → WTN conflict	**0.58 (0.16)*** **	
H2a: freq. of self-initiated WTN interruption → WTN conflict	-0.05 (0.17) NS	
H3a: freq. of other-initiated > self-initiated	**24.2*** ** (t-value)	
H4a: freq. of other-initiated WTN interruptions → work performance	-0.19 (0.12) NS	-0.18 (0.12) NS
H5a: freq. of self-initiated WTN interruptions → work performance	0.17 (0.12) NS	0.13 (0.13) NS
H6a: freq. of other-initiated WTN interruptions → nonwork performance	**-0.40 (0.15)*** **	**-0.40 (0.15)*** **
H7a (main): freq. of self-initiated WTN interruptions → nonwork performance	0.17 (0.15) NS	0.14 (0.19) NS
H7a (quadratic): [freq. of self-initiated WTN interruptions] ^{2} →nonwork performance		0.02 (0.06) NS
Nonwork-to-Work Interruptions	Model 1	Model 2
H1b: freq. of other-initiated NTW interruption → NTW conflict	**-0.38 (0.21)***	
H2b: freq. of self-initiated NTW interruption → NTW conflict	**0.43 (0.21)****	
H3b: freq. of other-initiated > self-initiated	0.10 NS (t-value)	

H4b: freq. of other-initiated NTW interruptions → nonwork performance	0.11 (0.20) NS	0.12 (0.21) NS
H5b: freq. of self-initiated NTW interruptions → nonwork performance	-0.11 (021) NS	-0.10 (0.21) NS
H6b: freq. of other-initiated NTW interruptions → work performance	-0.02 (0.17) NS	-0.05 (0.16) NS
H7b (main): freq. of self-initiated NTW interruptions → work performance	-0.08 (0.17) NS	0.00 (0.17) NS
H7b (quadratic): [freq. of self-initiated NTW interruptions] ^{2} → work performance		-0.15 (0.09) NS

*** p<0.001 ** p<0.01 * p<0.05 † p<0.1 NS – non-significant

Table A7 Hypothesis Testing Results

Work-to-Nonwork Interruptions	Support
H1a: other-initiated WTN interruption → WTN conflict	**Yes**
H2a: self-initiated WTN interruption → WTN conflict	No
H3a: other-initiated > self-initiated	**Yes**
H4a: other-initiated WTN interruptions → work performance	No
H5a: self-initiated WTN interruptions → work performance	No
H6a: other-initiated WTN interruptions → nonwork performance	**Yes**
H7a (main): self-initiated WTN interruptions → nonwork performance	
H7a (quadratic): [self-initiated WTN interruptions]^2 → nonwork performance	No
Nonwork-to-Work Interruptions	Support
H1b: other-initiated NTW interruption → NTW conflict	No
H2b: self-initiated NTW interruption → NTW conflict	**Yes**
H3b: other-initiated > self-initiated	No
H4b: other-initiated NTW interruptions → nonwork performance	No
H5b: self-initiated NTW interruptions → nonwork performance	No
H6b: other-initiated NTW interruptions → work performance	No
H7b (main): self-initiated NTW interruptions → work performance	
H7b (quadratic): [self-initiated NTW interruptions]^2 → work performance	No

APPENDIX B: INTERRUPTION MANAGEMENT

Technology-mediated cross-domain interruptions are an unavoidable outcome of today's information communication technologies. The seemingly effortless use of these technologies has brought a challenge – how to maintain the proper focus on the tasks while responding to the demands delivered via a large diversity of devices and applications. Therefore, how to manage the constant technology-mediated interruptions represents a major challenge faced by knowledge workers.

In addition to the main focus on the four types of interruptions and their consequences, this dissertation also explores interruption management by developing a theoretical model of interruption management and empirically testing its influence on the consequences of interruptions. This exploration represents a logical and important extension to the main thrust of the dissertation. Though the focus is primarily on theoretical development, we also conducted a preliminary empirical examination of interruption management. Specifically, we developed some preliminary measures of interruption management and included them in the questionnaire for the study. In this manner, we were able to provide some preliminary findings on the effect of interruption management. However, follow-up research should engage in further scale development and empirically test the role of interruption management in a more comprehensive manner.

Appendix B presents the development of the interruption management framework, and discusses the preliminary findings of how interruption management influences the outcomes of the four types of interruptions. These represent our initial efforts in the stream of post-

dissertation studies on interruption management. This appendix concludes with implications for research and practice.

MANAGING TECHNOLOGY-MEDIATED INTERRUPTIONS

B.1 Introduction

The seemingly effortless use of communication technologies has brought a challenge – how to maintain the proper focus on ongoing tasks while responding to the demands delivered via a large diversity of devices and applications. Therefore, how to effectively manage technology-mediated interruptions represents a new challenge faced by knowledge workers, whose work is highly autonomous, mobile, and communication-rich. Although the growing number of publications over time across disciplines reflects a boost of interest in the interruption phenomenon, a systematic approach is needed to further our understanding and inform practice (Spiekermann et al. 2008). This study represents one of the first that provide an integrative model of interruption management. In particular, the conceptual model delineates how interruption management can occur at each of three stages of the interruption process, identifies eight behaviors of interruption management, and proposes three categories of interruption management mechanisms. Moreover, this study also contributes to the behavioral research on technology use. Managing technology-mediated interruptions captures how individuals use technologies under special circumstances (i.e., when such technology use breaks the continuity of an ongoing task). How to manage an interruption varies across individuals and situations, far beyond what can be captured by general use measures (e.g., frequency, time, and history of use).

By developing a conceptual model, the study provides a nuanced view of how knowledge workers manage technology-mediated interruptions by stage. It thus aims to make two

contributions to the interruption management literature. First, the study develops an integrated framework of interruption management. By elaborating on interruption management behaviors that can be facilitated by three categories of interruption management mechanisms (technology-based, social-based, and self-discipline based) at the three stages of interruption processing (detection, interpretation, and integration), this comprehensive framework can serve as a roadmap to guide future research and practice.

Significant research efforts have been taken to examine how technology features enable individuals to manage the detection of interruptions, such as tactile cuing (e.g., Hopp et al. 2005; Hopp-Levine et al. 2006; Smith et al. 2009) and auditory cuing (e.g., Milewski 2006). Although a great number of studies examine how technology features contribute to interruption management during the detection stage, there is a paucity of research on how to manage interruptions during other stages (i.e., interpretation and integration) or through other mechanisms (i.e., those based on social norms and self-discipline). Given the socially constructed nature of interruption management, technology features alone are not sufficient to solve the challenge (Hudson et al. 2002). This study aims to bridge the gap by providing a conceptual framework of interruption management that differentiates mechanisms based on technology, social norms, and self-discipline across the detection, interpretation, and integration stages.

Second, the study represents one of the first that consider a portfolio of technologies in the examination of interruption management. Interest in interruption management has spawned a great number of studies each focusing on a single technology, such as phone calls (e.g., Grandhi et al. 2010; Milewski 2006), IM (e.g., Garrett et al. 2007), or email (e.g., Rennecker et al. 2005; Russell et al. 2007). However, nowadays knowledge workers rely on a combination of

technologies in their work and personal life. Therefore, a study that focuses on multiple technologies has a better chance capturing the complexity inherent in knowledge workers' communication environment which is highly mobile and digitized.

The appendix begins with a review of the theoretical background, i.e., behavioral research on interruption management. Next, we develop an integrative framework that proposes interruption management behaviors and mechanisms by stage of the interruption process. A theoretical model and hypotheses are then presented of how interruption management moderates the effect of technology-mediated cross-domain interruptions on its consequences (i.e., it places interruption management within the nomological network of the research model tested in this dissertation). This model is then empirically tested and results are presented and discussed. The appendix concludes with implications for research, design, and practice.

B.2 Theoretical Background

This study draws upon the interruption studies from both the HCI and the IS fields, particularly, technology solutions to interruptions and anecdotal cases on user behaviors of mobile devices.

There has been consistent interest in interruption management from Human Computer Interaction (HCI) researchers, who focus on understanding user cognitive processing and the generation of new technology tools to boost task performance (e.g., Hopp et al. 2005). These studies aim to improve the design of technology artifact and often center on a particular one such as cockpit display system.

Managing technology-based interruptions fall under the broad category of technology use. However, it has not yet received much attention from IS researchers, despite the central role

of technologies in our life and given the high frequency of technology-mediated interruptions. A few exceptions include anecdotal cases on user behaviors of ubiquitous technologies, such as the BlackBerry (Mazmanian et al. 2006) and IM (Garrett and Danziger, 2008). Interruption management is not the central theme of these studies, which focus largely on understanding the user behaviors and the influences of such technologies. As far as we know, there has been no Information Systems (IS) research that systematically examines interruption management theoretically or empirically.

Although studies from the fields of HCI and IS significantly contribute to our understanding of interruption management, different terms have been used to describe theoretically similar concepts (e.g., shedding and dismissal behaviors) and few efforts have been made to provide an overarching framework to guide further exploration, which this study aims to do. We believe that an integrative framework will yield a finely grained understanding of interruption management and provide a common frame of reference for future research and practice. Key concepts that inform the development of our framework are reviewed next.

B.2.1 Definition of Interruption Management

In this study, we define *interruption management* as an action taken by individuals to control detection, interpretation, and integration of a technology-mediated interruption. Based on how an interruption's utility is assessed (i.e., as negative or potentially positive), two paradigms on interruption management emerge from the literature. The first paradigm, adopted by most studies on interruption management, views technology-mediated interruptions as counterproductive, and aims to eliminate them and their negative consequences. This paradigm originates from the limited attention capacity models in psychology (Broadbent 1958; Kahneman 1973). The second paradigm – a less explicated, emerging one – does not negate the disruptive

effects of an interruption, but acknowledges the potential (positive) value in addition to the negative effects. Therefore, it suggests that interruption management should assess each interruption based on its net utility (Avrahami et al. 2006; Grandhi et al. 2010), and aims to optimize individuals' decision-making process about how to detect and respond to an interruption. This is also the perspective adopted in the current study.

This research conceptualizes interruption management as a result of how individuals assess costs and benefits associated with a technology-mediated interruption. Therefore, it breaks the traditional link between interruption and negative consequences by proposing that if benefits of an interruption outnumber its costs, and if individuals can enact effective rather than deficient interruption management, negative consequences such as elevated conflict between work and personal life or substandard performance may not necessarily follow the occurrence of an interruption. In other words, this research proposes that effective management enables people to harness the benefits of an interruption and mitigate the costs.

B.2.2 Three Stages Where Interruption Management Can Occur

Interruption management can occur at each of three interruption processing stages: detection, interpretation, and integration of an interruption (Latorella 1999; Latorella 1998). This process starts with the onset of an interruption, and ends with resumption of the ongoing task.

Prior to the detection of an interruption, people are focused on an ongoing task. During the first processing stage, *detection*, people's attention is redirected from the ongoing task to the notification stimulus of an interruption, which needs to be salient enough in order to overcome sensory thresholds (i.e., to be detected). The notification stimulus is then stored in short-term memory to be further processed in the following stage (i.e., interpretation). Successful detection can trigger the second processing stage, *interpretation*, if people's attention remains redirected to

the notification stimulus. During this stage, people's attention is momentarily redirected to assess the performance requirements of the interruption (e.g., from whom, how much time would the interruption take, etc). Based on this assessment, characteristics of the task at hand, and characteristics of the interruption, at the *integration* stage people integrate the interruption into the current sequence of tasks. This integration can occur immediately or in a deferred manner.

The three stages at which interruption management can occur are relevant in the context of other-initiated interruptions, but the last two stages (i.e., interpretation and integration) also apply to self-initiated interruptions. For example, when people decide to check their smartphones for work-related emails at dinner table, they just simply do so after a quick assessment of the performance requirements without the process being triggered by any notification stimulus.

B.3 Interruption Management Framework

In order to understand how knowledge workers manage both other-initiated and self-initiated interruptions, this study proposes two frameworks (Figure 1 with a focus on other-initiated interruptions and Figure 2 with a focus on self-initiated interruptions) that delineate interruption management as occurring across a three-stage process. The framework for self-initiated interruptions (Figure B2) represents a reduced version of that for other-initiated interruptions (Figure B1). The framework consists of three major components – (1) stages at which interruption management can occur; (2) behaviors of interruption management that represent the actual handling of the interruptions as they occur, and (3) interruption management mechanisms that can be enacted prior to an interruption occurring to manage the interruption.

Both behaviors and mechanisms influence how disruptive an interruption will be to the current task at each stage. Individuals engage in such behaviors and enact such mechanisms to

either integrate or segment the roles from their work and personal life. That is, some interruption management mechanisms and behaviors will be used to segment one's work and personal life and avoid or delay dealing with the cross-domain interruption while others will be used to more immediately detect and integrate cross-domain interruptions into the ongoing set of activities.

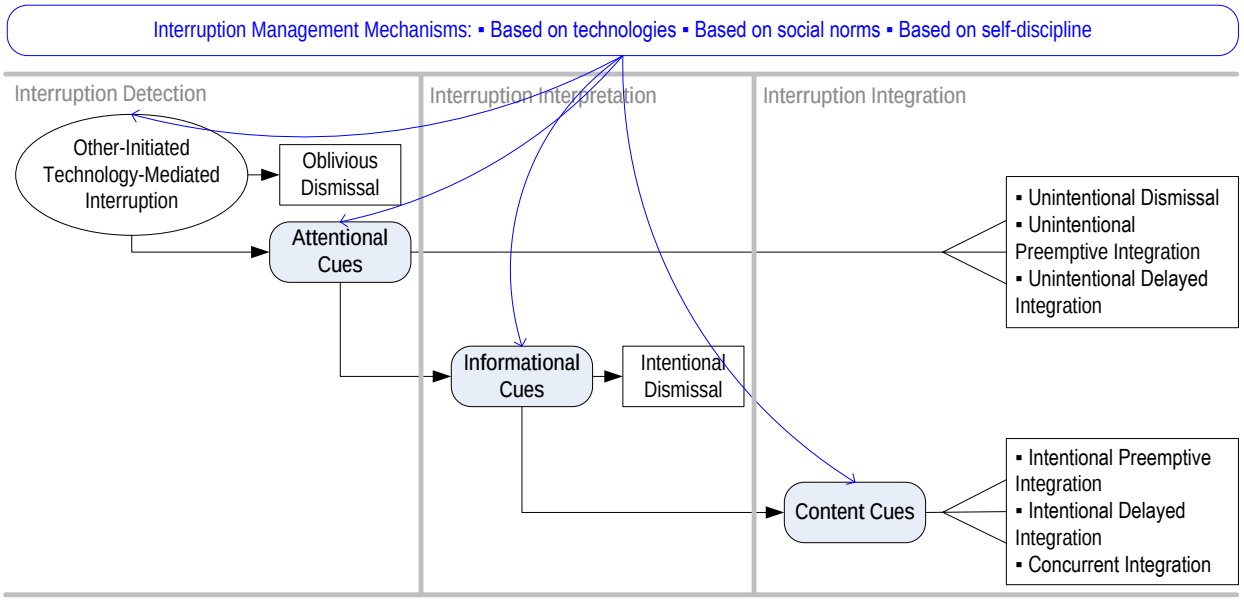


Figure B1 Managing Other-Initiated Technology-Mediated Interruptions

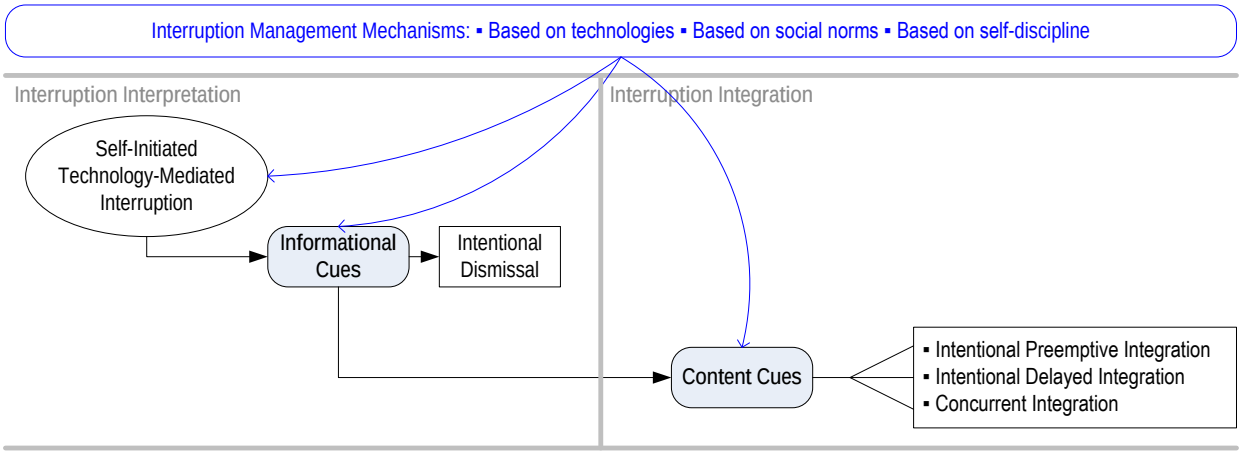


Figure B2 Managing Self-Initiated Technology-Mediated Interruptions

B.3.1 Framework Components

Technology-mediated cross-domain interruptions represent a tension between the domains of work and personal life. There are many ways that people can resolve the tension. **Interruption management behaviors** refer to the actions taken by individuals to handle an interruption. We identify eight interruption management behaviors, which represent eight different ways in which individuals can resolve the tension between work and personal life as epitomized in cross-domain interruptions.

People differ greatly in how they erect "mental fences" around work and personal life (Edwards & Rothbard, 2000; Rau & Hyland, 2002; Zerubavel 1991). In Hartmann's (1997) words, people have "thick" or "thin" boundaries around different roles. Prior research has identified individual differences in the degree to which people segment or integrate roles from work and personal life (Nippert-Eng, 1996a). The segmentation approach refers to the separation of work-related and personal tasks, whereas integration allows them to be intertwined (Nippert-Eng, 1996b; Ashforth et al., 2000; Edwards & Rothbard, 2000). Accordingly, people's desire for segmentation (or integration) is also reflected in the way they manage cross-domain

interruptions. Therefore, interruption management can be segmentation-oriented or integration-oriented, with the former trying to maintain a clear boundary between work-related and personal tasks, while the latter trying to mingle the tasks from the two domains.

Interruption management behaviors are enabled through the use of **interruption management mechanisms**, which, as we will describe next, are based on technology, social norms, or self-discipline. The use of these mechanisms provides affordances that enable certain interruption management behaviors. For example, knowledge workers may segment their work and personal life by obliviously dismissing all work-related emails during off hours (oblivious dismissal refers to intentionally not detecting an interruption). This interruption management behavior, i.e., oblivious dismissal, can be enabled by interruption management mechanisms based on technology (e.g., disabling the notification on the smartphone) or based on self-discipline (e.g., refraining from checking for work-related emails). Had the notification on the smartphone (ring, vibrate, light) been on, one could not avoid detecting that an interruption has occurred. Thus the technology-based mechanism of turning the notification features off enabled the interruption management behavior of oblivious dismissal in order to achieve segmentation between work and personal life.

On the contrary, individuals may want to integrate their work and personal life by intentionally preempting for a personal IM message at work. Such behavior of intentional preemptive integration (i.e., stopping what they were doing and immediately responding to the IM) can be enabled by a combination of interruption management mechanisms based on technology (e.g., logging in on skype at work), or based on social norms (e.g., establishing rules with family members that only high-priority messages will be sent through IM), or based on self-discipline (e.g., bundling some personal tasks with low demanding work tasks).

We next discuss interruption management behaviors and mechanisms. The discussion identifies relevant behaviors and mechanisms for each of the three stages where interruption management can occur, i.e., detection, interpretation, and integration.

B.3.2 Interruption Management Behaviors

B.3.2.1 Overview

The manner in which individuals respond to technology-mediated interruptions falls into two broad categories – dismissal and integration.[17]

*Dismissa*l behaviors are driven by the *shedding* strategy that enables individuals to eliminate tasks of low importance (Schneider et al. 1988). Depending on the amount of prior processing, dismissal behaviors are further differentiated into *oblivious dismissal*, *unintentional dismissal*, and *intentional dismissal* (Latorella 1999; McFarlane et al. 2002).[18] Oblivious dismissal occurs when an interruption fails to be detected. For example, some people avoid being interrupted by phone calls during off hours by turning the phone off, leaving it behind in the car, or setting it in silent mode. Unintentional dismissal occurs when individuals detect an interruption but dismiss it without interpreting its performance requirements. For example, when they hear the beep for a new message during a meeting with their clients, knowledge workers

[17] The term "integration" has been used in both the interruption studies and the micro-role transition literature. In interruption studies, interruption represents one category of interruption management behaviors – the interruption being accommodated into the current task sequence. In the micro-role transition literature, it can take two meanings. First, integration can be used to describe the relationship between the roles of one's work and personal life, in terms of how integrated or segmented they are as determined by role boundary and role contrast. It represents the opposite of segmentation. Second, integration can also be used to describe how individuals actively manage the boundaries between their work and personal life, in terms of how they integrate or segment the roles from work and personal life.

[18] For dismissal behaviors, we follow the terminology used by Latorella (1999), *i.e.*, oblivious dismissal, unintentional dismissal, and intentional dismissal. But we further unpack "intentional integration" (Latorella, 1999) into intentional preemptive integration, unintentional delayed integration, intentional delayed integration, and concurrent integration. To differentiate from intentional preemptive integration, we rename "preemptive integration" (Latorella, 1999) into "unintentional preemptive integration."

may pause for a second but still carry on the conversation without reading the message. Intentional dismissal occurs when individuals dismiss an interruption after detecting it and interpreting its performance requirements. For example, when people receive a phone call from a friend at work, they dismiss it because they do not expect anything critical from the caller.

Second, depending on the sequence in which an interruption and the ongoing task are performed, integration behaviors are further differentiated into *unintentional preemptive integration*, *intentional preemptive integration*, *unintentional delayed integration*, *intentional delayed integration*, and *concurrent integration*. *Concurrent integration* occurs when an interruption and the ongoing task are handled in parallel, while the others occur when both tasks are handled sequentially. For example, people can read their personal emails during a mass communication meeting at work. Intentional delayed integration, intentional preemptive integration, and concurrent integration are based on individuals' conscious evaluation and prioritization, whereas the unintentional integration behaviors (i.e., delayed and preemptive) are not. *Unintentional preemptive integration* occurs when individuals respond to an interruption immediately after detecting it without interpreting its performance requirements. They give the interruptions absolute priority over the ongoing task. For example, some knowledge workers process each email once they receive it, treating all emails equally. *Intentional preemptive integration* occurs when individuals respond to an interruption immediately after interpreting its performance requirements. They give a selection of interruptions high priority over the ongoing task for immediate processing. For example, some knowledge workers direct their attention to each email pop-up window, but only immediately process a selection of them (i.e., intentional preemptive integration). They postpone the processing of other emails to a later time (i.e., intentional delayed integration). *Unintentional delayed integration* occurs when individuals

respond to an interruption at a later time after detecting it without interpreting its performance requirements. They give the ongoing task high priority, deferring to a later time the processing of all interruptions. For example, some knowledge workers ignore all work-related phone calls at the dinner table. *Intentional delayed integration* occurs when individuals respond to an interruption at a later time after detecting it and interpreting its performance requirements. They give a selection of interruptions low priority after the ongoing task.

All the integration behaviors except concurrent integration are driven by the delaying strategy that forces temporal separation between an interruption and the ongoing task (Schneider et al. 1988). Priority of an interruption relative to the ongoing task varies across situations. The behaviors of delayed integration (i.e., unintentional and intentional) defer the interruption, whereas the behaviors of preemptive integration (i.e., unintentional and intentional) defer the ongoing task. Concurrent integration occurs when individuals respond to an interruption while engaging in the ongoing task simultaneously (Kirmeyer 1988). The underlying strategy is circumventing that resolves a resource conflict by relying on compatible channels (Schneider et al. 1988). For example, people can talk on a hands-free device while driving safely, as talking and driving rely on different channels.

As we discussed earlier, individuals engage in these behaviors to manage interruptions by either segmenting their work and personal life roles or by integrating the two. It should be clear that some of the interruption management behaviors enable segmentation while others enable integration. As Table B1 indicates, all the interruption management behaviors that involve dismissal or delayed integration aim at segmenting and avoiding the interruption (at least for the time), while preemptive or concurrent interruption management behaviors aim at integrating.

Table B1 Segmentation/Integration Oriented Behaviors of Interruption Management

	Segmentation	Integration
Detection	oblivious dismissal, unintentional dismissal	
Interpretation	intentional dismissal	
Integration	unintentional delayed integration, intentional delayed integration	unintentional preemptive integration, intentional preemptive integration, concurrent integration

B.3.2.2 Interruption Management Behaviors by Stage

Technology-mediated communications allow more flexibility of tempo relative to face-to-face communications, as it is socially and purposely constructed to allow gaps of silence (Reinsch et al. 2008). For example, attentional cues due to other-initiated interruptions create a natural break point for an individual to decide how to handle an interruption, without causing any socially awkward silence as would occur in face-to-face communications. Therefore, decisions on how to respond to an interruption are not necessarily made during the final stage of interruption management after the assessment of all available cues (i.e., attentional, informational, and content cues). In other words, interruption management behaviors occur during different stages (the stage where an interruption management behavior takes place is indicated in Table B2). For example, when people ignore an IM message without proceeding to the following stages to find out who sent it (i.e., informational cue) or what it is about (i.e., content cue), their interruption management behavior – unintentional dismissal – takes place during the detection stage.

Table B2 Interruption Management Behaviors

	Interruption Management Behavior	Stage
Dismissal	*Oblivious dismissal* occurs when an interruption fails to be detected.	Interruption not detected
	Unintentional dismissal occurs when individuals detect an interruption but dismiss it without interpreting its performance requirements.	Detection
	Intentional dismissal occurs when individuals dismiss an interruption after detecting it and interpreting its performance requirements.	Interpretation
Integration	*Unintentional preemptive integration* occurs when individuals respond to an interruption immediately after detecting it without interpreting its performance requirements.	Integration
	Intentional preemptive integration occurs when individuals respond to an interruption immediately after interpreting its performance requirements.	Integration
	Unintentional delayed integration occurs when individuals respond to an interruption at a later time after detecting it without interpreting its performance requirements.	Integration
	Intentional delayed integration occurs when individuals respond to an interruption at a later time after detecting it and interpreting its performance requirements.	Integration
	Concurrent integration occurs when individuals respond to an interruption while engaging in the ongoing task simultaneously	Integration

B.3.2.2.1 Detection Stage

The behaviors of interruption management that may occur during the detection stage include oblivious dismissal and unintentional dismissal. Unintentional dismissal occurs when individuals elect to dismiss an interruption *before* rationally assessing its performance requirements based on informational cues. Decisions are made without proceeding to the following stage (i.e., interpretation).

When detected, an other-initiated interruption creates a distraction, which refers to a psychological reaction triggered by attentional cues (Jett et al. 2003). Notification stimuli such as sound alert or taskbar flash interfere with individuals' cognitive processes by diverting their attention away from the ongoing task. This suggests that distraction and detection are inseparable, as distractions enable an other-initiated interruption to be successfully detected. However, not all behaviors of interruption management at the detection stage are based on

distractions. Oblivious dismissal does not involve any distraction due to the absence of attentional cues associated with its occurrence. In contrast, unintentional dismissal relies on the detection of an interruption, invariably accompanied by distractions. The same holds true for the other other-initiated interruptions that are detected but proceed to the following stage for further processing. Although individuals have yet to decide on a behavioral reaction to such interruptions, their successful detection implies the presence of distractions.

B.3.2.2.2 Interpretation Stage

The behavior of interruption management that may occur during the interpretation stage is intentional dismissal, when individuals elect to dismiss an interruption *after* rationally assessing its performance requirements based on informational cues.

Individuals' behavioral response to an interruption during the following stage (i.e., integration) is based on how they interpret the performance requirements of the interruption. Based on the informational cues, interpretation involves representing an interruption's performance requirements in one's working memory. An individual then evaluates the importance of the interrupting domain against that of the interrupted domain in a cost-and-benefit analysis. For example, information on the sender, subject, and the preview (or full view) of an email presents a snapshot of the communication. Such informational and content-based cues allow individuals to assess the importance and resource requirement of an interruption. Caller ID enables an individual to form a rough expectation of what a phone call or a text message is about. For example, a parent is very likely to associate a phone call from the schoolteacher with child urgency. Such information enables one to formulate a response based not only on the current task domain but also the characteristics of the interrupter – the perceived importance of the interrupter and the perceived urgency of the matter. Interruption management

at the interpretation stage affects how effectively informational cues that convey metadata of an interruption are processed. The effectiveness is determined jointly by the speed of processing and the amount of useful information being processed.

B.3.2.2.3 Integration Stage

Five behaviors of interruption management may occur during the integration stage: unintentional preemptive integration, unintentional delayed integration, intentional preemptive integration, intentional delayed integration, and concurrent integration, all of which are based on rational assessment of an interruption's performance requirements during the preceding stage (i.e., interpretation). A hallmark of the interruption phenomenon is the incompatible demands of resources underlying the relationship between an interruption and the ongoing task. After its detection and interpretation, how an interruption is integrated into the current task sequence is largely affected by how one coordinates the resource requirements of the interruption and the ongoing task. Interruption management at the integration stage is critical for both other-initiated and self-initiated interruptions.

Unlike unintentional (preemptive or delayed) interruption behaviors, intentional behaviors involves a more informed decision-making, based on the processing of informational and content-based cues, i.e., who initiates the interruption, when it occurs, and what it is about.

B.3.3 Interruption Management Mechanisms

B.3.3.1 Overview

From an individual perspective, interruption management relies on a combination of technological tools, social practices, and individual efforts to help knowledge workers to organize and control a wide variety of attention-demanding media (Andrews 2004). Accordingly,

we conceptualize three categories of interruption management mechanisms, based on technology, social norms, and self-discipline. The relevance and importance of these factors and mechanisms may vary by stage – detection, interpretation, and integration.

B3.3.1.1 Mechanisms Based on Technology

With a focus on technology features, mechanisms based on *technology* support interruption management by configuring attentional, informational, and content cues of an interruption. A technology-mediated interruption is often composed of attentional, informational, and content cues, with varying levels of relevance and importance during the stages of detection, interpretation, and integration.

Detection of an interruption depends largely on *attentional cues*. An attentional cue heralds an other-initiated interruption. In the context of technology-mediated interruptions, an attentional cue often refers to a notification stimulus based on technology features. For example, ring or vibration of a phone suggests an incoming call, taskbar flash or beep suggest a new IM message or a new email, and a beep or vibrate of a smartphone suggests a new RSS feed.

Interpretation of an interruption is based primarily on *informational cues*. An informational cue contains meta-data of an interruption. Commonly seen informational cues include: subject, time sent/received, sender, other recipients, and icons (e.g., exclamation mark, flag, or paper clip) of an email; caller ID and time received of a phone call or a text message; and contact name of an instant message.

Integration of an interruption involves processing *content cues*. A content cue captures the substance that an interruption aims to convey, such as a phone conversation, an IM log, or main message of an email or a voice mail. For example, processing a voice mail includes

listening to it, understanding the message conveyed, and taking further action if needed (e.g., returning the call or sending information requested by the caller through email).

Technology-based interruption management mechanisms can support different interruption management behaviors, which aim at integrating or segmenting the domains of work and personal life. For example, speech-to-text applications that send the transcription of voicemails through email or texting allow knowledge workers to concurrently handle the personal messages while attending a videoconference (i.e., concurrent integration), integrating work and personal life. Turning up the phone volume in a noisy environment (i.e., increasing the salience of the attentional cue) facilitates the detection of an interruption by knowledge workers, so that they can answer it right away (i.e., intentional or unintentional preemptive integration), integrating work and personal life. On the contrary, setting the IM status as busy or invisible indirectly influences detection and interpretation of an interruption, separating work and personal life. Through awareness display, this mechanism reduces the number of detected interruptions by preventing non-critical messages from being initiated (when the status is busy) or rendering the messages to be displayed as offline ones (when the status is invisible) (i.e., oblivious dismissal). It also affects interpretation of the interruptions that still occur nonetheless, as they are more likely to be critical ones and deserve immediate attention (i.e., intentional preemptive integration). Table B3 provides a mapping of various technology-based interruption management mechanisms to the interruption management behaviors they support. The table is not meant to be exhaustive but rather illustrative in nature by including some of the most commonly mentioned interruption management mechanisms identified in our study.

B3.3.1.2 Mechanisms Based on Social Norms

Given the communicative nature of most technology-mediated interruptions, they often involve communication partners. Mechanisms based on *social norms* support interruption management by influencing expectations of communication partners. There is a recursive relationship between social expectations and individuals' interruption management behaviors. Perceived organizational expectation of responsiveness and workplace norms of appropriate technology use may inform and shape how individuals deal with other-initiated and self-initiated interruptions (Mazmanian et al. 2006). Social signals such as an office door may not be effective until norms surrounding them have been culturally constructed and established (Hudson et al. 2002). People can also embed socially constructed meanings into technological features, such as the frequency of an attentional cue or the choice of a certain medium. For example, based on the pre-established rules with their family, some knowledge workers interpret three consecutive phone calls received at work from their family as emergency. Likewise, some knowledge workers have an agreement with their coworkers that all work-related communications during off hours are through email rather than phone calls unless a business emergency emerges.

The mechanisms based on social norms can facilitate interruption management behaviors during all three stages. The pre-established social norms facilitate the *intentional* interruption management behaviors (i.e., intentional dismissal, intentional preemptive integration, and intentional delayed integration) by enriching attentional or informational cues. The mechanisms based on social norms can also facilitate the interruption management behaviors of unintentional dismissal. For example, the choice of media (e.g., phone call over IM) can suggest the level of emergency and importance. For example, while knowledge workers may ignore all work-related emails during personal vacation (i.e., unintentional dismissal), they often take work-related

phone calls (i.e., intentional preemptive or delayed integration), knowing that their colleagues will call them for business emergency but send emails for tasks that do not require immediate attendance.

B3.3.1.3 Mechanisms Based on Self-discipline

Mechanisms based on *self-discipline* support interruption management by having individuals adjust their own behaviors. Perhaps driven by an unrelenting desire for information, some knowledge workers unknowingly initiate interruptions through a compulsive checking of emails (Mazmanian et al. 2006). This need to monitor incoming information is often amplified by the mobility and ubiquity afforded by pocket-able devices. A great number of individuals find the pull of an incoming email or phone call irresistible, although they intend to keep the time block (e.g., family movie night) free of interruptions. It may take personal willpower or just simple tactics such as changing the physical location to remove people's temptation to respond (Hudson et al. 2002). For example, people can enjoy an email-free afternoon in a WiFi-free park, leaving the digitized workplace or home behind.

The mechanisms based on technology and social norms can facilitate interruption management behaviors during all three stages, whereas mechanisms based on self-discipline tend to be more relevant to the stages of detection and integration. Mechanisms based on self-discipline rely on individuals' actively regulating their own behaviors, e.g., whether/when/how to check for new emails and how to integrate work and personal tasks productively. However, the interpretation of an interruption aims to represent an interruption's performance requirements in people's working memory and involves far more *cognitive* processing (e.g., assessing the cognitive load and importance of the interruption) than the detection and the integration.

Therefore, mechanisms based on self-discipline, with an emphasis on behavioral processing, may be less effective during the interpretation stage.

The mechanisms based on self-discipline can facilitate both *delayed* and *preemptive* interruption management behaviors by managing the sequence and the timing of how an interruption is integrated into the task sequence. They also enable the behaviors of unintentional dismissal and unintentional delayed integration by regulating the pattern of their technology use, e.g., the frequency of checking for new messages.

As we discussed previously, interruption management behaviors are enabled by different interruption management mechanisms. Table B3 maps specific technology-based, social-based, and self-discipline based interruption management mechanisms to interruption management behaviors that they enable. This is not meant to be an exhaustive list of interruption management mechanisms but rather a set of the most frequently used ones as identified through the literature and based on our 15 interviews.

Table B3 Behaviors and Mechanisms of Interruption Management by Stage

	Mechanisms Based on Technology	**Mechanisms Based on Social Norms**	**Mechanisms Based on Self-discipline**
Detection: oblivious dismissal	Change the availability of the attentional cues (e.g., turn on/off the device, activate/deactivate the notification stimulus), change the salience of the attentional cues (e.g., turn up/down the volume)	Build socially constructed meanings into the choice of media (e.g., use phone calls for emergency but use emails for non-urgent communications)	
Detection: unintentional dismissal	Change the availability of the attentional cues (e.g., turn on/off the device, activate/deactivate the notification stimulus), change the salience of the attentional cues (e.g., turn up/down the volume)		Change one's technology use behaviors (e.g., refrain from using the device or check the device upon each notification stimulus)

Interpretation: intentional dismissal	Enrich the informational cues (e.g., color coding address book contacts, customized ring tone)	Build socially constructed meanings into the attentional cues (e.g., use three consecutive phone calls to indicate home emergency)	
Integration: unintentional preemptive integration	Change the availability of the attentional cues (e.g., turn on/off the device, activate/deactivate the notification stimulus), change the salience of the attentional cues (e.g., turn up/down the volume)		Change one's technology use behaviors (e.g., refrain from using the device or check the device upon each notification stimulus)
Integration: intentional preemptive integration	Enrich the informational cues (e.g., color coding of contacts, customized ring tone)	Establish socially constructed norms in terms of whether, when, where, and how one prefer to be interrupted	Change the task sequence/timing
Integration: unintentional delayed integration	Change the availability of the attentional cues (e.g., turn on/off the device, activate/deactivate the notification stimulus), change the salience of the attentional cues (e.g., turn up/down the volume)		Change one's technology use behaviors (e.g., refrain from using the device or check the device upon each notification stimulus)
Integration: intentional delayed integration	To enrich the informational cues (e.g., color coding of contacts, customized ring tone)	Establish socially constructed norms in terms of whether, when, where, and how one prefer to be interrupted	Change the task sequence/timing
Integration: concurrent integration	Adopt the technologies with multi-channel capabilities (e.g., text-to-speech applications)		Change the task sequence/timing

B.3.3.2 Interruption Management Mechanisms by Stage

B.3.3.2.1 Detection Stage

Interruption management mechanisms facilitate the detection (or non-detection) of an interruption by directly or indirectly manipulating attentional cues. They enable people to identify potentially beneficial interruptions, prevent unnecessary interruptions from occurring or being detected, or defer their detection to a self-determined time, affecting whether and how an interruption is detected. First, people can *directly* manage how an other-initiated interruption is

detected by varying the salience of attentional cues. This approach depends heavily on technology-based mechanisms. Second, individuals can *indirectly* manage whether and how an other-initiated interruption is *initiated* (and thus will be detected) by influencing the behaviors of their contacts. Mechanisms based on social norms largely support this approach.

Mechanisms Based on Technology

Attentional cues of an other-initiated interruption largely determine how it is detected. Technology features notify users of specific events through attentional cues such as flashing of an icon or a taskbar button, sound alert, and vibrate. For example, in order to demand users' instant attention for each new incoming message, new incoming file, friend being online/offline, or message delivery status, an IM flashes its taskbar button, provide a sound alert, or display a pop-up note.

Individuals can manage *how* an other-initiated interruption is *detected* by varying the salience of attentional cues. Salience of an attentional cue is largely determined by its attributes – such as volume, strength, or frequency – in a given environment (e.g., level of background noise). Mechanisms based on technology change certain attributes of an attentional cue through device or application configuration. For example, the flashing icon for new incoming message can be turned on or off, and the ringer volume on a phone can be adjusted up or down, enabling dismissal or itnegration behaviors. Sometimes people achieve the same goal by making the media of interruption temporarily unavailable (e.g., locking the company-provided Blackberry in the car over the weekend to minimize work-related interruptions), enabling oblivious dismissal.

Individuals can also *indirectly* influence *whether* an other-initiated interruption is *initiated* by indicating their interruptability to others who would potentially interrupt them. A commonly used mechanism of interruption management is *awareness display*, which indicates

individuals' interruptability to inform potential interrupters' decisions of whether and how to initiate an interruption. Ethnographic research on co-located cooperation finds that knowledge workers unobtrusively and tacitly coordinate work activities without interrupting each other (Bardram et al. 2004). This points to the importance of social awareness (also known as appropriate obtrusiveness) in minimizing interruptions in collective work environments (Schmidt 2002). Social awareness arises from a highly adaptive activity that generates interruptions with appropriate obtrusiveness given the urgency of the current task (Bardram et al. 2004). In face-to-face situations, the extent to which target individuals can be interrupted is often readily visible to potential interrupters, who can then decide when and how to interrupt them. In distributed work environments where physical observation is not possible, awareness displays via technology features inform a potential interrupter's perception of the target individual's interruptability. For example, IM users indicate their interruptability through status settings (e.g., "busy"). Low interruptability as perceived by potential interrupters may lead them to choose a more opportune timing or a less intrusive technology (e.g., an email rather than a phone call).

Mechanisms Based on Social Norms

By developing social norms, individuals can *indirectly* influence whether and how a technology-mediated interruption will be *initiated*, enabling unintentional dismissal. One of the themes emerging from interviews conducted for the dissertation is that managers often establish their preferred communication patterns and make them clearly known to their subordinates, so that their teams know how to choose an appropriate communication mode given a particular situation. For example, people usually make phone call for urgent communications and email for less urgent cases. This rule not only guides others in selecting an appropriate communication channel when they initiate an interruption, but also enables individuals to filter out unnecessary

interruptions. For example, as several individuals mentioned in the interviews, they seldom check or answer work-related emails over weekends (i.e., unintentional dismissal), knowing that others will call them for urgent issues. As a result, matters of low priority are communicated via email, with their detection reasonably postponed. Additionally, people may educate their friends and family members not to contact them for trivial matters during working hours, and therefore avoid some casual communications at work.

Mechanisms Based on Self-discipline

Mechanisms based on self-discipline facilitate unintentional dismissal by having individuals regulate their own behaviors. People's attention is momentarily distracted when they detect an interruption. It takes strong will for people to redirect their attention back to the ongoing task and refrain from processing the informational cues of an interruption. For example, when knowledge workers decide to have a time block free of interruptions (unintentional dismissal), sometimes it takes just self-control to ignore the phone any time it rings.

The foregoing discussion on mechanisms that indirectly influence interruption management also suggests that how to respond to an other-initiated interruption is not necessarily negotiated after its occurrence. The negotiation can start before the interruption is initiated. By indicating their interruptability, individuals negotiate with others how and when they would respond to a potential interruption.

B.3.3.2.2 Interpretation Stage

Interruption management mechanisms facilitate the interpretation of an interruption by influencing the availability and the nature of informational cues, which allow people to assess the interruption's importance and resource requirements. They enable people to maximize the

amount of useful information and improve the effectiveness and efficiency of interpretation. As the *intentional* interruption management behaviors (i.e., intentional dismissal, intentional delayed and preemptive integration) depend on the interpretation of the informational cues, the mechanisms to be discussed here can facilitate all these behaviors. Intentional dismissal occurs during the interpretation stage, while the other two take place during the integration stage.

Mechanisms Based on Technology

Mechanisms based on technology affect the speed of interruption interpretation through built-in decision-making rules. Individuals can use technology settings to program some decision-making rules into the display of informational cues. For example, email applications allow users to group and color-code their contacts (e.g., management, subordinates, and peers), so that they can identify an important email (e.g., one from their boss) at a quick glance. Some applications and paid services (e.g., Other Inbox and Away Find) can also enable users to label and organize each incoming email into different folders associated with varying priority. In summary, colors and labels represent useful tools that facilitate individuals' assessment of an interruption's performance requirements based on metadata. Moreover, people can also change the accessibility of informational cues. For example, the intentional behaviors (i.e., intentional dismissal, intentional delayed and preempt integration) are facilitated when people connect their landline to their television and have a caller ID flash on the television screen every time an incoming call is received. Based on this easily accessible informational cue, they can then decide whether or not to answer the phone.

Mechanisms Based on Social Norms

Mechanisms based on social norms affect the amount of useful information that an informational cue conveys (in other words, how informative is an informational cue). By

building social norms, individuals can manage the informativeness of an informational cue in both direct and indirect ways. First, individuals can directly encourage or request their contacts to provide informational cues (such as an informative subject line of email). Second, individuals can indirectly enrich informational cues by embedding socially constructed meanings into other cues (such as attentional cues). The same technology feature, when coupled with socially constructed meanings, can demonstrate varying levels of information richness. An exclamation mark indicates the level of importance of an email – a piece of information in addition to other useful information such as sender, subject, and time sent. However, phone does not support such function for users to label a call as urgent. In order to facilitate the interpretation, individuals may develop some norms among the people around them to create an informational cue of a phone call. For example, according to agreement between people and their family, three phone calls in a row during working hours signal a family emergency, which will make the individual to answer it immediately even in an important meeting (i.e., intentional preemptive integration). Otherwise, the individual may just ignore the phone call (i.e., intentional dismissal) or return it at a later time (i.e., intentional delayed integration). This supplements the lack of content-based cues of phone call, facilitating one's decision making with respect to how to integrate the interruption.

B.3.3.2.3 Integration Stage

Interruption management mechanisms facilitate the integration of an interruption. They enable people to coordinate the resource requirements of the interruption and the ongoing task.

Mechanisms Based on Technology

Circumventing is one possible solution to a resource conflict. People can ease the tension between two activities, which compete for the same resource, by utilizing alternative, non-

conflicting resources to perform the activities. This strategy can be supported by applications that enable users to switch between channels reliant on compatible resources. For example, speech-to-text applications allow users to use time in a more productive way by tapping on the idle resources. Driving a car while typing a text message or talking over the phone without a hand-free device is dangerous, because the effective performance of each activity involves manual operation, competing for the same resource. However, when idle resources can be utilized (*e.g.*, speech dial or other applications operating by voice), a driver can achieve additional goals while driving (i.e., concurrent integration), becoming more productive during the same time period. Stuck in a meeting, an individual may not be able to talk over the phone, but can exchange information through IM or email.

Mechanisms Based on Social Norms

Social norms shape individuals' decision of how to integrate an interruption into the current sequence of tasks. Providing communication technologies (e.g., BlackBerry) to a group of knowledge workers within an organization is found to intensify expectations of responsiveness, and develop a norm of email monitoring during off hours (Mazmanian et al. 2006). Although email activity during off hours is not mandated, such expectations and behaviors persist as junior members imitate patterns of use established by senior members. This points to the importance of social norms in guiding how individuals respond to interruptions, e.g., choosing preemptive integration over delayed integration. The mechanisms based on social norms indirectly affect both delayed and preemptive behaviors, rather than directly enabling a specific behavior. The choice of an interruption management behavior is a function of the social norms – what is considered an appropriate way to handle an interruption varies across contexts.

Mechanisms Based on Self-discipline

As an important component of time management, planning plays an instrumental role in coordinating tasks with incompatible demands for resources (Miyata et al. 1986). Impact of an interruption on the ongoing task varies due to when it is integrated into the current sequence of task (Cutrell et al. 2001). Individuals can make an interruption less disruptive by delaying the response to it until a more opportune time such as natural break points (Adamczyk et al. 2004). There are some periods of time such as holes in schedule or periods of lull when an interruption is better received than others (Hudson et al. 2002).

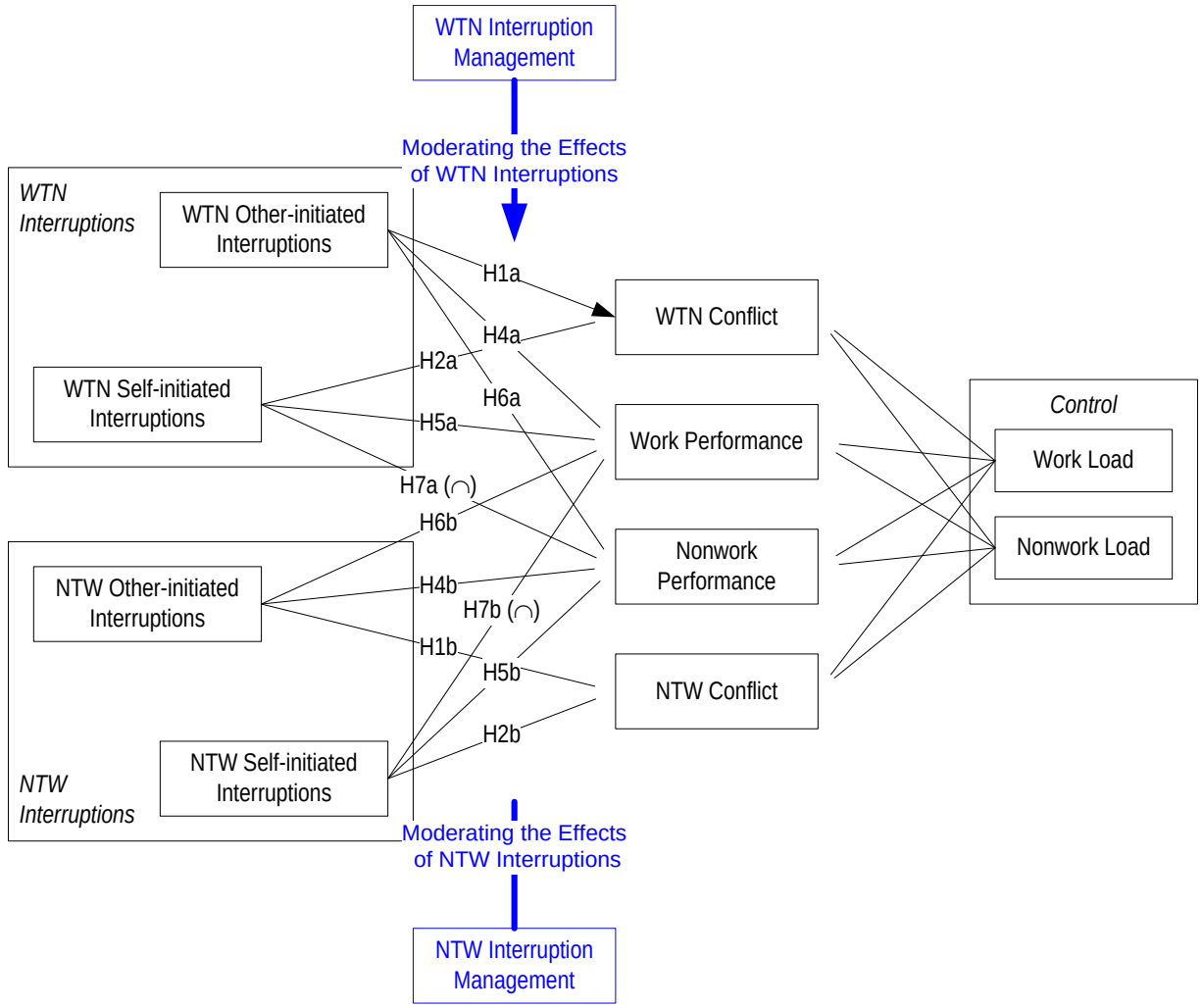
During the integration stage, individuals can maximize the productivity gain and reduce the performance loss by actively managing the sequence and the timing of tasks from work and personal life. The sequence in which the interruption and the ongoing task are handled can affect people's performance of work and personal life. For example, *bundling* is an important technique that can be used differently to segment or to integrate work and personal life. People can integrate an interruption (other- or self-initiated) in a way that accommodates the resource requirements of both tasks in a given situation. To segment work and personal life, an individual may group together in the same time slot tasks that belong to the same domain in order to reduce the number of role transitions needed. By bundling work-related tasks together and personal tasks together, the individual can carve out large temporal spaces dedicated to work or personal life, enabling intentional delayed integration. To integrate work and personal life, an individual may bundle the tasks to optimize the moment-to-moment resource demand and supply, regardless of their originating domains, enabling concurrent integration and intentional preemptive integration.

Whether an interruption is harmful or beneficial is a function of the timing when it is integrated into the current task sequence. To illustrate how interruption management at the integration stage can be beneficial, consider *time slicing*. It refers to the practice that an individual makes use of small time periods that would be otherwise void. Some frequently observed time slicing behaviors include: checking emails on a coffee run, monitoring stocks during an elevator ride, making a phone call while queuing up at a cafeteria, and placing an online order during lunch break. The percentage of people who feel short of time for what they need to do has been inching up (Smith 2005). The five integration behaviors allow time-starved knowledge workers to infiltrate tasks into micro-moments of every day across the boundaries between work and personal life. For example, knowledge workers can make a dinner reservation (i.e., intentional preemptive integration) or answer a personal IM message (i.e., unintentional or intentional preemptive integration) when there happen to be some slack resources available, e.g., when they are put on hold during a business phone call. Individuals can manage task sequence and timing simultaneously. For example, knowledge workers can intentionally schedule a work-related phone call during their children's swim meet in order to utilize the slack resources.

B.3.4 Research Model and Hypotheses

The empirical exploration of the role of interruption management behaviors integrates interruption management with the research model developed for the dissertation (see Chapter 3 for details). Specifically, we posit and test moderating effects of interruption management behaviors on the relationships between cross-domain technology-mediated interruptions and the outcome variables. We focus on the role of behaviors that occur across all three stages. Rather than distinguishing across the eight different types of interruption management behaviors discussed, we group these behaviors into integration-oriented and segmentation-oriented

behaviors and test the moderating effect of this (i.e., the extent to which the individual engages in integration-oriented [as opposed to segmentation-oriented] interruption management) on the relationships in the model (Figure B3). As this is not the primary focus of the dissertation, the current data set does not provide a comprehensive test of the interruption management behaviors and mechanisms and neither is it meant to. Rather, it is meant to provide some preliminary empirical evidence as to the role of interruption management in the model.



The moderating effects of WTN and NTW interruption management are hypothesized for all hypothesized main effect relationships of technology-mediated cross-domain interruptions shown in the model.

Figure B3 Research Model

As discussed in Chapter 3, technology-mediated cross-domain interruptions can affect people's work and personal life, in terms of WTN conflict, NTW conflict, work performance, and nonwork performance. People can take an active role in managing how these consequences are generated through interruption management behaviors, some of which aim at segmenting work and nonwork tasks while others aim at interweaving them. Individuals may engage in segmentation- or integration-oriented behaviors of interruption management in order to mitigate the negative outcomes and maximize the beneficial effects of interruptions.

Technology-mediated cross-domain interruptions are expected to negatively influence WTN conflict and NTW conflict. Segmentation-oriented interruption management behaviors focus on erecting boundaries between work and personal life. They either prevent an interruption from entering the current task sequence or deferring its entry to a later (more opportune) time. On the contrary, integration-oriented interruption management behaviors aim to interweave work and nonwork tasks. When they engage in integration-oriented interruption management behaviors, knowledge workers detect and respond to an interruption in a timely manner, making more difficult a full engagement in work or personal life where the ongoing task concerns. Therefore, we expect the observed effects of WTN (other- and self-initiated) interruptions on WTN conflict to be weaker among people who engage in segmentation-oriented interruption management behaviors than those who engage in integration-oriented behaviors. The same arguments also apply to the nonwork-to-work direction.

H1a-m: Interruption management behaviors will moderate the effects of frequency of WTN other-initiated technology-mediated cross-domain interruptions on WTN conflict such that the frequency of WTN other-initiated technology-mediated cross-domain

interruptions will have a stronger effect when individuals engage in integration- rather than segmentation-oriented interruption management behaviors.

H2a-m: Interruption management behaviors will moderate the effect of frequency of WTN self-initiated technology-mediated cross-domain interruptions on WTN conflict such that the frequency of WTN self-initiated technology-mediated cross-domain interruptions will have a stronger effect when individuals engage in integration- rather than segmentation-oriented interruption management behaviors.

H1b-m: Interruption management behaviors will moderate the effects of frequency of NTW other-initiated technology-mediated cross-domain interruptions on NTW conflict such that the frequency of NTW other-initiated technology-mediated cross-domain interruptions will have a stronger effect when individuals engage in integration- rather than segmentation-oriented interruption management behaviors.

H2b-m: Interruption management behaviors will moderate the effect of frequency of NTW self-initiated technology-mediated cross-domain interruptions on NTW conflict such that the frequency of NTW self-initiated technology-mediated cross-domain interruptions will have a stronger effect when individuals engage in integration- rather than segmentation-oriented interruption management behaviors.

Technology-mediated cross-domain interruptions are also expected to influence work performance and nonwork performance. *Integration*-oriented interruption management behaviors can facilitate the process where the interrupting domain benefits from the interruptions. When people engage in integration-oriented interruption management behaviors, the interrupting domain obtains more additional resources such as personal time, attention, and energy (e.g., integration behaviors vs. dismissal behaviors) or does so in a more timely manner (e.g.,

preemptive behaviors vs. delayed behaviors). Therefore, we expect the observed effects of WTN (other- and self-initiated) interruptions on work performance to be weaker among people who engage in segmentation-oriented interruption management behaviors than those who engage in integration-oriented behaviors. The same arguments also apply to the nonwork-to-work direction.

H3a-m: Interruption management behaviors will moderate the effects of frequency of WTN other-initiated technology-mediated cross-domain interruptions on work performance such that the frequency of WTN other-initiated technology-mediated cross-domain interruptions will have a stronger effect when individuals engage in integration- rather than segmentation-oriented interruption management behaviors.

H4a-m: Interruption management behaviors will moderate the effects of frequency of WTN self-initiated technology-mediated cross-domain interruptions on work performance such that the frequency of WTN self-initiated technology-mediated cross-domain interruptions will have a stronger effect when individuals engage in integration- rather than segmentation-oriented interruption management behaviors.

H3b-m: Interruption management behaviors will moderate the effects of frequency of NTW other-initiated technology-mediated cross-domain interruptions on nonwork performance such that the frequency of NTW other-initiated technology-mediated cross-domain interruptions will have a stronger effect when individuals engage in integration- rather than segmentation-oriented interruption management behaviors.

H4b-m: Interruption management behaviors will moderate the effects of frequency of NTW self-initiated technology-mediated cross-domain interruptions on nonwork performance such that the frequency of NTW self-initiated technology-mediated cross-

domain interruptions will have a stronger effect when individuals engage in integration- rather than segmentation-oriented interruption management behaviors.

As previously discussed, *integration*-oriented rather than *segmentation*-oriented interruption management behaviors work to the advantage of the interrupting domain (in terms of performance) to a greater extent. On the contrary, *segmentation*-oriented rather than *integration*-oriented interruption management behaviors benefit the interrupted domain (in terms of performance) to a greater extent. They can mitigate the process where the interrupted domain loses personal resources such as time, attention, and energy due to the interruptions. Segmentation-oriented interruption management behaviors prevent the interrupted domain from losing personal resources (e.g., integration behaviors vs. dismissal behaviors) or postpone such loss to a later time when slack resources become available (e.g., preemptive behaviors vs. delayed behaviors). Therefore, we expect the observed effects of WTN (other- and self-initiated) interruptions on nonwork performance to be weaker among people who engage in segmentation-oriented interruption management behaviors than those who engage in integration-oriented behaviors. The same arguments also apply to the nonwork-to-work direction.

H5a-m: Interruption management behaviors will moderate the effects of frequency of WTN other-initiated technology-mediated cross-domain interruptions on nonwork performance such that the frequency of WTN other-initiated technology-mediated cross-domain interruptions will have a stronger effect when individuals engage in integration- rather than segmentation-oriented interruption management behaviors.

H6a-m: Interruption management behaviors will moderate the effects of frequency of WTN self-initiated technology-mediated cross-domain interruptions on nonwork performance such that the frequency of WTN self-initiated technology-mediated cross-

domain interruptions will have a stronger effect when individuals engage in integration- rather than segmentation-oriented interruption management behaviors.

H5b-m: Interruption management behaviors will moderate the effects of frequency of NTW other-initiated technology-mediated cross-domain interruptions on work performance such that the frequency of NTW other-initiated technology-mediated cross-domain interruptions will have a stronger effect when individuals engage in integration- rather than segmentation-oriented interruption management behaviors.

H6b-m: Interruption management behaviors will moderate the effects of frequency of NTW self-initiated technology-mediated cross-domain interruptions on work performance such that the frequency of NTW self-initiated technology-mediated cross-domain interruptions will have a stronger effect when individuals engage in integration- rather than segmentation-oriented interruption management behaviors.

In summary, when people engage in segmentation-oriented rather than integration-oriented interruption management behaviors, the hypothesized relationships (see Chapter 3 for details) are expected to be weaker. However, this can work to the knowledge workers' advantage or disadvantage depending on the nature of the relationship being moderated (i.e., if the interruption effects are detrimental or beneficial), as presented in the foregoing discussion.

B.4 Methodology

Data on interruption management were collected from the same sample of knowledge workers and along with the other variables that were examined as the main focus of the dissertation (i.e., frequency of the four types of interruptions, work performance, nonwork

performance, WTN conflict, NTW conflict, work load, and nonwork load) (see Chapter 4 for details).

Based on empirical studies of technology use, on interviews with professional and managerial employees, and on discussions with colleagues interested in human computer interaction, we generated the items capturing the overall interruption management behaviors (segmentation- or integration-oriented) and interruption management mechanisms.[19] Based on our theoretical development, we measured interruption management during two stages: the detection stage that describes how respondents detect an interruption (e.g., turn phone off) and the integration stage when, after detecting the interruption they decide how to respond to it (e.g., delay responding till they get to work; respond immediately, etc).[20] Table B4 presents the items used in the study.

Specifically, we first developed items that capture the extent to which an individual takes a segmentation- or integration-oriented approach in detecting and responding to interruptions. A segmentation-oriented approach for detection would imply engaging in behaviors that avoid detection of cross-domain interruptions (e.g., don't check work-related emails till one goes back to the office). It leads to behaviors of oblivious dismissal and unintentional dismissal (i.e., the individual obliviously or intentionally dismiss all emails before going back to the office). A segmentation-oriented approach for responding would suggest delaying any response to work-related interruptions till one returned to the office. It leads to behaviors of intentional delayed

[19] For our empirical tests, we focused on the effects of overall interruption management behaviors (integration-oriented vs. segmentation-oriented), although we developed the scales for interruption management mechanisms by stages.

[20] Interruption management spans across three stages – detection, interpretation, and integration of an interruption. This research collapses interpretation management and integration management by into one construct, i.e., interpretation/integration management, which captures how individuals respond to an interruption after detecting it. Despite being theoretically distinct, interpretation management and integration management are so tightly coupled in practice that it is hard to empirically differentiate them in a meaningful way.

integration and unintentional delayed integration (i.e., the individual defers responding to certain or all interruptions to a later time). An integration-oriented approach would be the exact opposite of these where an individual would engage in behaviors to integrate the cross-domain interruptions in their ongoing tasks (e.g., the individual always answer the important clients' phone calls during off hours). It leads to the interruption management behaviors of concurrent integration and intentional and unintentional preemptive integration, where people concurrently handle both tasks or give certain interruptions or all interruptions priority over the ongoing task for immediate processing.

Second, we further differentiated individuals' interruption management mechanisms (i.e., detecting and responding to interruptions) into the three categories previously described: behaviors based on technology configuration, based on social norms, and based on self-discipline. Specific practices were also identified for each category. For example, turning on/off communication device and using customized ring tones represent interruption management mechanisms based on technology; educating work contacts in terms of whether/how one prefers to be interrupted during off hours represents an interruption management mechanism based on social norms; controlling the time and sequence of tasks represent an interruption management mechanism based on self-discipline.

We developed two sets of items to capture how frequently people engage in each of the interruption management mechanisms, and to what extent their engagement is segmentation- or integration-oriented. For example, knowing that people utilize social norms to deal with interruptions does not necessarily tell us whether they utilize this to segment or to integrate cross-domain interruptions into the focal domain. Therefore, it was important to create a second item to ask whether these mechanisms were used to integrate or to segment.

Table B4 Scales of Interruption Management

Construct	Definition	Items
WTN Interruption management	Management of technology-mediated interruption is defined as an action taken by individuals to facilitate detection, interpretation, and integration of a technology-mediated interruption. The interruption management techniques aim to provide a level of segmentation or integration between work and personal life.	[Integration-oriented WTN mgmt overall 1] During nonwork hours, I typically avoid work-related interruptions. (7-point Likert scale: Strongly / Moderately / Slightly Disagree, Neutral, Slightly / Moderately / Strongly Agree)
		[Integration-oriented WTN mgmt overall 2] During nonwork hours, I typically... (7-point Likert scale with "avoid work-related interruptions", "selectively respond to work-related interruptions", and "always respond to work-related interruptions" as three major points on the 7-point continuum).
		[Integration-oriented WTN detection Mechanisms1-3] 1. During nonwork hours, I typically configure my devices/applications in order to...[tech] 2. I typically let my colleagues know whether and how I prefer to be interrupted during nonwork hours in order to…[social norm] 3. During nonwork hours, I typically manage the sequence/timing of my tasks to… [self-discipline] (8-point Likert scale with "avoid detecting any work-related interruptions", "selectively detect work-related interruptions", and "always detect work-related interruptions" as three major points on the continuum, and the last one "I do not typically do that").
		[Integration-oriented WTN response Mechanisms 1-4] 1. During nonwork hours, I typically configure my devices/applications in order to... 2. I typically let my colleagues know whether and how I prefer to be interrupted during nonwork hours in order to… 3. During nonwork hours, I typically manage the sequence of my tasks (e.g., bundle responding to all work-related interruptions in one time block) in order to… [self-discipline1] 4. During nonwork hours, I typically manage the timing of my tasks (e.g., handle a work-related phone call on my way to the grocery store) in order to… [self-discipline2] (8-point Likert scale with "defer responding to any work-related interruptions", "selectively respond to work-related interruptions", and "always immediately respond to work-related interruptions" as three major points on the continuum, and the last one "I do not typically do that").

		[WTN mechanisms 1-8] To what extent do you do the following to manage work-related technology-mediated interruptions during nonwork hours? - turn on/off my devices/applications [tech1] - adjust volume/vibrate of my devices/applications [tech2] - customize the ring tones [tech3] - manage the sequence of my tasks (e.g., bundle responding to all work-related interruptions in one time block) [self-discipline1] - manage the timing of my tasks (e.g., handle a work-related phone call on my way to the grocery store) [self-discipline2] - let my colleagues know whether I prefer to be interrupted [social norm1] - let my colleagues know how (e.g. via phone call, email, instant messenger, texting, etc) I prefer to be interrupted [social norm2] - let my colleagues know under what circumstances (e.g., timing, only in crisis) I prefer to be interrupted [social norm3] (7-point Likert scale: very rarely/rarely/rather rarely/occasionally/rather frequently/frequently/very frequently)
NTW interruption management	Management of technology-mediated interruption is defined as an action taken by individuals to facilitate detection, interpretation, and integration of a technology-mediated interruption. The interruption management techniques aim to provide a level of segmentation or integration between work and personal life.	[Integration-oriented NTW overall 1] During work hours, I typically avoid nonwork-related interruptions. (7-point Likert scale: Strongly / Moderately / Slightly Disagree, Neutral, Slightly / Moderately / Strongly Agree)
		[Integration-oriented NTW overall 2] During work hours, I typically... (7-point Likert scale with “avoid nonwork-related interruptions”, “selectively respond to nonwork-related interruptions”, and “always respond to nonwork-related interruptions” as three major points on the 7-point continuum).
		[Integration-oriented NTW detection Mechanisms 1-3] 1. During work hours, I typically configure my devices/applications in order to...[tech] 2. I typically make known to my family/friends whether and how I prefer to be interrupted during work hours so that I can...[social norm] 3. During work hours, I typically manage the sequence/timing of my tasks to...[self-discipline] (8-point Likert scale with “avoid detecting any nonwork-related interruptions”, “selectively detect nonwork-related interruptions”, and “always detect nonwork-related interruptions” as three major points on the continuum, and the last one “I do not typically do that”).

		[Integration-oriented NTW response Mechanism 1-4] 1. During work hours, I typically configure my devices/applications in order to...[tech] 2. I typically make known to my family/friends whether and how I prefer to be interrupted during work hours so that I can...[social norm] 3. During work hours, I typically manage the sequence of my tasks (e.g., bundle responding to all nonwork-related interruptions in one time block) in order to…[self-discipline1] 4. During work hours, I typically manage the timing of my tasks (e.g., handle a nonwork-related phone call on my way to the client site) in order to…[self-discipline2] (8-point Likert scale with "defer responding to any nonwork-related interruptions", "selectively respond to nonwork-related interruptions", and "always immediately respond to nonwork-related interruptions" as three major points on the continuum, and the last one "I do not typically do that").
		[NTW mechanisms 1-8] To what extent do you do the following to manage nonwork-related technology-mediated interruptions during work hours? - turn on/off my devices/applications [tech1] - adjust volume/vibrate of my devices/applications [tech2] - customize the ring tones [tech3] - manage the sequence of my tasks (e.g., bundle responding to all nonwork-related interruptions in one time block) [self-discipline1] - manage the timing of my tasks (e.g., handle a nonwork-related phone call on my way to the client site) [self-discipline2] - let my family/friends know whether I prefer to be interrupted [social norm1] - let my family/friends know how (e.g. via phone call, email, instant messenger, texting, etc) I prefer to be interrupted [social norm2] - let my family/friends know under what circumstances (e.g., timing, only in crisis) I prefer to be interrupted [social norm3] (7-point Likert scale: very rarely/rarely/rather rarely/occasionally/rather frequently/frequently/very frequently)

B.5 Data Analysis and Results

We tested the moderating effects of integration-oriented or segmentation-oriented interruption management behaviors on the relationships posited in the research model for the dissertation. As for the rest of the dissertation, we performed the analysis in PLS. We first present the results of our scale validation followed by the results for the structural model.

Table B5 shows the descriptive statistics of the constructs. Customized ring tones, as a technology-based interruption management mechanism, represent the least frequently used mechanism in managing both WTN and NTW interruptions (mean = 2.16 for WTN and mean = 2.34 for NTW), significantly lower than all the other mechanisms except that customized ring tones as a mechanism of managing NTW interruptions is not significantly different from turning on/off devices/applications.

In terms of how frequently a mechanism is used in managing WTN vs NTW interruptions, there are statistically significant differences for the mechanism based on technology ([mechanism tech1] turn on/off device or application – higher for WTN interruptions), based on social norms ([mechanism social norm 1-3] let other people know whether/how/under what circumstances I prefer to be interrupted – higher for NTW interruptions), and based on self-discipline ([mechanism timing] manage the timing of tasks – higher for NTW interruptions).

The majority of respondents do use interruption management mechanisms, and in doing so they mostly take a balanced approach – selectively detecting or responding to interruptions (with the mean scores of these scales fluctuating around 4). Overall, people tend to integrate work and personal life to a greater extent in managing WTN interruptions than in managing

NTW interruptions, as indicated by the statistically significant difference between the items measuring integration-oriented overall interruption management (means=4.77/4.51 for WTN and means=4.16/3.89 for NTW). The mechanisms based on self-discipline (manage the timing of tasks) are used to achieve significantly different goals in managing WTN and NTW interruptions – aiming at integrating work-related interruptions into personal life while separating personal interruptions from the work domain. This suggests that the boundary between work and personal life is more permeable in the work-to-nonwork direction than the opposite. The differences on why other mechanisms are used are not statistically significant across work and personal life.

All items in the model are the same as those used for the main study. Each interruption management construct (WTN and NTW) was measured using the appropriate two overall integration-oriented items from Table B4. The psychometric properties of the scales were assessed in the same manner as that presented in Chapter 5. An assessment of the Comparison of the square root of the AVE (the leading diagonal in Table B6) to inter-construct correlations (Table B6) and the CFA results presented in Table B7 suggest that the constructs exhibit good convergent and discriminant validity. Further, with the exception of the overall interruption management scales, all other scales exhibit good reliability as shown by the reliability results presented on table B6.

Table B5 Descriptive statistics

Items[a]	**N**[b]	**Mean**	**Std. Dev.**	**Max**	**Min**
Integration-oriented WTN mgmt overall 1	95	4.77	1.67	7	1
Integration-oriented WTN mgmt overall 2	94	4.51	1.24	7	1
Integration-oriented NTW mgmt overall 1	95	4.16	1.69	7	1
Integration-oriented NTW mgmt overall 2	95	3.89	1.05	7	1
WTN mechanism tech 1	94	3.78	1.92	7	1
WTN mechanism tech 2	94	3.4	1.92	7	1
WTN mechanism tech 3	94	2.16	1.68	7	1

WTN mechanism sequence	94	3.9	1.72	7	1
WTN mechanism timing	94	3.7	1.80	7	1
WTN mechanism social norm 1	93	3.04	1.91	7	1
WTN mechanism social norm 2	94	3.32	1.94	7	1
WTN mechanism social norm 3	94	3.31	2.02	7	1
NTW mechanism tech 1	94	2.99	1.76	7	1
NTW mechanism tech 2	94	3.63	2.13	7	1
NTW mechanism tech 3	94	2.34	1.97	7	1
NTW mechanism sequence	94	3.84	1.86	7	1
NTW mechanism timing	94	4.19	1.74	7	1
NTW mechanism social norm 1	93	3.69	2.04	7	1
NTW mechanism social norm 2	94	3.79	2.07	7	1
NTW mechanism social norm 3	94	3.72	2.02	7	1
Integration-oriented WTN detection [tech]	72 (23)	4.28	1.56	7	1
Integration-oriented WTN detection [social norm]	66 (29)	4.32	1.46	7	1
Integration-oriented WTN detection [self-discipline]	82 (12)	4.22	1.41	7	1
Integration-oriented WTN response [tech]	72 (21)	4.15	1.47	7	1
Integration-oriented WTN response [social norm]	66 (28)	4.05	1.26	7	1
Integration-oriented WTN response [self-discipline1]	78 (16)	4.10	1.32	7	1
Integration-oriented WTN response [self-discipline2]	77 (17)	4.22	1.25	7	1
Integration-oriented NTW detection [tech]	70 (25)	4.36	1.39	7	1
Integration-oriented NTW detection [social norm]	69 (26)	4.04	1.33	7	1
Integration-oriented NTW detection [self-discipline]	83 (12)	4.28	1.09	7	1
Integration-oriented NTW response [tech]	71 (23)	3.94	1.39	7	1
Integration-oriented NTW response [social norm]	66 (28)	3.77	1.21	7	1
Integration-oriented NTW response [self-discipline1]	72 (21)	3.78	1.21	6	1
Integration-oriented NTW response [self-discipline2]	75 (18)	3.67	1.37	7	1

[a] The first two items that measure overall interruption management are measured on seven-point scales with the anchors 1 = Strongly disagree to 7 = Strongly agree. The other two items that measure overall interruption management are measured on seven-point scales with the anchors 1 = avoid WTN/NTW interruptions, 4 = selectively respond to WTN/NTW interruptions, to 7 = always respond to WTN/NTW interruptions.

All items that measure interruption management mechanisms are measured on seven-point scales with the anchors 1 = Very rarely, 4 = Occasionally, 7 = Very frequently.

All items that measure detection and response mechanisms are measured on eight-point scales with the anchors 1 = avoid detecting/responding to any WTN/NTW interruptions, 4 = selectively detect/respond to WTN/NTW interruptions, to 7 = always detect/respond to WTN/NTW interruptions, and 8 = I do not typically do that. The mean, standard deviation, maximum, and minimum are reported based on the respondents who answered 1 to 7.

[b] The numbers in the parentheses represent the number of respondents who answered "I do not typically do that."

Due to the sample size, we tested the moderating effects of WTN and NTW interruption management on each dependent variable (i.e., WTN conflict, NTW conflict, work performance,

and nonwork performance) rather than entering all moderating effects for all dependent variables in the model at the same time. For each dependent variable, two models are examined – the baseline model and the one with the interaction terms. The results of the eight models are presented in Table B8. Power calculation suggests that our sample size is sufficient for us to detect the effects on WTN conflict, NTW conflict, work performance, and nonwork performance. The observed power for each of the four models is above 0.9.

As shown in Table B8, none of the moderating effects turn out to be significant. However, WTN interruption management has a significant direct effect on WTN conflict, meaning that when people manage interruptions in an integration-oriented approach than in a segmentation-oriented approach they experience higher levels of work-to-nonwork conflict.

In order to further understand the role of interruption management mechanisms, we examined the effects of integration-oriented interruption management mechanisms by stage (i.e., **detection and response**). The results (Tables 9-12) point to the asymmetrical effects of detection and response management mechanisms across work and personal life. Although neither detection nor response management mechanisms significantly influence the effects of *WTN interruptions*, integration-oriented *detection* management of *NTW interruptions* significantly increases NTW conflict and undermines both work and nonwork performance. Moreover, it mitigates the negative effects of NTW self-initiated interruptions on NTW conflict, meaning that when integration-oriented detection management is used, the same amount of NTW self-initiated interruptions affects NTW conflict to a lesser extent than when segmentation-oriented detection management is used (Figure 4B). Integration-oriented NTW response management increases NTW conflict, and moderates the effects of NTW interruptions (both other- and self-initiated) on

nonwork performance – when individuals use integration-oriented response management, they tend to experience more performance gains.

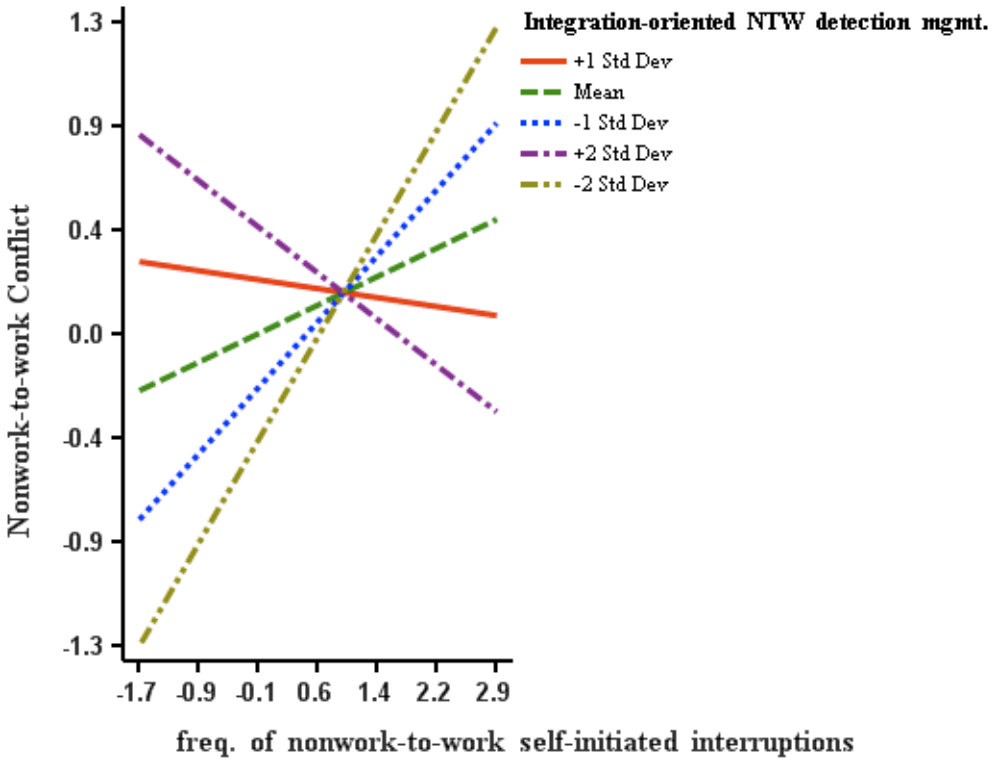


Figure 4B Moderating effect of NTW detection management

We also explored the moderating effects of interruption management mechanisms (frequency) on the relationship between the interruptions and their consequences. Particularly, we assessed the three types of mechanisms – those based on **technology, social norms, and self-discipline** – within the same model. The results (Table 13B for WTN interruption management mechanisms and Table 14B for NTW) show that individuals use the mechanisms differently across work and personal life. NTW interruption management mechanisms based on social norms have significant main effects on the outcome variables (reducing NTW conflict, and

enhancing work and nonwork performance), whereas the WTN interruption management mechanisms based on technology and self-discipline significantly reduces WTN conflict and enhance work performance.

Table B6 Inter-construct correlations

	Reliability	1	2	3	4	5	6	7	8	9	10	11	12
1. WTN interruption mgmt	0.62	**0.85**											
2. NTW interruption mgmt	0.64	-0.02	**0.86**										
3. Freq. of WTN Other-initiated Interruptions	1	0.47	0.04	1.00									
4. Freq. of WTN Self-initiated Interruptions	1	0.27	0.08	0.72	1.00								
5. Freq. of NTW Other-initiated Interruptions	1	0.06	0.37	0.26	0.28	1.00							
6. Freq. of NTW Self-initiated Interruptions	1	0.06	0.41	0.30	0.33	0.80	1.00						
7. WTN Conflict	0.79	0.47	0.05	0.55	0.42	0.14	0.11	**0.91**					
8. NTW Conflict	0.76	0.05	0.22	0.11	0.16	0.09	0.15	0.39	**0.82**				
9. Work Perf.	0.88	-0.13	-0.15	-0.09	0.02	-0.10	-0.11	-0.09	-0.17	**0.85**			
10. Nonwork Perf.	0.94	-0.33	0.03	-0.40	-0.20	-0.10	-0.17	-0.43	-0.32	0.44	**0.92**		
11. Work Load	0.92	0.34	-0.10	0.48	0.38	0.05	0.06	0.60	0.19	0.12	-0.30	**0.96**	
12. Nonwork Load	0.78	-0.04	0.18	0.16	0.10	0.36	0.27	0.30	0.39	-0.04	-0.21	0.27	**0.90**

Table B7 Item loadings and cross loadings

	1	2	3	4	5	6	7	8	9	10	11	12
NTW interruption mgmt 1	0.842	0.039	0.389	0.223	0.066	0.063	0.375	0.101	-0.144	-0.295	0.333	-0.035
WTN interruption mgmt 2	0.861	-0.077	0.407	0.242	0.030	0.043	0.429	-0.021	-0.083	-0.266	0.246	-0.036
NTW interruption mgmt 1	0.027	0.834	0.140	0.179	0.386	0.412	0.097	0.188	-0.097	0.015	-0.037	0.214
NTW interruption mgmt 2	-0.063	0.877	-0.065	-0.028	0.258	0.298	0.002	0.186	-0.151	0.041	-0.122	0.107
Freq. of WTN Other-initiated Interruptions	0.468	0.036	1.000	0.722	0.257	0.300	0.555	0.111	-0.088	-0.402	0.482	0.158
Freq. of WTN Self-initiated Interruptions	0.273	0.079	0.722	1.000	0.281	0.332	0.422	0.155	0.021	-0.196	0.380	0.102
Freq. of NTW Other-initiated Interruptions	0.056	0.370	0.257	0.281	1.000	0.800	0.144	0.088	-0.102	-0.104	0.049	0.358
Freq. of NTW Self-initiated Interruptions	0.062	0.410	0.300	0.332	0.800	1.000	0.112	0.149	-0.109	-0.174	0.057	0.271
WTN Conflict 1	0.338	0.062	0.479	0.397	0.113	0.101	0.907	0.463	-0.157	-0.485	0.591	0.314
WTN Conflict 4	0.521	0.036	0.530	0.370	0.148	0.103	0.912	0.247	-0.005	-0.302	0.506	0.232
NTW Conflict 1	0.061	0.223	0.144	0.183	0.030	0.075	0.424	0.914	-0.098	-0.286	0.238	0.372
NTW Conflict 3	-0.018	0.176	0.016	0.036	0.061	0.093	0.212	0.838	-0.249	-0.236	0.060	0.371
NTW Conflict 4	0.090	0.113	0.125	0.187	0.192	0.286	0.326	0.684	-0.066	-0.298	0.155	0.166
Work Performance 1	-0.078	-0.306	-0.064	0.051	-0.169	-0.180	-0.066	-0.085	0.849	0.298	0.095	-0.004
Work Performance 2	-0.092	-0.120	-0.078	0.017	-0.102	-0.039	-0.007	-0.112	0.909	0.273	0.145	-0.016
Work Performance 3	-0.230	0.025	-0.123	-0.069	-0.027	-0.108	-0.211	-0.275	0.804	0.526	0.064	-0.016
Work Performance 4	-0.067	-0.020	-0.039	0.062	-0.011	-0.015	-0.032	-0.159	0.841	0.449	0.117	-0.108
Nonwork Performance 1	-0.282	0.031	-0.340	-0.126	-0.101	-0.146	-0.343	-0.311	0.385	0.924	-0.257	-0.208
Nonwork Performance 2	-0.375	0.057	-0.375	-0.163	-0.122	-0.191	-0.391	-0.164	0.414	0.867	-0.297	-0.114
Nonwork Performance 3	-0.318	0.003	-0.410	-0.201	-0.084	-0.157	-0.455	-0.336	0.349	0.961	-0.320	-0.198

Nonwork Performance 4	-0.221	0.034	-0.340	-0.229	-0.073	-0.140	-0.384	-0.377	0.465	0.911	-0.214	-0.252
Work Load 1	0.418	-0.118	0.514	0.419	0.062	0.083	0.618	0.181	0.082	-0.326	0.968	0.257
Work Load 2	0.222	-0.064	0.409	0.306	0.029	0.023	0.537	0.178	0.162	-0.246	0.958	0.273
Nonwork Load 1	0.058	0.140	0.276	0.168	0.358	0.278	0.296	0.292	-0.003	-0.240	0.315	0.898
Nonwork Load 2	-0.128	0.189	0.017	0.021	0.292	0.214	0.248	0.415	-0.061	-0.141	0.185	0.910

1-WTN interruption mgmt
2-NTW interruption mgmt
3- Freq. of WTN Other-initiated interruption
4- Freq. of WTN Self-initiated interruption
5- Freq. of NTW Other-initiated interruption
6- Freq. of NTW Self-initiated interruption
7- WTN Conflict
8- NTW Conflict
9- Work Performance
10- Nonwork Performance
11- Work Load
12- Nonwork Load

Table B8 PLS Model Testing Results

	WTN Conflict			NTW Conflict			Work Performance				Nonwork Performance			
Freq. of WTN other-initiated interptn		0.195 † (0.144) [0.089]	0.188 NS (0.532) [0.362]					-0.215 NS (0.213) [0.157]	-0.163 NS (0.281) [0.281]	-0.130 NS (0.309) [0.337]		-0.363 * (0.181) [0.023]	-0.411 NS (1.030) [0.345]	-0.394 NS (1.127) [0.363]
Freq. of WTN self-initiated interptn		0.059 NS (0.112) [0.299]	0.052 NS (0.393) [0.447]					0.158 NS (0.162) [0.165]	0.117 NS (0.338) [0.364]	0.046 NS (0.385) [0.452]		0.190 NS (0.155) [0.111]	0.207 NS (0.630) [0.371]	0.225 NS (0.711) [0.376]
Freq. of NTW other-initiated interptn					-0.255 † (0.160) [0.057]	-0.291 † (0.180) [0.054]		-0.003 NS (0.193) [0.493]	0.006 NS (0.180) [0.486]	-0.076 NS (0.193) [0.347]		0.169 NS (0.181) [0.176]	0.119 NS (0.172) [0.245]	0.114 NS (0.195) [0.280]
Freq. of NTW self-initiated interptn					0.169 NS (0.185) [0.181]	0.210 NS (0.206) [0.155]		-0.038 NS (0.187) [0.419]	-0.014 NS (0.177) [0.468]	-0.187 NS (0.165) [0.129]		-0.227† (0.166) [0.087]	-0.161 NS (0.167) [0.168]	-0.158 NS (0.188) [0.201]
WTN interptn mgmt.	0.335 *** (0.065) [0.000]	0.256 ** (0.085) [0.002]	0.256 ** (0.083) [0.002]				-0.226 † (0.143) [0.058]	-0.168 NS (0.151) [0.134]	-0.128 NS (0.137) [0.176]	-0.147 NS (0.144) [0.154]	-0.288 ** (0.104) [0.003]	-0.188 * (0.104) [0.036]	-0.137 † (0.106) [0.099]	-0.156 NS (0.142) [0.137]
[quad.] Freq. of WTN self-initiated interptn														-0.158 NS (0.621) [0.399]
Freq. of WTN other-initiated interptn x WTN interptn mgmt.			0.034 NS (0.540) [0.474]						0.255 NS (0.609) [0.338]	0.225 NS (0.234) [0.169]			1.040 NS (1.102) [0.173]	0.914 NS (1.543) [0.277]
Freq. of WTN self-initiated interptn x WTN			-0.061 NS (0.414) [0.441]						-0.042 NS (0.618) [0.472]	-0.014 NS (0.465) [0.488]			-0.892 NS (0.696) [0.101]	-1.058 NS (1.387) [0.223]

interptn mgmt.														
[quad.] Freq. of WTN self-initiated interptn x WTN interptn mgmt.														0.321 NS (1.268) [0.400]
NTW interptn mgmt.				0.166 * (0.091) [0.035]	0.183 † (0.112) [0.052]	0.162 NS (1.248) [0.448]	-0.111 NS (0.187) [0.277]	-0.109 NS (0.155) [0.241]	-0.142 NS (1.470) [0.461]	-0.208 NS (1.446) [0.442]	0.039 NS (0.134) [0.385]	0.067 NS (0.127) [0.299]	0.046 NS (1.279) [0.485]	0.050 NS (1.211) [0.483]
[quad.] Freq. of NTW self-initiated interptn										-0.194 † (0.139) [0.083]				
Freq. of NTW other-initiated interptn x NTW interptn mgmt.						0.011 NS (0.139) [0.468]			-0.242 NS (0.202) [0.116]	-0.205 NS (0.182) [0.131]			-0.059 NS (0.141) [0.338]	-0.052 NS (0.149) [0.363]
Freq. of NTW self-initiated interptn x NTW inteptn mgmt.						-0.081 NS (1.294) [0.475]			-0.141 NS (1.482) [0.462]	-0.187 NS (1.417) [0.447]			-0.235 NS (1.224) [0.424]	-0.236 NS (1.173) [0.420]
[quad.] Freq. of NTW self-initiated interptn x NTW										-0.043 NS (0.135) [0.375]				

interptn mgmt.														
Work load	0.436 *** (0.078) [0.000]	0.351 *** (0.090) [0.000]	0.354 *** (0.090) [0.000]	0.111 NS (0.098) [0.130]	0.103 NS (0.101) [0.155]	0.094 NS (0.101) [0.177]	0.214 * (0.128) [0.048]	0.234 * (0.136) [0.044]	0.156 NS (0.126) [0.109]	0.130 NS (0.102) [0.102]	-0.147 † (0.108) [0.088]	-0.075 NS (0.128) [0.279]	-0.121 NS (0.118) [0.153]	-0.115 NS (0.129) [0.187]
Nonwork load	0.194 * (0.084) [0.011]	0.177 * (0.092) [0.028]	0.177 * (0.078) [0.012]	0.330 *** (0.098) [0.000]	0.376 *** (0.115) [0.000]	0.391 *** (0.120) [0.000]	-0.084 NS (0.153) [0.292]	-0.059 NS (0.140) [0.337]	-0.015 NS (0.120) [0.450]	0.014 NS (0.119) [0.453]	-0.185 * (0.109) [0.046]	-0.166 † (0.108) [0.063]	-0.131 NS (0.103) [0.103]	-0.129 NS (0.113) [0.128]
R-square	48.0%	51.9%	52.1%	18.7%	21.0%	21.3%	7.8%	9.8%	21.6%	24.7%	18.0%	25.3%	33.4%	33.8%
Δ R-square		3.9%	0.2%		2.3%	0.3%		2.0%	11.8%	3.1%		7.3%	8.1%	0.4%
F-value [p-value]		3.344* [0.03]	0.167 NS [0.84]		4.874** [0.00]	0.613 NS [0.54]		4.388 ** [0.001]	11.200 *** [0.000]	5.020 *** [0.001]		6.204 *** [0.001]	4.972 ** [0.001]	0.473 NS [0.62]

Path coefficient (standard error) [one-tailed p-value]
***p<0.001, ** p<0.01, *p<0.05, †<0.1, NS-non-significant.

Table B9 PLS Model Testing Results (WTN detection management)

WTN Detection Mgmt.	**WTN Conflict**		**Work Performance**		**Nonwork Performance**	
Freq. of WTN other-initiated interruptions	0.32 * (0.14) [0.012]	0.31 * (0.15) [0.021]	-0.30 † (0.19) [0.059]	-0.20 NS (0.17) [0.121]	-0.40 * (0.19) [0.019]	-0.34 * (0.17) [0.024]
Freq. of WTN self-initiated interruptions	-0.001 NS (0.10) [0.500]	0.01 NS (0.13) [0.469]	0.17 NS (0.16) [0.145]	0.06 NS (0.17) [0.362]	0.24 † (0.16) [0.068]	0.15 NS (0.17) [0.190]
Freq. of NTW other-initiated interruptions			0.06 NS (0.19) [0.376]	0.12 NS (0.18) [0.253]	0.17 NS (0.18) [0.173]	0.17 NS (0.19) [0.186]
Freq. of NTW self-initiated interruptions			-0.06 NS (0.16) [0.354]	-0.03 NS (0.16) [0.425]	-0.22 † (0.15) [0.073]	-0.16 NS (0.16) [0.160]
WTN detection mgmt.	0.02 NS (0.11) [0.428]	0.01 NS (0.09) [0.455]	0.28 NS (0.30) [0.176]	0.26 NS (0.28) [0.177]	-0.12 NS (0.19) [0.264]	-0.13 NS (0.18) [0.236]
Freq. of WTN other-initiated interruptions x WTN detection mgmt.		0.07 NS (0.15) [0.321]		0.08 NS (0.17) [0.319]		0.24 NS (0.21) [0.128]
Freq. of WTN self-initiated interruptions x WTN detection mgmt.		0.02 NS (0.11) [0.428]		-0.31 NS (0.31) [0.160]		-0.17 NS (0.20) [0.198]
Work load	0.41 *** (0.08) [0.000]	0.41 *** (0.10) [0.000]	0.17 NS (0.14) [0.114]	0.12 NS (0.15) [0.213]	-0.12 NS (0.14) [0.196]	-0.13 NS (0.13) [0.160]
Nonwork load	0.14 † (0.10) [0.082]	0.14 † (0.10) [0.082]	-0.03 NS (0.15) [0.420]	-0.07 NS (0.13) [0.295]	-0.15 NS (0.12) [0.107]	-0.16 † (0.11) [0.074]
R-square	46.6%	46.9%	12.0%	18.9%	21.3%	25.0%
Δ R-square		0.3%		6.9%		3.7%
F value [p-value]		0.26 NS [0.77]		14.60 *** [0.000]		5.92 *** [0.000]

Path coefficient (standard error) [one-tailed p-value]
***p<0.001 **p<0.01 *p<0.05 † p<0.1 NS – non-significant

Table B10 PLS Model Testing Results (WTN response management)

WTN Response Mgmt.	**WTN Conflict**		**Work Performance**		**Nonwork Performance**	
Freq. of WTN other-initiated interruptions	0.31 * (0.15) [0.021]	0.28 * (0.15) [0.032]	-0.25 † (0.19) [0.096]	-0.24 NS (0.19) [0.105]	-0.43 * (0.19) [0.013]	-0.42 * (0.19) [0.014]
Freq. of WTN self-initiated interruptions	-0.01 NS (0.11) [0.463]	-0.03 NS (0.12) [0.401]	0.16 NS (0.15) [0.144]	0.11 NS (0.16) [0.246]	0.24 † (0.17) [0.080]	0.25 † (0.17) [0.072]
Freq. of NTW other-initiated interruptions			0.01 NS (0.22) [0.481]	0.05 NS (0.19) [0.396]	0.15 NS (0.18) [0.203]	0.18 NS (0.20) [0.185]
Freq. of NTW self-initiated interruptions			-0.04 NS (0.17) [0.407]	-0.06 NS (0.16) [0.354]	-0.21 NS (0.18) [0.123]	-0.23 NS (0.18) [0.102]
WTN response mgmt.	0.09 NS (0.11) [0.207]	0.08 NS (0.09) [0.188]	0.10 NS (0.18) [0.290]	0.08 NS (0.18) [0.328]	-0.07 NS (0.17) [0.340]	-0.11 NS (0.20) [0.291]
Freq. of WTN other-initiated interruptions x WTN response mgmt.		-0.05 NS (0.10) [0.309]		0.19 NS (0.19) [0.160]		0.10 NS (0.21) [0.317]
Freq. of WTN self-initiated interruptions x WTN response mgmt.		0.13 NS (0.13) [0.160]		-0.05 NS (0.17) [0.384]		0.11 NS (0.23) [0.316]
Work load	0.39 *** (0.11) [0.000]	0.42 *** (0.09) [0.000]	0.18 NS (0.15) [0.116]	0.19 NS (0.15) [0.104]	-0.11 NS (0.12) [0.181]	-0.12 NS (0.13) [0.179]
Nonwork load	0.16 † (0.11) [0.074]	0.15 † (0.10) [0.068]	-0.03 NS (0.14) [0.415]	-0.03 NS (0.13) [0.409]	-0.13 † (0.10) [0.098]	-0.13 † (0.10) [0.098]
R-square	47.3%	49.0%	5.6%	8.3%	20.6%	24.2%
Δ R-square		1.7%		2.7%		3.6%
F value [p-value]		1.42 NS [0.25]		13.01 *** [0.000]		5.95 ** [0.004]

Path coefficient (standard error) [one-tailed p-value]
***p<0.001 **p<0.01 *p<0.05 † p<0.1 NS – non-significant

Table B11 PLS Model Testing Results (NTW detection management)

NTW Detection Mgmt.	**NTW Conflict**		**Work Performance**		**Nonwork Performance**	
Freq. of NTW other-initiated interruptions	-0.25 † (0.17) [0.072]	-0.34 * (0.18) [0.031]	0.002 NS (0.19) [0.495]	-0.04 NS (0.18) [0.412]	0.16 NS (0.18) [0.188]	0.01 NS (0.18) [0.477]
Freq. of NTW self-initiated interruptions	0.18 NS (0.18) [0.160]	0.23 NS (0.19) [0.114]	-0.03 NS (0.18) [0.434]	-0.01 NS (0.18) [0.477]	-0.15 NS (0.15) [0.160]	-0.07 NS (0.16) [0.331]
Freq. of WTN other-initiated interruptions			-0.18 NS (0.19) [0.173]	-0.06 NS (0.16) [0.354]	-0.38 * (0.19) [0.024]	-0.27 † (0.18) [0.068]
Freq. of WTN self-initiated interruptions			0.15 NS (0.16) [0.175]	0.07 NS (0.15) [0.321]	0.20 NS (0.16) [0.107]	0.10 NS (0.16) [0.266]
NTW detection mgmt.	**0.20 *** (0.10) [0.000]**	**0.19 * (0.11) [0.043]**	**-0.21 † (0.14) [0.068]**	**-0.19 * (0.11) [0.043]**	**-0.23 * (0.10) [0.012]**	**-0.23 * (0.11) [0.019]**
Freq. of NTW other-initiated interruptions x NTW detection mgmt.		0.11 NS (0.14) [0.217]		0.21 NS (0.26) [0.210]		0.08 NS (0.19) [0.337]
Freq. of NTW self-initiated interruptions x NTW detection mgmt.		**-0.17* (0.10) [0.046]**		-0.27 NS (0.29) [0.177]		-0.27 NS (0.31) [0.193]
Nonwork load	0.40 *** (0.13) [0.001]	0.41 *** (0.14) [0.002]	-0.03 NS (0.14) [0.415]	0.002 NS (0.13) [0.493]	-0.12 NS (0.12) [0.160]	-0.07 NS (0.10) [0.242]
Work load	0.05 NS (0.11) [0.325]	0.05 NS (0.10) [0.309]	0.17 NS (0.16) [0.145]	0.11 NS (0.14) [0.217]	-0.16 NS (0.13) [0.111]	-0.19 * (0.11) [0.043]
R-square	21.8%	24.7%	9.1%	14.3%	24.9%	30.8%
Δ R-square		2.9%		5.2%		5.9%
F value [p-value]		4.81 * [0.01]		14.55 *** [0.000]		7.66 *** [0.000]

Path coefficient (standard error) [one-tailed p-value]
***p<0.001 **p<0.01 *p<0.05 † p<0.1 NS – non-significant

Table B12 PLS Model Testing Results (NTW response management)

NTW Response Mgmt.	**NTW Conflict**		**Work Performance**		**Nonwork Performance**	
Freq. of NTW other-initiated interruptions	-0.27 † (0.18) [0.068]	-0.30 * (0.17) [0.040]	-0.01 NS (0.19) [0.479]	-0.06 NS (0.17) [0.362]	0.19 NS (0.20) [0.172]	0.10 NS (0.15) [0.253]
Freq. of NTW self-initiated interruptions	0.16 NS (0.19) [0.201]	0.20 NS (0.17) [0.121]	-0.04 NS (0.16) [0.401]	0.04 NS (0.17) [0.407]	-0.25 † (0.16) [0.061]	-0.15 NS (0.14) [0.143]
Freq. of WTN other-initiated interruptions			-0.25 † (0.17) [0.072]	-0.14 NS (0.15) [0.176]	-0.42 * (0.19) [0.014]	-0.26 † (0.16) [0.054]
Freq. of WTN self-initiated interruptions			0.19 NS (0.17) [0.133]	0.11 NS (0.15) [0.232]	0.23 † (0.16) [0.077]	0.09 NS (0.15) [0.275]
NTW response mgmt.	**0.25 ** (0.10) [0.007]**	**0.21 * [0.10] [0.019]**	-0.13 NS (0.19) [0.247]	-0.15 NS (0.15) [0.160]	0.14 NS (0.18) [0.219]	0.11 NS (0.18) [0.271]
Freq. of NTW other-initiated interruptions x NTW response mgmt.		0.08 NS (0.11) [0.234]		0.20 NS (0.19] [0.147]		**0.23 * (0.12] [0.029]**
Freq. of NTW self-initiated interruptions x NTW response mgmt.		0.10 NS (0.18] [0.290]		0.20 NS (0.21] [0.171]		**0.28 * (0.12] [0.011]**
Nonwork load	0.45 *** (0.12] [0.000]	0.44 *** (0.12] [0.000]	-0.04 NS (0.14] [0.387]	-0.03 NS (0.13] [0.409]	-0.12 NS (0.11] [0.139]	-0.11 NS (0.10] [0.137]
Work load	-0.02 NS (0.12] [0.434]	-0.01 NS (0.10] [0.460]	0.22 † (0.14) [0.060]	0.18 NS (0.14) [0.101]	-0.14 NS (0.13) [0.142]	-0.19 * (0.11) [0.043]
R-square	24.5%	25.1%	6.6%	13.5%	22.0%	33.3%
Δ R-square		0.6%		6.9%		11.3%
F value [p-value]		0.98 NS [0.38]		20.44 *** [0.000]		13.57 *** [0.000]

Path coefficient (standard error) [one-tailed p-value]
***p<0.001 **p<0.01 *p<0.05 † p<0.1 NS – non-significant

Table B13 PLS Model Testing Results (mechanisms of WTN interruption management)

	WTN Conflict		**Work Performance**		**Nonwork Performance**	
Freq. of WTN other-initiated interruptions	0.39 ** (0.15) [0.005]	1.18 NS (1.45) [0.209]	-0.25 † (0.18) [0.084]	-0.74 NS (2.13) [0.364]	-0.39 * (0.20) [0.027]	-1.80 NS (2.12) [0.199]
Freq. of WTN self-initiated interruptions	0.01 NS (0.13) [0.469]	-0.48 NS (1.08) [0.328]	0.12 NS (0.19) [0.264]	0.41 NS (1.95) [0.416]	0.19 NS (0.18) [0.147]	1.13 NS (1.71) [0.255]
Freq. of NTW other-initiated interruptions			0.07 NS (0.19) [0.356]	0.05 NS (0.22) [0.410]	0.16 NS (0.18) [0.188]	0.09 NS (0.19) [0.318]
Freq. of NTW self-initiated interruptions			-0.08 NS (0.18) [0.328]	-0.04 NS (0.19) [0.416]	-0.22 † (0.16) [0.086]	-0.18 NS (0.16) [0.131]
WTN mechanisms [tech]	**-0.17 † (0.12) [0.080]**	**-0.16 † [0.12] [0.093]**	-0.19 NS (0.25) [0.224]	-0.18 NS [0.26] (0.245)	0.11 NS [0.13] (0.199)	0.12 NS [0.15] (0.213)
WTN mechanisms [social]	-0.02 NS [0.11] [0.428]	0.01 NS (0.11) [0.463]	0.01 NS (0.15) [0.473]	-0.05 NS (0.29) [0.431]	0.08 NS (0.11) [0.234]	0.04 NS (0.15) [0.395]
WTN mechanisms [self]	0.15 NS (0.15) [0.160]	0.17 NS (0.18) [0.173]	0.13 NS (0.15) [0.194]	0.21 † (0.17) [0.110]	0.11 NS (0.13) [0.199]	0.14 NS (0.15) [0.176]
Freq. of WTN other-initiated interruptions x WTN mechanisms [tech]		-17.56 NS (19.94) [0.191]		8.48 NS (20.05) [0.337]		-1.84 NS (24.83) [0.352]
Freq. of WTN self-initiated interruptions x WTN mechanisms [tech]		8.35 NS (30.236) [0.392]		-11.47 NS (31.98) [0.360]		33.30 NS (39.25) [0.199]
Freq. of WTN other-initiated interruptions x WTN mechanisms [social]		4.05 NS (9.07) [0.328]		-4.83 NS (12.07) [0.345]		-6.38 NS (13.15) [0.314]
Freq. of WTN self-initiated interruptions x WTN mechanisms [social]		0.54 NS (12.63) [0.418]		1.88 NS (16.43) [0.385]		4.10 NS (13.02) [0.377]
Freq. of WTN other-initiated interruptions x WTN mechanisms [self]		2.19 NS (12.74) [0.213]		4.36 NS (15.66) [0.221]		23.91 NS (18.08) [0.105]
Freq. of WTN self-initiated interruptions x WTN mechanisms [self]		8.35 NS (30.23) [0.392]		1.59 NS (27.74) [0.418]		-52.88 NS (37.49) [0.101]
Work load	0.35 *** (0.09) [0.000]	0.34 *** (0.09) [0.000]	0.21 † (0.13) [0.055]	0.21 (0.15) [0.082]	-0.12 NS (0.12) [0.160]	-0.11 NS (0.13) [0.199]

Nonwork load	0.12 † (0.09) [0.093]	0.10 NS (0.08) [0.107]	-0.08 NS (0.15) [0.297]	-0.07 NS (0.14) [0.309]	-0.14 NS (0.12) [0.123]	-0.07 NS (0.12) [0.280]
R-square	51.4%	54.6%	10.3%	13.6%	25.3%	33.3%
Δ R-square		3.2%		3.3%		8.0%
F value [p-value]		0.74 NS [0.619]		2.99 * [0.011]		2.96 * [0.012]

Path coefficient (standard error) [one-tailed p-value]
***p<0.001 **p<0.01 *p<0.05 † p<0.1 NS – non-significant

Table B14 PLS Model Testing Results (mechanisms of NTW interruption management)

	NTW Conflict		**Work Performance**		**Nonwork Performance**	
Freq. of NTW other-initiated interruptions	-0.27 † (0.18) [0.068]	-0.83 NS (1.08) [0.222]	0.03 NS (0.17) [0.430]	0.25 NS (1.30) [0.423]	0.19 NS (0.17) [0.133]	-0.02 NS (0.91) [0.491]
Freq. of NTW self-initiated interruptions	0.20 NS (0.18) [0.134]	0.32 NS (0.47) [0.248]	-0.20 NS (0.17) [0.121]	-0.09 NS (0.49) [0.427]	-0.23 † (0.15) [0.064]	-0.13 NS (0.41) [0.375]
Freq. of WTN other-initiated interruptions			-0.23 † (0.16) [0.077]	-0.19 NS (0.17) [0.133]	-0.43 ** (0.17) [0.006]	-0.33 * (0.19) [0.043]
Freq. of WTN self-initiated interruptions			0.22 † (0.16) [0.086]	0.18 NS (0.17) [0.146]	0.28 * (0.16) [0.041]	0.17 NS (0.17) [0.160]
NTW mechanisms [tech]	-0.05 NS (0.14) [0.360]	-0.13 NS (0.41) [0.375]	0.08 NS (0.17) [0.319]	0.06 NS (0.46) [0.448]	-0.05 NS (0.15) [0.369]	-0.13 NS (0.52) [0.401]
NTW mechanisms [social]	**-0.33 ** (0.12) [0.003]**	-0.12 NS (0.99) [0.451]	**0.32 ** (0.11) [0.002]**	0.23 NS (0.95) [0.404]	**0.33 ** (0.11) [0.001]**	0.39 NS (0.78) [0.309]
NTW mechanisms [self]	0.19 NS (0.16) [0.119]	0.15 NS (0.80) [0.425]	0.11 NS (0.16) [0.246]	0.12 NS (0.76) [0.437]	-0.04 NS (0.11) [0.358]	0.004 NS (0.76) [0.497]
Freq. of NTW other-initiated interruptions x NTW mechanisms [tech]		-9.19 NS (10.18) [0.185]		6.89 NS (14.06) [0.313]		-10.77 NS (11.77) [0.181]
Freq. of NTW self-initiated interruptions x NTW mechanisms [tech]		22.97 NS (41.66) [0.291]		-1.44 NS (26.46) [0.412]		16.93 NS (33.34) [0.306]
Freq. of NTW other-initiated interruptions x NTW mechanisms [social]		15.21 NS (11.52) [0.105]		-3.53 NS (13.13) [0.131]		13.12 NS (11.03) [0.119]
Freq. of NTW self-initiated interruptions x NTW mechanisms [social]		-21.82 NS (72.00) [0.381]		8.72 NS (62.51) [0.445]		-9.62 NS (49.52) [0.157]
Freq. of NTW other-initiated interruptions x NTW mechanisms [self]		-5.19 NS (11.03) [0.320]		-4.77 NS (12.58) [0.353]		-2.24 NS (9.63) [0.408]
Freq. of NTW self-initiated interruptions x NTW mechanisms [self]		-1.43 NS (55.85) [0.403]		-6.27 NS (54.05) [0.454]		-7.17 NS (47.24) [0.162]
Nonwork load	0.39 *** (0.11) [0.000]	0.46 *** (0.09) [0.000]	-0.13 NS (0.11) [0.120]	-0.02 NS (0.14) [0.443]	-0.12 NS (0.10) [0.116]	-0.08 NS (0.11) [0.234]

Work load	0.05 NS (0.10) [0.309]	0.05 NS (0.09) [0.290]	0.17 NS (0.14) [0.114]	0.18 NS (0.15) [0.116]	-0.15 NS (0.12) [0.107]	-0.16 † (0.12) [0.093]
R-square	28.8%	41.1%	19.1%	21.8%	29.5%	40.7%
Δ R-square		12.3%		2.7%		11.2%
F value [p-value]		3.79 ** [0.002]		1.53 NS [0.180]		3.39 ** [0.005]

Path coefficient (standard error) [one-tailed p-value]
***p<0.001 **p<0.01 *p<0.05 † p<0.1 NS – non-significant

B.6 Discussion and Conclusion

Our preliminary findings of the empirical study on the moderating effects of interruption management (at the aggregate level) show that the moderating effects were non-significant. This does not necessarily suggest the absence of moderating effects. However, the non-significant paths may be due to the fact that both interruption management and performance are captured at the aggregate level. For example, we examined the extent to which individuals engage in segmentation vs integration-oriented behaviors. Examining behaviors and mechanisms at a more granular level (as in what we present in our theoretical development) or at each stage separately, may yield different results. In fact, some significant moderating effects emerged from our analysis of the effects of NTW interruption management mechanisms by stage (i.e., detection and response management), particularly the extent to which individuals engage in NTW detection management and response management to segment or integrate non-work related interruptions into their work life. Integration-oriented NTW detection management significantly mitigates the negative effects of NTW self-initiated interruptions on NTW conflict; and NTW response management significantly enhances the positive effects of both NTW other- and self-initiated interruptions on nonwork performance.

We also explored interruption management effects by each of the three types of interruption management mechanisms developed in this study (technology-based, social-based, and self-discipline based). Findings of the study on the moderating effects of the frequency with which individuals used interruption management mechanisms show that the moderating effects are not significant, although some main effects are asymmetrically significant across work and personal life. This may suggest that frequency of engaging in a particular interruption management mechanism alone is not enough to influence the effects of interruptions on the

consequences, and calls for finer differentiation along additional dimensions in order to identify any moderating effects. Individuals may engage in different mechanisms at different stages of interruptions, and may use the same mechanism for different purposes (i.e., segmenting or integrating work and personal life). Therefore, the same mechanism may have different effects on the relationship between interruptions and their consequences – mixing these effects together may have the differences cancel each other out. However, a notable finding is that different mechanisms have different effects depending on the direction of the interruption. Social-based mechanisms significantly affect the consequences of NTW interruptions whereas technology-based and self-discipline based mechanisms significantly influence the consequences of WTN interruptions

B.6.1 Implications for Research

The study represents one of the first studies that systematically conceptualize interruption management by developing a theoretical framework. Studies that examine how knowledge workers try to use information communication technologies in a productive and healthy manner tend to focus on a single application (e.g., IM) or device (e.g., BlackBerry). Moreover, these studies allude to, but not explicitly investigate interruption management. It is important to consolidate the findings from various studies into an integrated framework that will inform future research and practice. Given the rapid development of technologies, it is critical that the framework can also generalize across technologies.

In particular, the theoretical framework discusses eight different behaviors of interruption management that may occur across the three stages (i.e., detection, interpretation, and integration). The study also identifies three categories of interruption management mechanisms –

based on technology, social norms, and self-discipline. Moreover, the framework differentiates between the management of other-initiated and self-initiated interruptions.

The research model developed in this study provides avenues for future research to theoretically extend or empirically test the conceptual model of interruption management. Future research can focus on developing scales for interruption management and empirically test the effects of interruption management behaviors and mechanisms. The effectiveness of different interruption management behaviors and mechanisms can be compared across the three stages. Our empirical study also provides some preliminary findings that detection management and response management significantly moderate effects of NTW interruptions on conflict and performance. This suggests the stage of interruption being an important dimension to differentiate the effects of interruption management mechanisms. Future research can also explore the domain-level consequences of these behaviors and mechanisms through diary study, and the task-level consequences through experiments. This will provide an in-depth understanding of how and why mechanisms have different effects across the stages. Moreover, additional studies are also needed to identify more interruption management mechanisms.

B.6.2 Implications for Design

Our study has important implications for technology designers. The growing prevalence of ubiquitous technologies that engender a great number of both other-initiated and self-initiated interruptions calls for a switch in focus for designers, from user interfaces that support self-initiated and controlled tasks to new ones that enable users to effectively *integrate* other-initiated tasks into the current sequence of tasks (McCrickard et al. 2003). However, most studies on interruption management focus on technology-based mechanisms during the *detection* stage. In particular, significant research efforts have been taken to examine the design of notifications and

alerts, primarily the *attentional* cues. This points to three major directions for future development.

First, technology features that contribute to interruption management during interpretation and integration with a focus on informational and content cues call for further development. Particularly, technologies that support multi-modal messages can be a powerful tool of integration management. Their ability to accept a message in one modality and deliver it in another enables individuals to circumvent the incompatible demands of an interruption and the ongoing task and attend to both concurrently using compatible channels (e.g., visual and auditory processing). Such technologies target content cues of an interruption, rather than attentional cues which are the focus of current design efforts. For example, emerging speech-to-text applications (such as ReQall that converts a voice mail into an email) deliver content of an interruption in a modality (i.e., text-based email, in the case of ReQall) different from the one in which the interruption is initiated (i.e., speech-based voice mail, in the case of ReQall). Moreover, convergent technology (e.g., BlackBerry) allows users to manage how information is accepted and sent (Mazmanian et al. 2006).

Second, technology features that speed up decision-making process of interruption management are highly desired. Integration of attentional and informational cues (e.g., customized ring tone of phones) represents an attempt in such direction, allowing individuals to detect and interpret an interruption simultaneously within a single step. Although some design attempts have been made, the abovementioned technology features have yet to become largely available across devices and applications, not to mention gaining popularity.

A third design implication is concerned with the boundary between work and personal life. Given technology-mediated interruptions as a growing threat to the boundary between work and personal life, users would welcome technology features that allow them to differentiate between work and personal communications, and thus to activate distinct interruption management mechanisms accordingly. The future trend of ultra mobility of communication devices will further exacerbate the blurred boundaries between work and personal life. The ability to separate work and personal interruptions can enable individuals to integrate or separate the domains of work and personal life as desired.

B.6.3 Implications for Practice

This research also has important implications for practice in terms of organizational and individual interventions. Interruption management is a socially constructed process, but related studies emphasize largely on the technology aspect. Therefore, mechanisms based on social norms and self-discipline need to be further understood, developed, and implemented. First, the study presents a set of interruption management tools to organizations and individuals. Second, this study also brings to the attention of organizations and individuals a multitude of factors that affect individuals' decision-making process of interruption management. Interest in interruption management has led to a proliferation of studies on technology features. This study also suggests design implications in the preceding section. However, effectiveness of such technology-based solutions depends on how they are appropriated into practices and are supported by organizational culture and social norms.

Although there is no mechanism that is predominantly used to manage interruptions, people report slightly more frequent use of mechanisms based on social norms and self-

discipline. This does not necessarily suggest that technology-based mechanisms are less useful in managing interruptions. On the contrary, these mechanisms hold great potential given the rapid advancement of technologies. This study examines three technology-based mechanisms (*i.e.*, turning on/off device, adjusting the volume/vibration, and using customized ring tone), which emerged from pre-survey interviews as the most frequently used features. They reflect the status quo in technology design, and also show that more can be done through technology-based interruption management mechanisms.