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E-MAIL INTERRUPTIONS AND INDIVIDUAL PERFORMANCE: IS THERE A SILVER LINING?[1]

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Interruption of work by e-mail and other communication technologies has become widespread and ubiquitous. However, our understanding of how such interruptions influence individual performance is limited. This paper distinguishes between two types of e-mail interruptions (incongruent and congruent) and draws upon action regulation theory and the computer-mediated communication literature to examine their direct and indirect effects on individual performance. Two empirical studies of sales professionals were conducted spanning different time frames: a survey study with 365 respondents and a diary study with 212 respondents. The results were consistent across the two studies, showing a negative indirect effect of exposure to incongruent interruptions (interruptions containing information that is not relevant to primary activities) through subjective workload, and a positive indirect effect of exposure to congruent interruptions (interruptions containing information that is relevant to primary activities) through mindfulness. The results differed across the two studies in terms of whether the effects were fully or partially mediated, and we discuss these differences using meta-inferences. Technology capabilities used during interruption episodes also had significant effects: rehearsing (fine-tuning responses to incoming messages) and reprocessing (reexamining received messages) were positively related to mindfulness, parallel communication (engaging in multiple e-mail conversations simultaneously) and leaving messages in the inbox were positively related to subjective workload, and deleting messages was negatively related to subjective workload. This study contributes to research by providing insights on the different paths that link e-mail interruptions to individual performance and by examining the effects of using capabilities of the interrupting technology (IT artifact) during interruption episodes. It also complements the experimental tradition that focuses on isolated interruptions. By shifting the level of analysis from specific interruption events to overall exposure to interruptions over time and from the laboratory to the workplace, our study provides realism and ecological validity.

Keywords: E-mail interruptions, individual performance, IT capabilities, action regulations, media synchronicity theory, survey study, diary study, PLS, linear mixed models, multilevel modeling

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The appendices for this paper are located in the "Online Supplements" section of the *MIS Quarterly*'s website (http://www.misq.org).

Introduction

While e-mail offers flexibility and enhances connectivity among people (Dennis et al. 2008), it can also be interruptive (Addas and Pinsonneault 2015; Cameron and Webster 2013; Gupta et al. 2013). For example, mobile e-mail devices enable push notifications and an always-on connectivity (Mazmanian et al. 2013), thereby creating Pavlovian-like stimuli eliciting immediate responses (Barley et al. 2011; Iqbal and Horvitz 2007; Mazmanian et al. 2013). E-mail can lead to addiction disorders and urges to interrupt oneself (Marulanda-Carter and Jackson 2012; Mazmanian et al. 2013). These behaviors can arise from personal compulsion (Russell et al. 2007), social pressures, and/or organizational expectations (Barley et al. 2011).

Research indicates that e-mail interruptions have important consequences on work. Information workers typically read e-mails every 15 minutes (Hair et al. 2007), average more than two hours a day attending to e-mails (Marulanda-Carter and Jackson 2012), and often get drawn into "chains of diversions" before resuming their primary tasks (Iqbal and Horvitz 2007). Attending to e-mails incurs recovery costs (i.e., the time it takes to resume work after an e-mail interruption) that typically last several minutes for each interruption (Jackson et al. 2003; Iqbal and Horvitz 2007). E-mails are also a key source of work-related stress (Barley et al. 2011).

Much research exists on the impact of IT-mediated interruptions (of which e-mail is a part). Most of the evidence is based on laboratory experiments that rely on a stimulus-based approach that treats interruptions as on-off stimuli and places emphasis on the characteristics of the interrupting events (e.g., presence, frequency, or duration of interruptions). These characteristics are said to affect performance directly (e.g., Adamczyk and Bailey 2004; Bailey and Konstan 2006; Speier et al. 1997). The stimulus-based approach provides important insights about the impact of interruptions on performance, but it has also yielded contradictory empirical evidence. The evidence suggests that interruptions both increase (e.g., Marulanda-Carter and Jackson 2012; McFarlane et al. 2002) and decrease (Mark et al. 2008; Zijlstra et al. 1999) task completion time and increase (Earley et al. 1990; Gluck et al. 2007) and decrease (Basoglu et al. 2009; Speier et al. 1997) task performance effectiveness. There have been some efforts to complement the stimulus-based approach by examining the informational content of interruptions, such as content similarity to (Gillie and Broadbent 1989) and relevance for (Czerwinski et al. 2000; Galluch et al. 2015) the main task. However, these studies have focused only on the direct effects of interruptions on either stress or the performance of an immediate task, and have examined a limited aspect of performance (i.e., task completion time).

This paper makes three contributions. First, we provide a nuanced treatment of e-mail interruptions. Drawing upon action regulation theory (ART), we study the effects of exposure to interruptions (a composite of frequency and duration) combined with the informational content of interruptions (disaggregating e-mail interruptions into congruent and incongruent). We examine the direct and mediated effects of exposure to e-mail interruptions on individual performance (rather than on a limited aspect of immediate task performance). Our nuanced treatment of e-mail interruptions enriches our understanding of their impact and uncovers the fine-grained mechanisms by which exposure to them can both directly and indirectly affect performance. As a result, our findings can help explain the mixed evidence of past research.

Second, we extend research by examining the capabilities of the interrupting technology, which have received scarce attention. Drawing on the computer-mediated communication (CMC) literature, we argue that how one uses key capabilities of e-mail during interruption episodes can affect the outcomes of one's exposure to interruptions. This contribution further enhances our understanding of e-mail interruptions and their impact.

Third, our study examines overall exposure to e-mail interruptions that occur in the work practice. Prior studies have mainly been conducted in laboratory settings and have examined the effects of single interruptions on individuals working on specific, isolated, and short-term experimental tasks. While this approach provides tight control and facilitates establishing causal relationships, it does not capture the richness of real-world settings. Our work complements the extant research by examining how being exposed to a series of interruptions over a certain period of time affects individual performance in a real workplace. Hence, by shifting the level of analysis from specific interruption events to overall exposure to interruptions over time and from the laboratory to the workplace, our study provides realism and ecological validity.

Our model was tested with two separate and complementary studies of sales professionals and managers. A survey study ($n = 365$) was conducted to test the main and mediated effects of exposure to incongruent and congruent e-mail interruptions on salespersons' weekly performance. In addition, 212 other respondents completed a diary study that measures e-mail interruptions and daily performance over two consecutive workdays. The diary study served to replicate the survey study and to extend it by examining the effects of the six e-mail capabilities that are used during interruption episodes. Our studies show that exposure to incongruent e-mail interruptions (i.e., interruptions with information that is not relevant to primary activities) is negatively associated with

individual performance both directly and indirectly through subjective workload. Furthermore, we show that exposure to congruent interruptions that are relevant or complementary to primary activities has a positive direct relationship with performance and indirect relationships that are both negative (through subjective workload) and positive (through mindfulness). We also show that six key capabilities of e-mail (reprocessing, rehearsing, communicating in parallel, foldering, leaving in the inbox, deleting) used during interruption episodes have positive and negative relationships with subjective workload and mindfulness.

In the following section, we describe the conceptual boundaries and synthesize key findings from the literature on technology-mediated interruptions. Next, we draw on ART and the CMC literature to develop the key parts of our model. We then present hypotheses that relate exposure to e-mail interruptions to individual performance. The methods are described next, followed by a presentation of the results, the discussion, and finally the contributions.

E-Mail Interruptions and Their Consequences

Study Boundaries and Conceptualizations

We define e-mail interruptions as externally triggered temporary suspensions of an individual's primary task activities to process the content of one or more incoming e-mail messages (Jett and George 2003; Speier et al. 1997; see Appendix A for definitions of the key constructs). Primary activities represent the core work tasks for which individuals are responsible (Iqbal and Horvitz 2007).[2] Processing e-mail content involves channeling cognitive attention and typically includes reading one or more messages, responding by writing back or forwarding, and/or executing actions called for by the message(s).[3]

Rather than concentrating on a specific e-mail interruption episode, we focus on individuals' overall exposure to interruptions over the course of their work (i.e., across multiple interruption episodes). Each episode begins when an individual's primary activities are suspended to process incoming e-mail and ends with the resumption of primary activities. During a given interruption episode, individuals may process a message entirely or partially (e.g., by skimming it), process it several times (e.g., first by replying, then by executing actions called for by the message), or process several messages. This means that resuming primary activities does not necessarily imply full completion of the interruption task. For example, an interrupting e-mail may have been read without reply because of pending information, and it may interrupt again in the future once the information becomes available. Stated differently, interrupting e-mails often do not involve one-shot processing but rather several intermittent interactions to complete some tasks (Whittaker et al. 2011).

We distinguish between two types of e-mail interruptions based on the informational content of the interrupting messages and its relevance to primary activities. Incongruent e-mail interruptions provide or request information or actions that are not relevant to, and that divert attention away from, primary activities (Appendix A). These messages might relate to secondary work activities (i.e., noncore work), extra-role activities (e.g., helping a colleague with a work-related issue), or activities that are unrelated to work (e.g., a message regarding a family event). While incongruent interruptions are not relevant for primary activities, they are not necessarily unimportant for one's work. For example, for a salesperson whose primary activities constitute new sales generation, an e-mail requesting information to invoice a customer for a previously delivered service is an incongruent interruption. This interruption is not directly relevant for generating new sales and may disrupt the effective performance thereof, yet it might still be part of the overall work with which the salesperson is involved (secondary activities).

By contrast, congruent e-mail interruptions contain relevant and key information (e.g., for a salesperson, information about a prospective customer's needs), reveal discrepancies (e.g., a problem with an ongoing sales pitch), or request actions that are pertinent to performing one's primary activities (e.g., a request for new features in a product). Congruent interruptions often motivate behavioral changes and adjustments (Addas and Pinsonneault 2015; Jett and George 2003). Our conceptualization excludes messages that are relevant, but have no bearing on performing primary activities (e.g., a message confirming a meeting about task-related issues). In other words, we focus on messages for which core task-related problems might be solved (e.g., addressing a prospec-

[2]Our conceptualization of primary activities differs from prior research on interruptions. In the past, the emphasis was only on a focal task being interrupted. In our case, our notion of primary activities is broader and includes the entire set of activities that are part of one's work responsibility. As a result of our broader focus, we treat interruptions not as discrete events, but rather as episodes that extend over time and span multiple activities. That is, we are not looking at a single immediate task being interrupted but rather at how individuals are exposed to interruption episodes over the course of their work.

[3]Processing messages can occur within the e-mail medium or across other media as well (e.g., accessing a video link in an e-mail).

tive customer's complaint) or decisions made (e.g., selecting a pricing method).[4]

Our target construct of interest, individual performance, can be conceptualized at various levels of specificity and temporal scales. At one end is micro-level task performance, which reflects a single behavioral episode of performance on a specific, isolated, and immediate (short-term) task. To date, most interruptions research conceptualizes performance at that level. At the other end is job performance, which is at a more aggregate level and longer term in nature. Job performance includes aggregate-level task performance—also known as in-role performance (i.e., behaviors that contribute to the organization's technical core)—and contextual performance (i.e., behaviors that support the organizational, social, or psychological environment; Sonnentag and Frese 2002). Since we examine exposure to interruptions as individuals perform their ongoing work activities, our conceptualization of individual performance focuses on aggregate task performance (in-role performance). We exclude contextual performance because it does not contribute to the technical core. We define individual performance as the aggregated value of the behaviors that an individual performs on their core work tasks over a given interval of time. Our conceptualization of individual performance is situated at an intermediate level of specificity and temporal scale between micro-level task performance and macro-level job performance.

Impact of IT-Mediated Interruptions

Given the limited research on e-mail interruptions, we examine the broader literature on the impact of IT-mediated interruptions (e-mail, instant messaging, customized PC pop-up messages) to inform our study. Appendix B summarizes the empirical results and groups the studies by whether they focused on incongruent or congruent interruptions. Since most studies treated interruptions as stimuli and did not consider their informational content, this grouping was—unless explicitly addressed in the study—based on our analysis. Further, we report on the two most frequently examined outcomes of interruptions: emotional/cognitive load (subjective workload) and task performance (efficiency and effectiveness).

We make four observations based on Appendix B. First, most studies examined the direct effects of interruption properties such as frequency or duration on outcome variables that are related to performing an immediate task—for example, cognitive load (Adamczyk and Bailey 2004), task resumption or completion time (Monk et al. 2008), task-related errors (Bailey and Konstan 2006), and memory lapses (e.g., Dodhia and Dismukes 2009).

Second, classifying prior studies as to whether they examined incongruent or congruent interruptions helps to make sense of the apparent conflicting evidence. Our review suggests that incongruent interruptions were associated with increased emotional/cognitive load (Adamczyk and Bailey 2004; Bailey and Konstan 2006). Further, they were consistently associated with lower performance effectiveness, such as higher error rates (Basoglu et al. 2009; Kapitsa and Blinnikova 2003; McFarlane 2002), lower memory accuracy (Arroyo and Selker 2003; Dodhia and Dismukes 2009), and lower output quality (Gupta et al. 2013; Speier et al. 1997). The bulk of the evidence also indicates that incongruent interruptions are linked to longer primary task resumption lags and longer task completion times (Bailey and Konstan 2006; McFarlane 2002; Speier et al. 1997).

In general, while congruent interruptions were related to higher subjective workload (Szalma et al. 2006), they did not negatively affect performance efficiency (Czerwinski et al. 2000) and were positively associated with performance effectiveness in terms of better decision-making performance (Earley et al. 1990), greater sensitivity to errors (Szalma et al. 2006), higher perceived performance (Ang et al. 1993), and better learning (Robertson et al. 2004).[5] Thus, our examination of prior studies using the concepts of incongruent/congruent interruptions helps to explain the mixed evidence of past research and provides preliminary support to a fundamental premise of this paper that these two types of interruptions might affect performance differently.

Third, most past research on the impact of interruptions is based on experiments conducted in laboratory settings and focuses on micro-level interruptions, brief exposures (sometimes measured in seconds), and performance of an immediate task over a relatively short period of time (i.e., duration of an experiment). Laboratory experiments provide strong evidence of causal relationships but can only achieve a limited amount of the realism that is needed to fully understand the impact of IT-induced interruptions.

Indeed, studies that looked at cumulative exposure to inter-

[4]Our conceptualization of congruent interruptions draws on Jett and George's (2003) discrepancy interruptions and on the feedback interventions literature (Ilgen et al. 1979; Kluger and De Nisi 1996), which defines interventions in a broader sense by including discrepancies and other task-related information or directives that help individuals perform their activities.

[5]Of note, many studies classified as congruent interruptions did not conceptualize these events as interruptions but rather as feedback discrepancies (that nevertheless interrupted individuals; e.g., Ang et al. 1993; Earley et al. 1990; Szalma et al. 2006).

ruptions over time in actual workplace settings found evidence of negative effects extending beyond the level of immediate task performance (Addas and Pinsonneault 2015; Baethge and Rigotti 2013; Grebner et al. 2003). The evidence also suggests that cumulative exposure produces effects that are difficult to capture in a laboratory experiment. For instance, e-mails were found to create chains of diversions that made it difficult for information workers to resume their work and harmed their performance (Iqbal and Horvitz 2007). In addition, there is evidence of a carryover effect that amplified the impact of interruptions occurring in series. Research shows that tripling the number of interruptions increased task resumption time eightfold (Zijlstra et al. 1999). Our study extends past research by examining the effects of cumulative exposure to IT-induced interruptions in real-world settings and therefore enriches our understanding of this important phenomenon.

Fourth, there are only a limited number of studies that have examined the impact of technology characteristics and those that did, focused on features that were used outside of interruption episodes. For instance, some studies focused on features used before (multimodal notification cues; Arroyo and Selker 2003) or after (post-interruption cues; Trafton et al. 2005) interruption episodes. Others focused on cross-media effects, but did not theorize within-media differences (Mark et al. 2008; Nagata 2006). We extend this literature by examining the effects of six key capabilities of e-mail that are used during interruption episodes.

In sum, a more nuanced treatment of interruptions can shed more light on their differential effects. Incongruent and congruent interruptions seem to have common but also different effects on individual performance, yet we do not know the mechanisms responsible for these differences. Further, the literature focuses mostly on micro-task performance in laboratory settings. We also need to study the effects of exposure to interruptions in the workplace to complement and enrich our understanding of the phenomenon. Finally, little is known on the role played by the technology as used during interruption episodes. Below, we address these issues by drawing upon action regulation theory (ART) and the CMC literature.

Theoretical Development

Action Regulation Theory

Action regulation theory (ART) is a theory of self-regulated, goal-directed behavior that is widely used in work psychology and as a theory of interruptions (Baethge and Rigotti 2013; Russell et al. 2007; Zijlstra et al. 1999). In contrast to other theories that view interruptions as isolated events affecting immediate (or short-term) task performance (e.g., distraction conflict theory; Speier et al. 1997), ART has a broader focus that treats interruptions as general work stressors affecting the accomplishment of actions on longer-term aggregate tasks (Hacker 2003). ART is concerned with how people constantly regulate their actions by adjusting them to external conditions. It conceptualizes action regulation in terms of sequential phases (setting goals; selecting action plans; executing actions; monitoring and obtaining feedback) and hierarchical levels or modes of control (automatized; knowledge-based; conscious/mindful).

ART stipulates that, for each action that is planned or executed, individuals mobilize cognitive resources and their performances increase to the extent that individuals can successfully regulate their actions toward achieving their goals (Frese and Zapf 1994; Raabe et al. 2007). Performance typically decreases when individuals cannot adequately perform such self-regulation. Goal achievement is facilitated or hindered based on environmental variables and personal characteristics that influence the cognitive regulation of action.

ART offers two insights that are central to our theorizing. First, ART treats interruptions as overall job stressors that impede action regulation. Interruptions are considered a form of regulation obstacles. They are stimuli in the work environment representing daily hassles (Frese and Zapf 1994) that hinder action regulation and thus goal achievement. Interruptions (and other regulation obstacles) increase stress and cognitive load (Baethge and Rigotti 2013) since they disrupt action flow and require expending additional effort (e.g., repeating steps) or the use of risky actions (e.g., dropping or rushing steps) to achieve the goal (Frese and Zapf 1994). Interruptions also hinder action regulation and goal accomplishment, which affects individual performance. Interruptions can influence both action preparation (e.g., through interfering with the generation of new action plans and/or the retrieval of existing plans from memory) and action execution (e.g., through committing errors) (Frese and Zapf 1994; Zijlstra et al. 1999). Further, ART suggests that the stress created by interruptions and other regulation problems increases errors and reduces performance efficiency (Frese and Zapf 1994).

Second, ART specifies the role of task-relevant feedback as a trigger for mindful processing and regulating of actions. It identifies three task-oriented, hierarchically organized modes of cognitive processing (Frese and Zapf 1994; Hacker 2003). The first mode, automatized processing, functions at the lowest level and is used to regulate specific and routinized tasks. This mode is the least effortful but also the least effec-

tive for modifying plans. The second mode, knowledge-based processing, operates at an intermediate processing level and is used to regulate well-trained schematic action patterns. In this mode, individuals can pull ready-made plans from their memories and tweak them to apply them to a new situation. According to Frese (2007), automatized processing and knowledge-based processing are subsumed under Langer's (1989) concept of mindlessness. The third mode is conscious or mindful processing, which is used for analyzing and synthesizing new task information (Frese 2007; Frese and Zapf 1994). In this mode, individuals display a conscious task-oriented awareness of their actions and their contexts. They reflect on the situation and on their own strategies, deliberate actively over their actions, analyze the situation as a whole system, consider multiple perspectives and possibilities for action, and work out alternative solutions (Hacker 2003).[6]

ART suggests that individuals constantly monitor their progress and use task-relevant information to regulate their actions and adjust their strategies (Frese and Zapf 1994). Task-relevant information may originate internally or from other people in the work environment (e.g., coworkers, managers, or other stakeholders). It includes opportunities for new goals, discrepant feedback, and other relevant information on work activities (Frese 2007; Raabe et al. 2007).

ART stipulates that, while actions are frequently regulated using the automatized and knowledge-based modes that rely on well-practiced routines and are less effortful, receiving relevant information and feedback can trigger a switch to the mindful processing mode. Actions become regulated through mindful processing when the feedback received reveals barriers (e.g., challenging problems; discrepancies) or opportunities (e.g., new goals; new task information) that are relevant to one's work activities (Frese 2007). In such situations, mindful processing is more effective than automatized processing because it allows individuals to better analyze and synthesize the new information and to change action plans as needed. Mindful processing is optimal for nonroutine activities and enables individuals to more effectively regulate their actions when receiving novel or discrepant task information. The mindful mode creates opportunities for learning and motivates and guides people toward improving their performance (Frese and Zapf 1994; Roe 1999). Research in cognitive psychology and organizational science suggests that interruptions generating new task information or revealing discrepancies (i.e., congruent interruptions) break routinized behaviors and lead individuals to switch to mindful processing (Jett and George 2003; Louis and Sutton 1991).

E-Mail Capabilities Used During Interruption Episodes

ART also suggests that the technology plays an important role in supporting or hindering action regulation. Technology increases transparency and predictability and acts as an external source for action regulation, which can relieve mental demands (Zapf 1993), spur mindful processing (Hacker 2003), and enhance task completion by overcoming the negative effects of interruptions (Frese and Zapf 1994). Others suggest that technology can be a source of regulation problems because it may provide deficient information or have functionality issues (Frese and Zapf 1994). While ART identifies technology as potentially important for understanding action regulation and interruptions in the workplace, the actual role of technology has been under-theorized. Specifically, little attention has been given to how the use of particular capabilities during interruption episodes can affect action regulation and individual performance.

We complement and augment ART by drawing upon two streams of research from the CMC literature: Dennis et al.'s (2008) media synchronicity theory with its focus on capabilities related to how messages are communicated among individuals, and e-mail management research with its focus on capabilities about how messages are organized. Media synchronicity theory identifies five key media capabilities that influence performance outcomes: parallelism (the number of simultaneous transmissions that can effectively take place), rehearsability (the extent to which a medium enables a sender to rehearse or fine tune a message during encoding, before sending), reprocessability (the extent to which a medium enables a message to be reexamined or processed again, during decoding, either within the context of a communication event or after the event has passed), transmission velocity (the speed at which a medium can deliver a message to intended recipients), and symbol sets (the number of ways in which a medium allows information to be encoded for communication). These five capabilities are posited to influence synchronicity in different ways and to ultimately affect performance through interaction with task and individual characteristics.

Further, studies on e-mail management have identified four main capabilities that allow individuals working in stressful and interruption-rich environments to organize their messages: leaving messages in the inbox (Barley et al. 2011; Russell et al. 2007), deleting messages (Dabbish and Kraut 2006), and assigning messages to either a folder (foldering) or an archive (archiving) (Ducheneaut and Watts 2005; Whit-

[6]While this mode is usually referred to as conscious processing, Frese (2007) argued that it is essentially equivalent to Langer's (1989) concept of mindfulness. In the present paper, we use the term mindfulness because it more carefully captures the meaning of this concept and reflects that individuals are not only aware of their tasks but also of the broader context of their activities.

taker et al. 2011). Leaving and foldering messages were both found to lead to cognitive overload (e.g., Dabbish and Kraut 2006; Russell et al. 2007), whereas deleting messages was related to decreased levels of stress and cognitive load (Barley et al. 2011).

Drawing upon these insights but adapting them to a user-centric perspective (focusing on user actions), we propose six e-mail capabilities that represent different actions taken by individuals to process, transmit, and organize their messages while dealing with e-mail interruptions: reprocessing, rehearsing, communicating in parallel, leaving in inbox, deleting, and foldering. Rather than treating them as potential structures for action provided by the medium (e.g., Dennis et al. 2008), we consider the extent to which these capabilities are actually used during interruption episodes. Being user-centric, rather than fixed properties of media, these six e-mail capabilities can be adapted and applied differently across individuals and situations (Barry and Fulmer 2004). Two capabilities from media synchronicity theory were excluded because they are structurally fixed by the medium (transmission velocity) or are relatively invariant across users (symbol sets).[7]

In sum, ART provides a useful lens owing to its broad focus that allows us to examine the effects of individuals' exposure to interruptions over the course of their work and its emphasis on the role of new task information and feedback as a trigger for mindful processing (which enables us to distinguish the information-based effects of interruptions). When combined with the notion of e-mail capabilities that we derive from the CMC literature, this theoretical perspective enables us to identify and tie together the main elements of our e-mail interruptions model presented next.

Hypotheses Development

Our model (Figure 1) hypothesizes links between e-mail interruptions exposure (i.e., a composite of interruptions frequency and duration, Baethge et al. 2014; Stutts et al. 2005) and individual performance. The model proposes that exposure to incongruent e-mail interruptions is negatively related to individual performance both directly and via subjective workload. Further, exposure to congruent e-mail interruptions has negative performance effects through subjective workload and positive performance effects directly and through mindfulness. The model also suggests positive and negative effects of e-mail capabilities used during interruption episodes.

[7]We also excluded capabilities that occur across media (e.g., Mark et al. 2008; Nagata 2006) and those that are deployed outside of interruption episodes, such as notification alerts that occur before suspension of primary activities (Iqbal and Horvitz 2007).

Incongruent/Congruent E-Mail Interruptions, Subjective Workload, and Performance

ART considers that all interruptions are disruptive stimuli existing in the work environment that negatively affect cognitive regulation and performance on the job. When interrupted, individuals often react by lowering their performance standards by dropping steps or taking shortcuts (Frese and Zapf 1994; Zijlstra et al. 1999). This behavior will likely decrease performance, especially its effectiveness (e.g., output quality). While people can work more efficiently by taking shortcuts, the high resumption costs of interruptions—especially incongruent ones—are likely to cancel gains in efficiency (see Appendix B). These resumption costs are expected to multiply when individuals are continuously exposed to interruptions (Baethge et al. 2014). Time loss is also likely to occur because individuals often have to remember and repeat steps in their primary activities when they resume them. With repeated exposure, there is also a higher chance that some interruptions will occur at early phases of action regulation, before plans are activated in working memory, making it difficult to remember the interrupted activities. Interrupting at early phases may lead individuals to start their action plans over. In fact, the evidence suggests that there is a carryover efficiency cost of multiple interruptions (Mark et al. 2008; Zijlstra et al. 1999).

The negative impact of interruptions can be either reinforced or countered, depending on whether they contain irrelevant or relevant information about the primary activities. On one hand, with every exposure to incongruent interruptions, individuals are compelled to create a new problem state that distracts attention from primary activities (Salvucci and Bogunovich 2010). Performance will therefore likely suffer. On the other hand, exposure to congruent interruptions yields an informational gain that enables individuals to optimize their decision making and to increase their goal determination (Addas and Pinsonneault 2015; Raabe et al. 2007). One study found that exposure to feedback interventions twice daily improved the motivation and goal accomplishment of university admissions employees (Wilk and Redmon 1990). Congruent interruptions can help individuals find solutions to task problems, adjust their actions, and commit fewer errors, thereby increasing performance (Baethge et al. 2014). Accordingly,

H1: Exposure to incongruent e-mail interruptions is negatively related to individual performance.

H2: Exposure to congruent e-mail interruptions is positively related to individual performance.

Another common response to interruptions, other than lowering performance standards, is to mobilize additional

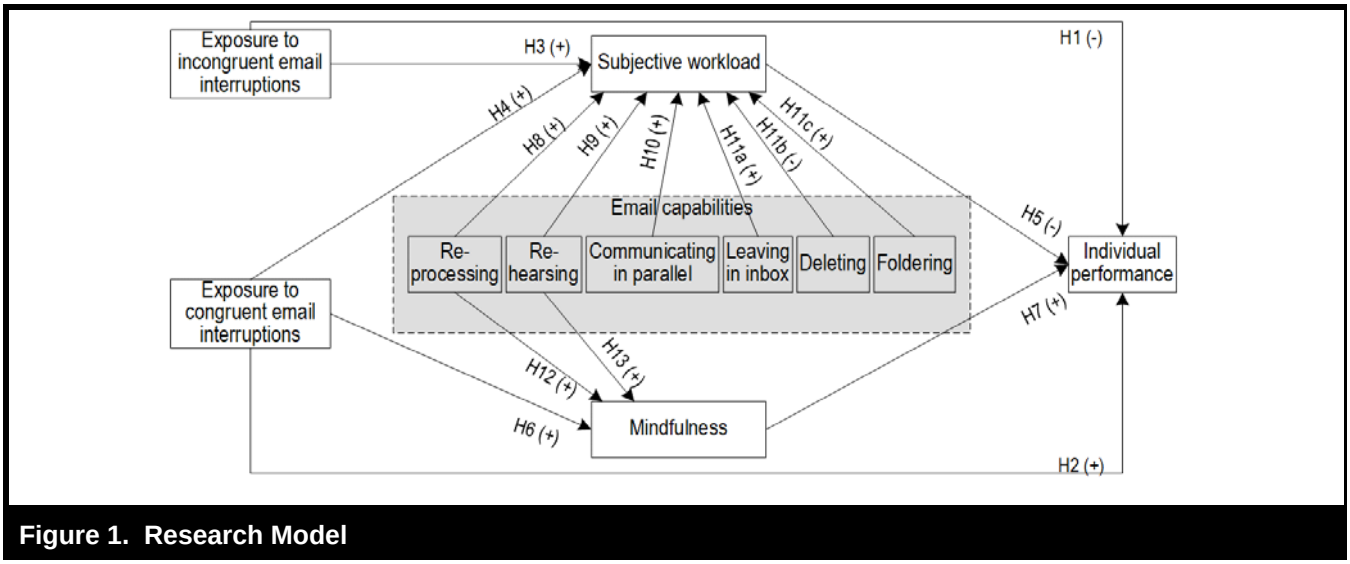


Figure 1. Research Model

cognitive resources to overcome the regulation obstacles, such as by working more intensely (Frese and Zapf 1994; Zijlstra et al. 1999). However, we argue that with repeated exposure to interruptions, this approach will increase subjective workload leading to lower performance. Research suggests that, with continuous exposure, mobilizing additional resources increases cognitive load substantially with little opportunity to replenish these resources (Zohar 1999). Thus, individuals will experience increased levels of stress, fatigue, and cognitive/emotional load (Baethge et al. 2014; Zohar 1999).

Indeed, repeated exposure to interruptions requires significant levels of mental regulation and attention shifting. Each new interruption requires storing and retrieving information in memory about action processes (e.g., goal states; plans; action rules) and their relationships (e.g., the order of actions; regulating the points at which activities stop and resume) (Frese and Zapf 1994). With cumulative interruptions, individuals must perform complex patterns of attending to multiple (and sometimes nested) interrupting stimuli, defining goals and subgoals for such interruptions, scheduling and prioritizing interruptions and primary activities, switching to the interruptions and back, and executing the interruptions while recalling, resuming, and regulating several repeatedly interrupted activities despite decaying memory cues. Because e-mail interruptions mean that individuals are often drawn to chains of diversions in which they attend to and juggle several activities within multiple interruption episodes (Iqbal and Horvitz 2007), such diversions complicate the relationships between action processes and further exacerbate subjective workload. Empirical results show that repeated exposure to interruptions is associated with several aspects of subjective workload—such as time pressure (Baethge and Rigotti 2013), irritation (Grebner et al. 2003; Zapf 1993), negative mood (Zohar 1999)—and with overall subjective workload (Baethge and Rigotti 2013; Zohar 1999).

We expect that both incongruent and congruent interruptions will be positively related to subjective workload. Galluch et al. (2015) found that incongruent interruptions that conflict with primary task requirements pull from a different cognitive sphere and compel individuals to sort through ambiguous and irrelevant sources of information. Consequently, these individuals experienced cognitive overload and strain. Similarly, continuous exposure to congruent e-mail interruptions can overwhelm individuals with new task-relevant information. For instance, sales literature suggests that salespersons who are exposed to a substantial number of e-mail interruptions about products, customers, and selling techniques experience information overload (Hunter and Goebel 2008). Subjective workload will also increase when the interruptions evoke corrective actions that lead individuals to fix discrepancies in their work, especially when time pressure is high (Kluger and DeNisi 1996). Finally, exposure to congruent interruptions can increase stress and negative emotional reactions when such interruptions contain negative feedback about an individual's performance (Ilgen et al. 1979; Szalma et al. 2006).[8] We thus propose:

H3: Exposure to incongruent e-mail interruptions is positively related to subjective workload.

[8]Galluch et al. (2015) suggest that task-relevant interruptions can reduce stress but this effect is limited to one aspect of perceived stress—namely, conflict in task requirements—and does not extend to their other stress dimension, perceived overload.

H4: Exposure to congruent e-mail interruptions is positively related to subjective workload.

There is ample evidence suggesting that subjective workload is negatively related to individual performance. Subjective workload is associated with fatigue and fatigue after-effects, which reduce performance (Baethge et al. 2014; Robert and Hockey 1997). In these situations, research indicates that individuals may take riskier actions (neglecting steps; taking shortcuts), which can also degrade performance (Frese and Zapf 1994; Hacker 2003). Subjective workload has been found to make people forget elements of their interrupted activities (Baethge and Rigotti 2013), reduce work productivity and accuracy (Kühnel et al. 2012), and increase errors (Eyrolle and Cellier 2000) and cognitive failures (Wallace and Chen 2005). Adler and Benbunan-Fich (2012) found that increased cognitive load from task switching leads to a decrease in performance quality and efficiency. Thus, we hypothesize:

H5: Subjective workload is negatively related to individual performance.

Congruent E-Mail Interruptions, Mindfulness, and Performance

Exposure to congruent interruptions is expected to be positively related to performance through mindfulness. As discussed earlier, ART stipulates that task-relevant information and feedback trigger a switch to mindful processing (Frese 2007), and this effect is supported in other streams of literature (e.g., Jett and George 2003; Louis and Sutton 1991). Receiving information revealing opportunities or discrepancies about primary activities compels individuals to break their routinized behaviors and enter into an active processing mode that is characterized by being better sensitized to the task environment, asking more questions, exploring different alternatives, and becoming open to new strategies (Frese and Zapf 1994; Hacker 2003). In short, task-relevant information activates the conscious or "mindful" regulation mode (Frese 2007).

Exposure to congruent interruptions can provide the external cues that trigger mindful processing. Individuals use these cues to construct new categories of their environments and make necessary adaptations based on the feedback. Indeed, research suggests that task-relevant events, such as explicit questioning by others or performance reviews, can interrupt ordinary processing and motivate individuals to switch to mindful processing modes (Jett and George 2003; Langer 1989; Louis and Sutton 1991). One study of team problem-solving, for example, found that congruent interruptions prompting discussions of task strategy and interpersonal issues shifted team members to more mindful problem-solving (Woolley 1998). We hypothesize:

H6: Exposure to congruent e-mail interruptions is positively related to mindfulness.

Mindful processing triggered by exposure to congruent interruptions will be related to higher individual performance. ART suggests that individuals who process their activities at deep conscious levels are more actively oriented to their tasks and actions, become more sensitive to performance abnormalities, leverage feedback in their work, and generally perform more efficiently and effectively (Frese and Zapf 1994). Others have shown that goal setting interventions are positively related to both micro-level and aggregate task performance because they arouse interest, stimulate discovery, and facilitate usage of task-relevant knowledge and strategies (Locke and Latham 2002). Further, goal setting interventions were found to improve performance by triggering on-task thoughts (Dimitrova et al. 2015) and active seeking of explanations for errors (Robertson et al. 2004). These mechanisms are functionally similar to the concept of mindfulness in ART. The mindful state enables individuals to improve their action regulation, such as by changing their plans or developing new plans based on the incoming information. Through mindfulness, individuals can resolve areas of discrepancy, apply corrective actions, and explore new goal-related opportunities. Therefore, we hypothesize:

H7: Mindfulness is positively related to individual performance.

E-Mail Capabilities, Subjective Workload, and Mindfulness

ART suggests that communication technologies can both facilitate and constrain the tasks being performed and the regulation of cognitive actions. Similarly, we hypothesize that some technological capabilities used during interruption episodes will have both positive and negative links with subjective workload and mindfulness. Media synchronicity and the CMC literature allow us to make the following eight hypotheses.

We expect reprocessing—the extent to which an individual reexamines or processes e-mail messages (their own or those received from others) again during interruption episodes (see Appendix A)—to be positively related to subjective workload. Reprocessing messages incurs cognitive costs associated with message (re)reading, understanding, and sensemaking (Clark and Brennan 1991; Tang et al. 2013). Individuals not only reprocess the content of messages but must also remember

their broader context. In one study, recruiters using e-mail-based interviews reported high stress levels owing to the substantial cognitive demands of reprocessing and interpreting the messages with few behavioral cues available (Giordano et al. 2010). Reprocessing can also lead to processing more information related to the messages, such as by accessing web links or documents attached to messages (Robert and Dennis 2005). Since reprocessing occurs within the context of interruption episodes, where cognitive resources are already stretched, it is likely to heighten cognitive load. Also, reprocessing can aggravate time pressure (temporal dimension of subjective workload) as people take longer to review and deliberate on their messages.

H8: Reprocessing is positively related to subjective workload.

We expect that rehearsing—the extent to which an e-mail recipient fine-tunes their responses to incoming messages during interruption episodes before sending the responses (Appendix A)—will positively relate to subjective workload as a result of the efforts needed to (re)formulate messages, especially with messages concerning complex or new situations (Clark and Brennan 1991). Rehearsing consumes significant time and cognitive resources to plan, edit, and review the intended messages, and to tailor them to specific audiences (Walther 2007). Individuals also leverage this "editability" of e-mail by spending considerable energy on carefully crafting their messages in an effort to enhance self-presentation (Walther 2007). Such actions are more detrimental when they occur during interruption episodes, since this means that the cognitive load of message construction is not divided across other moments (Duthler 2006), such as during lulls of activity. Rehearsing may also be related to increased temporal load as a result of pressure arising from delayed message transmission (Clark and Brennan 1991). Accordingly,

H9: Rehearsing is positively related to subjective workload.

Communicating in parallel represents the extent to which an individual engages in multiple e-mail conversations simultaneously (i.e., within some given interruption episode). It comprises two conversational patterns: simultaneous receipt or transmission of messages with multiple people and the interleaving of messages leading to multiple overlapping conversation threads (Dennis et al. 2008; Herring 1999). Communicating in parallel raises cognitive demands as simultaneous conversations compete over limited attentional resources (Minas et al. 2014; Tang et al. 2013). In addition to the load imposed by the interruptions, parallel communication raises workload by compelling individuals to switch between open conversations within interruption episodes. Herring (1999) argued that parallel communication increases interaction intensity and creates heavy demands for tracking and following the different interactions. Bellotti et al. (2003) found that the number of threaded e-mail messages being tracked was a key cause of overload. Communicating with multiple media in parallel was also found to increase process losses (a proxy of cognitive overload) (Cameron and Webster 2013). Thus, we hypothesize:

H10: Communicating in parallel is positively related to subjective workload.

Message organization capabilities reflect the range of filing actions used during interruption episodes, which include leaving messages in the inbox, deleting messages, assigning messages to folders (foldering), and assigning messages to archives (archiving).[9] Individuals may leave interrupting messages in the inbox, especially if the messages represent tasks that will not be completed in one shot. For instance, processing messages partially because of incomplete information creates attentional residues and persistent cognitive thoughts about the messages (see Leroy 2009). The visibility of these messages in the inbox may also produce pressure to complete the unfinished work, in addition to raising anxiety about possible future interruptions once the missing information becomes available. Indeed, Barley et al. (2011) found that leaving messages in the inbox—even outside of the context of interruptions—increases stress because these messages act as constant reminders of unfinished work and owing to the anxiety caused by a buildup of messages. A qualitative study of British e-mail users found that 68% felt overloaded by e-mail mostly because of a backlog of messages and the presence of messages in their inbox (Russell et al. 2007). We therefore hypothesize:

H11a: Leaving messages in the inbox is positively related to subjective workload.

By contrast, deleting messages during interruption episodes (e.g., before resuming primary activities) cleans out content and helps individuals reach closure. Russell et al. (2007) showed that when facing interruptions, e-mail users deleted messages more ruthlessly to reduce their feelings of overload. Others found that keeping the inbox clean enhanced coping and lowered stress and overload (Barley et al. 2011; Dabbish and Kraut 2006). Accordingly,

H11b: Deleting messages is negatively related to subjective workload.

[9]We do not hypothesize a relationship between archiving and subjective workload. Furthermore, while we note that subjective workload may be influenced by the action taken on the message (e.g., deleting) and by the action's consequences (e.g., a cleaner inbox), we focus on the combined effect rather than the relative effect of each.

Filing messages into folders organizes and structures the message and induces a perception of control. However, foldering is cognitively taxing, especially when done within interruption episodes. In addition to handling interruptions and resuming their primary activities, individuals must expend efforts to create the folders while imagining future retrieval requirements (Ducheneaut and Watts 2005), categorize them and remember their structure and relationships, and keep track of the folders. Dabbish and Kraut (2006) found that the number of folders created significantly increases e-mail overload. We thus expect that individuals who file proportionally more of their messages during interruption episodes will experience higher levels of subjective workload.

H11c: Foldering messages is positively related to subjective workload.

In addition to being linked to subjective workload, reprocessing and rehearsing messages are expected to be positively related to mindfulness. Reprocessing allows individuals to revisit and better understand their messages within the larger context and to better integrate the message content into primary activities (Dennis et al. 2008). When faced with task problems, individuals can review past interactions for similar issues, increase their focus on problem areas, and reflect more thoroughly on possible solutions.

Similarly, rehearsing helps individuals to become more engaged in their conversations and enables them to reflect on how their responses align with the viewpoints of others. By encouraging people to explicitly consider different options when constructing responses, rehearsing overcomes one of the key barriers to mindfulness, namely premature cognitive commitment (Tang et al. 2013). Additionally, by allowing the response to be customized to specific audiences (Tang et al. 2013), rehearsing enhances flexible task processing, one of the dimensions of mindfulness.

The above arguments are consistent with the literature on mindfulness, which suggests that individuals act mindfully when given reason for conscious consideration of the information with which they are presented (Langer 1989). In particular, mindful processing is triggered by three conditions related to the information being processed: novelty, discrepancy, and deliberate initiative (Langer 1989; Louis and Sutton 1991). Technology capabilities can also produce these triggering conditions (Louis and Sutton 1991). First, novelty is achieved because, according to media synchronicity theory (Dennis et al. 2008), the very purpose of reprocessing is to revisit prior messages for additional consideration and better understanding. Similarly, rehearsing enables individuals to achieve more accurate decoding and understanding. Hence, by helping to develop understanding and uncover previously unknown information, reprocessing and rehearsing can create thought-provoking stimuli for individuals to act mindfully in their task activities (Louis and Sutton 1991).

Second, reprocessing and rehearsing information essentially represent a deliberate initiative on the part of an individual to consciously consider new information (rehearsing) or reconsider previously processed information for new insights (reprocessing). Therefore, reprocessing and rehearsing provide the means by which individuals give conscious deliberation to information and process such information mindfully (Langer 1989).

Findings from media synchronicity studies provide additional support for these relationships. For reprocessing, Herring (1999) argued that e-mail messages provide a persistent textual record that aids cognitive processing and enables a heightened sense of awareness. Reprocessing has been linked to several factors that are associated with mindfulness, including engaging with difficult points in messages (engagement) (Tang et al. 2013), analyzing new issues and trends (novelty seeking) (Sproull and Kiesler 1991), reinterpreting information in light of a new situation (novelty producing) (Dennis et al. 2008), and sensitizing people to multiple points of view (flexibility) (Clark and Brennan 1991). With respect to rehearsing, Walther (2007) found that the duration and frequency of crafting and editing messages before transmission (editing behavior) results in more mindful communication and greater social orientation with others. Thus, we hypothesize:[10]

H12: Reprocessing is positively related to mindfulness.

H13: Rehearsing is positively related to mindfulness.

Method

To test the hypotheses, we used a multimethod design comprising two quantitative studies with two samples of business-to-business (B2B) sales professionals. This context is fertile for e-mail interruptions because of its dynamic nature that requires constant interactions with various stakeholders (Hunter and Goebel 2008). The first study is based on a survey and examines the effects of incongruent and congruent

[10]While it could be argued that mindfulness is an antecedent of reprocessing and rehearsing, the theoretical support (both from mindfulness and media synchronicity theories), findings from our survey pretests, as well as additional analyses we conducted (reported later), suggest that these capabilities are likely to be antecedents of mindfulness.

e-mail interruptions on individual performance and the two mediating effects (subjective workload and mindfulness). Individual performance was operationalized as weekly salesperson performance. This reference period of one week allowed us to capture a range of selling activities being performed (e.g., prospecting, presenting, closing) and to examine the effects of interruptions over a week.

The second study used a web-based diary and had two goals: to replicate the survey study while changing the impact period (daily performance over a two-day period) and to extend the survey study by adding the e-mail capabilities used during interruption episodes. Diaries are well-suited for assessing real phenomena over time (Baethge and Rigotti 2013). By collecting data close to the interruption events, the diary study also limited recall bias that might have occurred in the survey. Since we used a time-based signal (i.e., the diary was filled at a fixed interval at the end of the workday), our design limited the potential disruptive effect of the data collection (Ohly et al. 2010).

In sum, our research design fulfills three purposes of multimethod research: expansion, corroboration, and compensation (Venkatesh et al. 2013). First, the diary study expands the results of the survey study by adding the e-mail capabilities to the model. Second, we used the two studies to examine how the findings converge or diverge across methods and across weekly and daily performance time periods (corroboration). Third, our design leverages the strengths and compensates for the limitations of each approach (the survey provided breadth and was less intrusive; the diary minimized recall bias). We use meta-inferences to provide an integrative view of the findings from the two studies (Venkatesh et al. 2013).

Measures

Constructs were operationalized following MacKenzie et al. (2011) and new scales were developed following Moore and Benbasat (1991). Where possible, we adopted items from validated instruments. Appendix A presents the construct definitions, operationalizations, and measures. The choice of setting the past workweek as a reference period for measuring the variables in the survey study was made for three reasons. First, setting a precise reference period in which specific activities were performed in the immediate past improves recall accuracy (Converse and Presser 1986). Second, the workweek is a period that is most consistent with organizing business tasks, including sales activities. Finally, not all sales activities are performed within a typical day. Setting the reference period to one week in the survey study allowed us to account for this factor. The diary study, which used a daily reference period, reduced recall bias.

Most constructs are measured reflectively. Exposure to e-mail interruptions (incongruent/ congruent) is a composite of frequency and duration (Monk et al. 2008; Stutts et al. 2005). Message organization actions are made up of four compositional variables having a constant sum (leaving, deleting, foldering, archiving).[11] Perceived control (a control variable) is modeled as a second-order latent variable with reflective indicators at both levels. Finally, individual performance—operationalized as weekly salesperson performance in the survey study and daily salesperson performance in the diary study—is specified differently in the two studies. In the survey study, weekly salesperson performance is specified as a second-order latent variable with causal-formative indicators at both levels. This is because (1) the components at both levels tap into different aspects of the salesperson performance domain, (2) a second-order model is more parsimonious than a two-factor solution, and (3) our specification is consistent with prior recommendations (Cenfetelli and Bassellier 2009; Petter et al. 2007). In the diary study—where the gamut of primary selling activities is not necessarily captured in the shorter observation period of two consecutive workdays—we use reflective indicators that tap into general performance aspects to measure the first-level factors (efficiency and effectiveness). Yet, the second-order factor of salesperson performance is measured formatively, just as in the survey.

We included two marker variables to assess common method bias (trust and social desirability) and several control variables (perceived control, multitasking efficacy, knowledge, effort). To establish initial validity, we performed two rounds of card-sorting analysis with 20 academic experts who sorted the items into pre-defined categories (Moore and Benbasat 1991). We attained further validation by pretesting the survey with 10 sales professionals.[12]

[11]To address collinearity and negative spurious correlation associated with compositional data, we transformed the variables using centered logratio and dropped one variable—archiving—for which we did not hypothesize any relationships.

[12]The hit ratio of the card-sorting analysis was 83% after two rounds. The card-sorting and pretesting analyses resulted in modifying some items and removing others. Details on the analyses can be obtained from the authors.

Data Collection

Our target population was North American B2B salespersons selling products/services with a relatively quick turnaround. We collected data from two double opt-in panels that were actively managed by reputable data collection companies specializing in B2B research. Respondents were invited by e-mail, phone, and mail, and were provided URLs that linked to the online surveys. All respondents were screened for their involvement in sales activities, their selling segments, the length of their sales cycle, and the extent of their e-mail use.

Data were collected in a single wave for the survey study and over three waves for the diary study: (1) initial screening, introduction, and measurement of the control variables and demographics; (2) measurement of interruption frequency and duration, e-mail capabilities used during the interruption episodes, mindfulness, subjective workload, and performance during day 1; and (3) the same measurements as in wave 2 but for day 2, in addition to the marker variables. The second and third waves relied on an experience (interval-based) sampling approach and asked respondents to fill a daily diary for two consecutive days, at the end of each workday (after they finished working). This approach allowed us not to intrude in the workdays of respondents.

Our final sample sizes (see Appendix C for demographics) were n = 365 for the survey study (14.7% response rate) and n = 212 for the diary study (32.9% response rate across the three waves). We did not find evidence of nonresponse bias, as assessed by verifying that there were no significant differences in the mean responses of early and late respondents, with respect to demographic characteristics and the main constructs of the study (Cameron and Webster 2013).

Data Analysis

We used PLS (SmartPLS v3.2.1) for measurement validation and for testing the relationships in the survey study and linear mixed modeling (PROC MIXED in SAS 9.4) to test the relationships in the diary study. PLS was deemed appropriate for the survey study because of its suitability for handling large and complex models (Chin 2010; Ringle et al. 2012), as well as models with formatively measured latent variables (Chin 2010). In contrast to covariance-based methods, using PLS to analyze formatively measured latent variables—especially those in endogenous positions, such as our construct of individual performance—avoids problems related to identification (Temme et al. 2014), constraining structural parameters, and underrepresenting the variance of the underlying constructs (Lee and Cadogan 2013). Moreover, research on how e-mail interruptions and the use of IT capabilities affect individuals in the workplace is at an early stage of theoretical development and lacks long-term measurement development processes. For such nascent research areas, PLS is adequate because it does not impose stringent restrictions, such as uncorrelated measurement errors (Chin 2010), and since it is more robust to potential partial misspecification in the model (Henseler et al. 2014).

Significance levels were established in the survey study using 500 bootstrapped iterations in PLS with no sign changes. To test for mediation, we used bootstrapping with bias corrected 95% confidence intervals. This approach avoids the assumption of normal distribution of the indirect effects and directly quantifies them by creating confidence intervals with bootstrapping (Preacher and Hayes 2008). Salesperson performance was estimated using a two-step approach since almost all of its variance is explained by the first-order formative components. In the first step, the second-order latent variable is modeled using the repeated indicator approach and the latent variable scores of the first-order factors are obtained.[13] In the second step, the scores become observed variables for the second-order latent variable (Ringle et al. 2012).

For the diary study, we used linear mixed modeling (i.e., multilevel modeling) because the day-level data provided by the respondents were nested within the individual respondents and were thus nonindependent (i.e., correlated residuals). We estimated a random intercept model with predictors residing at both levels. Mediation analyses were performed by combining the dependent variable and the mediators into a single stacked response variable and then running a single mixed model (Bauer et al. 2006). We used the Monte Carlo method with 10,000 bootstraps to construct confidence intervals around the estimates for the indirect and total effects (Bauer et al. 2006).

Missing values, found in very small numbers, were mean-replaced (a separate test using pairwise deletion found no significant differences). Outliers in the data were scrutinized and retained in the analysis because they were deemed representative of the population. We transformed data that deviated the most from normality (e.g., interruptions exposure) to avoid inflated bootstrap standard errors (Ringle et al. 2012).

We took several steps to alleviate concerns about common method bias. In the study design, we avoided conceptual dependence between sets of questions (e.g., questions on e-mail patterns precede questions on behavioral outcomes

[13]We got similar results from an alternate procedure in which we obtained the scores by using only the first-order latent variables and interconnecting them in the first step.

occurring at the level of the sales activities). We also used different response scales for some questions. Further, we provided guidelines to respondents to alleviate cognitive constraints (e.g., instructions to focus on the number of interruptions rather than the number of e-mails) and affective constraints (e.g., assuring anonymity; reiterating that responses would be used solely for research rather than for evaluation purposes).

We also controlled the potential bias at the data analysis level. First, the highest latent variable correlation (SS: 0.53; DS: 0.51)[14] was much lower than the threshold of 0.90 that typically signals common method variance (Bagozzi et al. 1991). Second, we added a marker variable, propensity to trust (Cameron and Webster 2013), as a covariate in the model to partial out its effects on the other variables (Rönkkö and Ylitalo 2011). Comparing the results between the baseline and marker variable models revealed that no paths gained or lost significance (Appendix D). Third, we modeled social desirability as a proxy for the cause of bias in the diary study (Cameron and Webster 2013). It had nonsignificant relationships with all endogenous variables, further alleviating concerns that common method bias accounted for the results.

Results

Measurement Model Validation

We assessed the reliability and validity of the reflectively measured constructs (see Appendix E). All composite reliability values in both studies are well above the threshold set by Fornell and Larcker (1981). Convergent validity was established by showing that the average variance extracted (AVE) values exceeded 0.50. A single value was slightly below the threshold (SS: 0.48; DS: 0.49) and this concerned the first order dimension of a control variable (perceived control/social). Yet, all but one of the standardized item loadings on that latent variable were greater than 0.50 and highly significant ($p < .001$), suggesting adequate convergent validity (Chin 2010). Furthermore, most items have excellent loadings higher than 0.707, with three item loadings in the survey study (six in the diary study) within the acceptable 0.45–0.70 range (Chin 2010).[15] Discriminant validity was established by showing that all latent variables have higher square root of AVE scores than their correlations with other latent variables (Appendix E),[16] and that each item loaded higher on its own latent variable than on other latent variables (Appendix F).

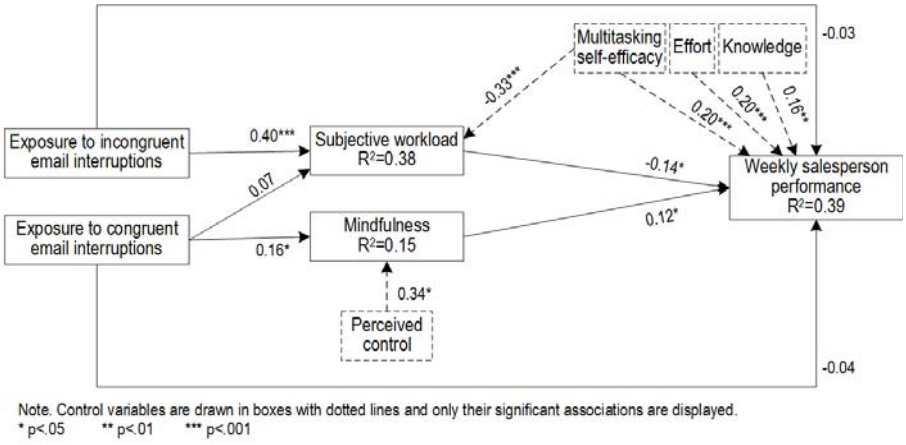
Formatively measured constructs and composite variables were validated using standard guidelines (Petter et al. 2007; Ringle et al. 2012). Appendices G and H list the validation steps and the figures or tables associated with each step. Appendix G shows the seven-step validation procedure for e-mail interruptions exposure. Conducting two separate large-scale studies (survey study and diary study) comprised the first step and established external validity. For the second step, we conducted an additional study to assess the potential recall bias in the survey concerning exposure to interruptions. Thirty sales professionals completed a shorthand version of the survey and filled a log to record their interruption events in near real-time during two typical days (Appendix G, Table G1). The results (Appendix G, Table G2) showed that the survey and log responses were significantly correlated both when looking at the separate dimensions (frequency and duration) of incongruent and congruent interruptions, and when combining the dimensions into composite measures of exposure. Further, the t-test results showed no significant differences among the survey and log responses for both dimensions of incongruent interruptions (t-test statistic = 0.53 for frequency and 1.04 for duration) nor for the composite measure (t-stat = 1.35). For congruent interruptions, the survey responses slightly overstated frequency and understated duration. However, the composite measure—which we used in our empirical analysis—showed no significant differences between the survey and log responses (t-stat = 1.94).

As shown in Appendix G, five additional measures were taken to further establish validity at both the research design stage (steps 3–5) and the data analysis stage, including estimating the significance of the indicator weights (step 6) and computing the VIF values to rule out excessive collinearity between the measures of e-mail interruptions exposure (step 7). Similarly, Appendix H shows the steps for validating the construct of individual performance.

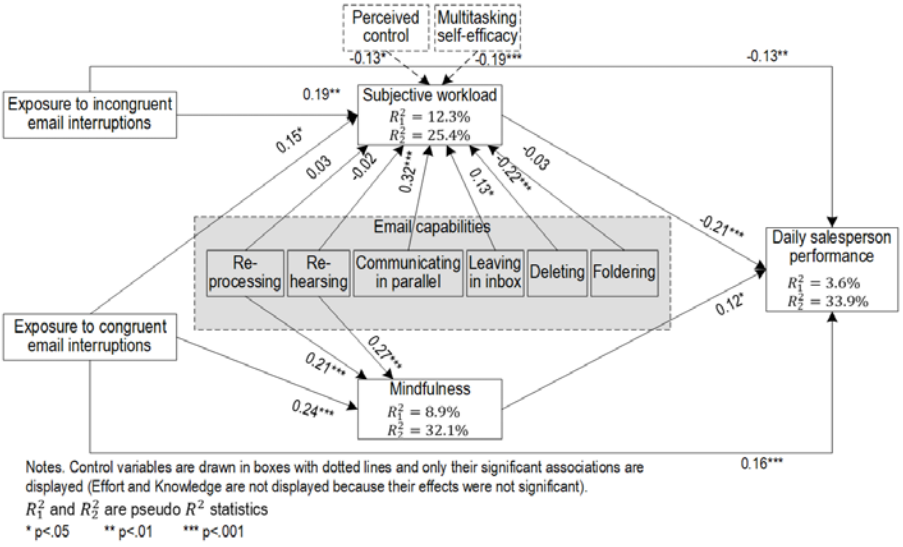
[14]SS = survey study; DS = diary study.

[15]A single item (SW5) had a low loading of 0.41 in the survey study. We decided to keep it for theoretical reasons since (1) it had been validated in the card-sorting analysis and pretests, (2) removing it would have resulted in losing the temporal/cognitive dimension of subjective workload, (3) it correlates significantly with all other subjective workload items, (4) subjective workload has a high composite reliability even with that item included, and (5) the same item had an excellent loading in the diary study.

[16]The only exception occurred in the diary study for the effectiveness dimension of individual performance, which had a square root of AVE value slightly lower than its correlation with the efficiency dimension of performance. We did not interpret this as a serious threat since the two factors are first-order dimensions of the same latent variable.



(a) Path Coefficients for the Survey Study



(b) Path Coefficients for the Dairy Study

Figure 2. Path Coefficients

Testing the Structural Model

Figure 2 shows the results. In the survey study, the predictors explained 38%, 15%, and 39% of the variance in subjective workload, mindfulness, and weekly salesperson performance, respectively. For the diary study, no equivalent measure of variance explained exists since the variance is partitioned into two components. We tested for model fit (improvement in the model when adding the predictors) in two ways. First, we assessed the significance of the change in deviance statistic. As shown in Appendix I, this statistic was significant, indicating that the full model is an improvement over the baseline or unconditional model (with only random intercepts and no predictors). Second, we assessed the change in variance explained in our outcome variables using two pseudo R^2 statistics, R_1^2 and R_2^2 (Hayes 2006).[17] As we show in Appendix I, including the predictors explained 25.4% of the

[17]These statistics are not analogous to the R^2 statistic of ordinary regression and care must be taken when interpreting them. First, they can be misleading since including level-2 predictors can reduce the values for variance explained. Second, they are conditioned on each other. For example, R_1^2 for a given outcome variable represents the proportion of variance remaining after partialing out between-person differences in the outcome that can be explained by the predictors (Hayes 2006).

between-person variance in subjective workload that is not already explained by differences within persons. Similarly, including the predictors explained 12.3% of the within-person variance in subjective workload that was not already explained by differences between persons. For mindfulness, the changes in variance explained were 32.1% (between-persons) and 8.9% (within-person), and for individual performance, they were 33.9% and 3.6%, respectively.

Exposure to Incongruent/Congruent E-Mail Interruptions and Individual Performance

Exposure to incongruent e-mail interruptions was negatively related to daily salesperson performance (β_{ds} = -0.13, p < .01) but not with weekly salesperson performance (β_{ss} = -0.03, p = .38).[18] Additionally, it was positively related to subjective workload in both studies (β_{ss} = 0.40, p < .001; β_{ds} = 0.19, p < .01), which in turn was negatively related to weekly performance (β_{ss} = -0.14, p < .05) and to daily performance (β_{ds} = -0.21, p < .001). As shown in Appendix J, the indirect effect was significant (β_{ss} = -0.07, CI = [-0.14;-0.01]; β_{ds} = -0.04, CI = [-0.07;-0.01]), suggesting a mediation effect of subjective workload.

Exposure to congruent e-mail interruptions was related to salesperson performance through three paths. It was directly positively related to daily performance (β_{ds} = 0.16, p < .001) but not to weekly performance (β_{ss} = -0.04, p = .57). Further, it was positively related to subjective workload in the diary study (β_{ds} = 0.15, p < .05), but not in the survey study (β_{ss} = 0.07, p = .10). The specific indirect effect was significant in the diary study (β_{ds} = -0.03, CI = [-0.06; -0.01]). A separate positive path occurred through mindfulness. Exposure to congruent e-mail interruptions was related to mindfulness (β_{ss} = 0.16, p < .05; β_{ds} = 0.24, p < .001), which in turn was positively related to both weekly performance (β_{ss} = 0.12, p < .05) and daily performance (β_{ds} = 0.12, p < .05). The specific indirect effect was significant (β_{ss} = 0.02, CI = [0.01;0.04]; β_{ds} = 0.03, CI = [0.01;0.05]). The total indirect effect was nonsignificant in both studies, and the total effect was significant in the diary study (Appendix J).

Effects of E-Mail Capabilities

Communicating in parallel and leaving messages in the inbox were both positively related to subjective workload (β_{ds} = 0.32, p < .001; β_{ds} = 0.13, p < .05) and deleting was negatively related to subjective workload (β_{ds} = -0.22, p < .001). Reprocessing, rehearsing, and foldering were not related to subjective workload. Finally, reprocessing and rehearsing messages were positively related to mindfulness (β_{ds} = 0.21, p < .001; β_{ds} = 0.27, p < .001).

To assess the directionality of the hypotheses, we examined the relationships between the e-mail capabilities in day 2 of the diary study and subjective workload and mindfulness in day 1. Our results support the directionality hypothesized in H8–H13, indicating that e-mail capabilities might precede subjective workload and mindfulness and not the opposite. That is, subjective workload and mindfulness measured in day 1 were not significantly related to the e-mail capabilities measured in day 2 (SW-REP: β_{ds} = -0.00, p = .95; SW-REH: β_{ds} = -0.01, p = .81; SW-PAR: β_{ds} = -0.04, p = .44; SW-LVE: β_{ds} = 0.00, p = .98; SW-FOL: β_{ds} = -0.05, p = .38; SW-DEL: β_{ds} = 0.09, p = .14; MIN-REP: β_{ds} = 0.07, p = .27; MIN-REH: β_{ds} = -0.01, p = .92).[19]

Discussion and Implications

A fundamental premise of this paper is that a richer understanding of the impact of e-mail interruptions can be obtained if we take their informational content into account. In addition, the paper argues that our present understanding can be enhanced by examining interruptions in the workplace and by analyzing how different capabilities of the technological artifacts were used during interruption episodes. Drawing on ART, a model linking two types of IT interruptions to individual performance directly and through two mediators (subjective workload and mindfulness) was developed. The roles of six e-mail capabilities used during interruption episodes (reprocessing, rehearsing, communicating in parallel, leaving messages in the inbox, deleting, and foldering) were also examined. Two empirical studies were conducted to test the research model and hypotheses.

To help interpret our findings, Table 1 provides an integrative view and draws meta-inferences across the two studies (Venkatesh et al. 2013). This table indicates that incongruent and congruent interruptions affect individual performance in fundamentally different ways. The direct effects of incongruent interruptions on performance seem to vary, depending on the time period. Specifically, exposure to incongruent

[18] β_{ss}: beta coefficient, survey study; β_{ds}: beta coefficient, diary study.

[19] SW = subjective workload; MIN = mindfulness; REP = reprocessing; REH = rehearsing; PAR = communicating in parallel; LVE = leaving messages in the inbox; DEL = deleting messages; FOL = foldering messages.

e-mail interruptions was negatively related to performance at the daily level but not at the weekly level. One explanation for the discrepant results is that individuals might better compensate for the negative impact over one week than over a day. While the diary study captured the performance of regular nine-to-five work days, the survey study may have captured recovery efforts and/or work-related efforts outside of the regular hours (before or after work or during weekends). For example, it is possible that individuals had more opportunities to engage in positive experiences (e.g., social activities; positive reflections on their work) over the course of a week, which has been found to increase job performance (Fritz and Sonnentag 2005). Individuals may also have had opportunities to work overtime (outside of regular) hours, which increases their productivity (Pencavel 2015).

Exposure to incongruent e-mail interruptions did, however, have an indirect effect through subjective workload, which held across both time frames. The fact that this effect persists in the survey study might be explained by the effort-recovery model. Specifically, if individuals worked overtime to compensate for their performance losses from incongruent interruptions, this conduct may have interfered with their recovery efforts, leading to an accumulation of stress and fatigue that was sustained at the weekly level (van der Hulst and Geurts 2001).

Exposure to congruent e-mail interruptions was directly positively related to performance at the daily level but not at the weekly level. This discrepancy may point to difficulties in sustaining the direct performance gains of congruent interruptions over time. Research in psychology indicates that such difficulties might occur when individuals receive both positive and negative feedback. In the former case, the positive feedback may lead to complacency over time (Podsakoff and Farh 1989). In the latter, the performance-triggering effects may taper off as the negative feedback becomes too frequent (Ilgen et al. 1979), or leads to feelings of learned helplessness or low self-esteem (Mesch et al. 1994). The lack of sustained positive effects of feedback over time was supported in several meta-analyses (e.g., Bangert-Drowns et al. 1991).

The indirect effect of exposure to congruent e-mail interruptions through subjective workload also occurred at the daily level but not at the weekly level. This result suggests that the stress-inducing effects of congruent interruptions (e.g., initial frustration for stopping work to deal with the incoming feedback) may subside over time. According to the job stress literature, providing instrumental support—which is a main purpose of congruent interruptions (Galluch et al. 2015)—decreases the stress resulting from job stressors (Beehr et al. 2000). Dormann and Zapf (1999) suggested that there is a time lag for this stress-reduction effect to occur.

The indirect positive effect of exposure to congruent e-mail interruptions through mindfulness was, however, supported in both studies. This suggests that congruent interruptions provided sustained performance gains over the two time frames by inducing mindful processing.

Together, these counteracting effects highlight a fundamental tension between the negative aspects of e-mail interruptions, when considered as a stimulus that disrupts activities, and the positive aspects, when considering the informational gains they provide. Stated differently, by combining stimulus-based and information-based aspects of interruptions, we get a richer understanding of how e-mail interruptions exposure can affect individual performance.

The second main premise of this paper is that the capabilities of the interrupting technology can have important effects. Our resultant inferences in Table 1 are drawn only from the diary study since these effects were not tested in the survey study. The table shows that five of the six e-mail capabilities were associated with mindfulness or subjective workload and indirectly influenced performance. In line with Barley et al. (2011), we found that leaving messages in the inbox was positively related with subjective workload. Our findings also indicate that communicating in parallel had a strong positive effect on workload while deleting messages had the opposite effect. Further, reprocessing and rehearsing were positively related to mindfulness.

Surprisingly, subjective workload was not affected by filing messages into folders during interruption episodes. One explanation for this finding is the possibility that it is not the foldering action itself that increases subjective workload, but rather the number of folders that individuals handle (e.g., Dabbish and Kraut 2006). Similarly, reprocessing and rehearsing were not related to subjective workload. A possible explanation is that individuals use these actions to prevent the interactions from becoming disorganized and thereby avoid overload (Nowak et al. 2009). Also, reprocessing allows people to economize their cognitive resources by drawing on readily available information rather than taxing their working memory (Cameron and Webster 2013). Taken together, these results suggest that the capabilities of the interrupting technology can either help or hinder performance, depending on how they are used by individuals. Rather than assuming that the features are fixed within the technology or the users, our approach is user-centric and allows variation of usage across respondents, as is often the case with most IT.

Table 1. Meta-Inferences

Relationship†	Survey Study				Diary Study					
***Exposure to e-mail interruptions*:**	**Est.**	**SE**	**Sig.**	**Support**	**Est.**	**SE**	**Sig.**	**Support**	**Meta-Inference**	**Explanation for Discrepant Results**
IEI → PERF (H1)	-0.03	0.04	.380	No	-0.13	0.05	.003	Yes	Exposure to incongruent e-mail interruptions is negatively related to individual performance at the daily level (diary) but not at the weekly level (survey).	The discrepant results across studies may be because of compensating forces over the longer time frame, such as recovery and/or overtime work. The diary study captures performance of "regular" 9-to-5 workdays whereas the survey might have captured rest or work outside of the regular hours. Research on recovery found job performance improvements from positive experiences (social activities; positive work reflection) and absence of negative experiences (non-work hassles and interruptions) during time away from work (Fritz and Sonnentag 2005). As well, working overtime (i.e., outside of regular hours) has been associated with increased productivity (Pencavel 2015).
CEI → PERF (H2)	-0.04	0.04	.346	No	0.16	0.05	<.001	Yes	Exposure to congruent e-mail interruptions is positively related to individual performance at the daily level (diary) but not at the weekly level (survey).	The discrepant results suggest that it may be difficult to sustain the direct performance gains of congruent interruptions over time. This might occur when individuals receive positive feedback leading to complacency over time (Podsakoff and Farh 1989). It might also occur with negative feedback when the effects taper off over time because the feedback is too frequent (Ilgen et al. 1979) or leads to feelings of leaned helplessness or low self-esteem (Mesch et al. 1994). Several meta-analyses found no evidence of the effects of feedback on individual performance occurring in the long term and called for more longitudinal studies (Bangert-Drowns et al. 1991; Hatala et al. 2014).
IEI → SW (H3)	0.40	0.05	<.001	Yes	0.19	0.06	.001	Yes	Exposure to incongruent e-mail interruptions affects individual performance through subjective workload. Unlike the direct effect, the indirect effect through subjective workload holds across both studies and thus seems to be longer lasting.	Results are consistent across both time frames. The fact that this effect persists at the weekly level whereas the effect of IEI on PERF does not might be explained by the effort-recovery model (Meijman and Mulder 1998). If individuals work overtime to compensate for performance decrements of IEI, this might interfere with recovery and lead to an accumulation of stress and fatigue that is sustained at the weekly level (van der Hulst and Geurts 2001).
CEI → SW (H4)	0.07	0.05	.100	No	0.15	0.06	.012	Yes	Exposure to congruent e-mail interruptions affects individual performance through subjective workload at the daily level (diary) but not at the weekly level (survey).	The discrepant results might suggest that—consistent with our literature review—individuals initially experience increased frustration and overload from exposure to congruent e-mail interruptions. However, because these interruptions provide instrumental task support (Galluch et al. 2015), this effect might subside over time. There is evidence in the job stress literature suggesting that instrumental support reduces the stress that results from job stressors (Beehr et al. 2000), and that there is a time lag for this stress-reduction effect to occur (Dormann and Zapf 1999).
SW → PERF (H5)	-0.14	0.06	.025	Yes	-0.21	0.05	<.001	Yes		

Table 1. Meta-Inferences (Continued)

Relationship†	Survey Study				Diary Study				Meta-Inference	Explanation for Discrepant Results
***Exposure to e-mail interruptions*:**	**Est.**	**SE**	**Sig.**	**Support**	**Est.**	**SE**	**Sig.**	**Support**		
CEI → MIN (H6)	0.16	0.08	.032	Yes	0.24	0.05	<.001	Yes	Exposure to congruent e-mail interruptions affects individual performance through mindfulness. Unlike the direct effect, the indirect effect through mindfulness holds across both studies and thus seems to be longer lasting.	Results are consistent across both time frames.
MIN → PERF (H7)	0.12	0.06	.049	Yes	0.12	0.05	.011	Yes		
***E-mail capabilities*:**	**Est.**	**SE**	**Sig.**	**Support**	**Est.**	**SE**	**Sig.**	**Support**		
REP → SW (H8)	N/A	N/A	N/A	N/A	0.03	0.07	.680	No	Communicating in parallel and leaving messages in the inbox are positively related to subjective workload and deleting messages is negatively related to subjective workload. Reprocessing and rehearsing are positively related to mindfulness.	E-mail capabilities were tested only in the diary study.
REH → SW (H9)	N/A	N/A	N/A	N/A	-0.02	0.06	.802	No		
PAR → SW (H10)	N/A	N/A	N/A	N/A	0.32	0.07	<.001	Yes		
LVE → SW (H11a)	N/A	N/A	N/A	N/A	0.13	0.07	.045	Yes		
DEL → SW (H11b)	N/A	N/A	N/A	N/A	-0.22	0.07	<.001	Yes		
FOL → SW (H11c)	N/A	N/A	N/A	N/A	-0.03	0.08	.689	No		
REP → MIN (H12)	N/A	N/A	N/A	N/A	0.21	0.05	<.001	Yes		
REH → MIN (H13)	N/A	N/A	N/A	N/A	0.27	0.05	<.001	Yes		

Notes:
Est. = standardized beta coefficient; SE = standard error; sig. = significance level.
IEI = Incongruent e-mail interruptions; CEI = Congruent e-mail interruptions; SW = subjective workload; MIN = mindfulness; PERF = individual performance; REP = reprocessing; REH = rehearsing; PAR = communicating in parallel; LVE = leaving messages in the inbox; DEL = deleting messages; FOL = foldering messages.
†Following Venkatesh et al. (2016), we draw meta-inferences only for the substantive relationships in the model.

Contributions to Research

The present paper makes three contributions to research. First, it provides insights into the different paths that link e-mail interruptions to performance. We develop a nomological network that shows that exposure to incongruent e-mail interruptions hinders performance while exposure to congruent e-mail interruptions has a negative impact because it increases workload and a positive impact because it increases mindfulness, with a net positive effect on performance over a short time period. These insights have several theoretical implications, one being that they advance research on IT-mediated interruptions and help address the mixed empirical results. Few studies consider the multiple paths linking interruptions to performance. Our work has implications for researchers to consider both the stimulus-based and information-based aspects of interruptions, to adopt a more nuanced treatment of the different types of interruptions, and to look at the fine-grained mechanisms that link interruptions directly and indirectly to performance. Our findings also suggest a need to extend ART in two ways: (1) to explore the fundamental tension regarding the losses resulting from interruptions and the gains from receiving task-relevant information, and (2) to engage more deeply the technological factors.

The second contribution of this paper is to examine the role of the media capabilities that are used during interruption episodes. The present paper bridges a gap between IS literature that conceptualizes technology but not its interruptive consequences and the work interruptions literature that conceptualizes interruptions but without examining the role of the technology (see Appendix B). Our findings provide insights showing that some capabilities used are beneficial while others have detrimental effects. As such, the paper opens new avenues of research, such as studying how other media capabilities could shape the outcomes of interruptions. Moreover, by accounting for the informational nature of interrupting media as well as the media capabilities, our study addresses the informational and technological dimensions of the IS artifact (Lee et al. 2015). Consequently, our findings can also be used by IS design science researchers to delve more deeply into designing these informational and technological artifacts, or other artifacts altogether, to manage how people respond to IT interruptions (e.g., systems that provide relevant interruptions at the right time to users). More broadly, our notion of media capabilities suggests an area for extension for IS research, which has mostly focused on the existence of media capabilities as potential structures for action that may or may not be used by individuals (Cameron and Webster 2013; Dennis et al. 2008).

Finally, our study suggests that context can be important. Interruptions in the laboratory and in the workplace are subject to different situational features and can have different meanings and effects. Our findings also suggest that the level of specificity when studying interruptions is important. While micro-level studies of interruptions (e.g., laboratory studies focusing on isolated task performance) offer a limited understanding of the effects of interruptions in the workplace, adopting too broad a perspective might mean that some of their effects are not detected (e.g., as employees might work overtime or engage in recovery activities during non-work hours). Our diary study adopted a midrange approach that showed clear evidence of effects at the daily level. Our study also has implications for future research to explore other possible linkages across levels—such as relating specific interruption events to micro-level effects—which can then spill over to a higher level (e.g., when an interrupted team member experiences stress that ripples out to other team members through contagion).

Contributions to Practice

Managers largely care about human capital and how individuals perform in their organizations. Our model shows managers how e-mail interruptions can affect individuals (subjective workload; mindfulness) and their performance levels. Our findings help organizational members recognize that despite the negative connotation associated with interruptions in the popular press, not all interruptions are necessarily bad. Rather, it is important to distinguish between congruent and incongruent interruptions. For example, one needs to know that while incongruent interruptions hinder performance, congruent interruptions have a net positive effect, although they come at the price of increased workload.

Understanding the mechanisms through which different types of e-mail interruptions affect performance would be a first step for developing effective e-mail management programs and interventions. And since our model is not restricted to specific e-mail content, it can be used widely by managers in different departments and units. For example, managers could develop specific e-mail handling policies for minimizing the adverse effects of e-mail interruptions (e.g., specifying a time response window for e-mails based on their urgency and/or relevance).

Our findings can also be used to encourage individuals to develop explicit work norms regarding their use of e-mail capabilities. For example, individuals should limit parallel exchanges during interruptions to prevent overload. Preventing overload also requires that people avoid keeping messages in their in-boxes. Instead, they might decide to folder messages. While deleting messages is actually related to lower subjective workload, this strategy should be exercised with caution to avoid losing important information. Other potential work norms include rehearsing and reprocessing messages. While individuals might be tempted to eschew rehearsing and reprocessing their messages during interruption episodes because this seemingly would increase their workload, our study found no evidence of such relationships. In fact, our findings suggest that people might well consider thinking carefully about the messages they construct (rehearsing) and examining carefully their previously received messages as needed (reprocessing) to ensure that they process their tasks more mindfully, which is beneficial for performance.

Finally, our results have design implications. E-mail clients could be programmed to screen incoming e-mails for task-relevant content. E-mail clients commonly distinguish (and filter) junk e-mail from all other kinds of e-mails, but do not differentiate messages relevant to primary activities from other messages that may also be work related. The latter can be achieved by scanning keywords in the messages. For tasks requiring deep focus and/or where feedback is critical, congruent interruptions can be displayed while working on primary activities, whereas incongruent interruptions can be masked until later. This proposed design is more dynamic than filters that prioritize messages based on crude measures such as the message source (McMurtry 2014). It also extends functionalities provided by existing context aware systems (e.g., Dabbish and Kraut 2008) and focuses on the user side, rather than on the interruption source.

Limitations and Future Research

This study has some limitations. One methodological limitation is our reliance on single informants who provided self-reported measures of their e-mail interruptions exposure. While this approach might raise concerns over common method bias, we have described how we mitigated such concerns through various steps taken at the design and analysis stages, and the results suggest that the bias is unlikely to have affected our results. The self-report nature of the data can also be a source of recall bias. Our carefully crafted design—using a multimethod approach and employing the validation steps reported in Appendix G—suggests that recall bias is unlikely to have altered our results. As described earlier, we conducted a separate study to assess the amount of bias in reporting e-mail interruptions exposure. We found no significant differences between the actual composite measures that were recorded in real-time log responses and the corresponding measures that were reported in a survey (see Appendix G).

Furthermore, while our study of e-mail interruptions in the workplace achieved realism, we cannot make conclusive statements about whether the effects we found are associations or true causal relationships. However, our tests of the directionality of the hypotheses reported earlier provide some preliminary evidence that the e-mail capabilities are likely to be antecedents of subjective workload and mindfulness. In addition, we mitigated a main concern for studies with limited causal inferences, namely that unmeasured variables are driving the variance in the endogenous variables. We did this by conducting two large-scale field studies using different methods and samples and involving individuals from diverse backgrounds, organizations, and industries. We also accounted for spurious relationships by modeling perceived control and multitasking efficacy as extraneous control variables that influence the endogenous variables in the model. This increases our confidence in the true association between the substantive variables, rather than being related through the effect of extraneous variables. Future research can employ longitudinal or controlled designs to test these relationships.

A final limitation is that the PLS analysis we conducted in the survey study does not model measurement error. While this might raise concerns about the estimates being biased and contaminated with measurement error, it is important to note that PLS can partially correct for the error because of the way the weighted composites are formed and adjusted (Henseler et al. 2014; Rigdon 2012). While PLS clearly has limitations, our use of the method (in the survey study) is justified given the early stage of theory development, the model's complexity, and the presence of higher-order formatively measured latent variables. We encourage future researchers using PLS to clearly weigh and discuss its benefits and costs, and if in doubt, to triangulate the results using more than one analytical technique.

We also have further suggestions for future research. We encourage the development of research streams based on our meta-inferences table to advance our understanding of the long-term effects of technology-mediated interruptions. For example, we showed that the direct effect of incongruent e-mail interruptions on performance subsided in the longer term survey study, but that the indirect effect through subjective workload was sustained. Future research can examine the factors that can alleviate the stress from these interruptions over time. Factors such as timing control, method control, and resource control have been suggested as potential mitigators of interruptions-induced stress, albeit on the short term (Galluch et al. 2015; McFarlane et al. 2002). Future research can examine these and other potential mitigating factors (e.g., individual factors such as experience and polychronicity) for their long-term efficacy.

Furthermore, we conjectured that the direct positive effects of congruent e-mail interruptions on individual performance were not sustained at the weekly level because continued exposure to feedback can result in complacency or loss of self-esteem. In addition to testing for these effects, future studies can examine how feedback and new task information may best be delivered to individuals while maintaining their benefits over time. Factors such as the nature, amount, and timing of the feedback can be studied, as well as the optimal media for delivering task-congruent information.

Finally, our conceptualization of e-mail capabilities assumes that individuals use the technology's capabilities in different ways. Future research could pursue this idea by examining the goals that drive such usage. Employing an affordance lens, future research can advance research in this area. Affordances are possibilities for action that depend on both the material aspects of the technology and the goals and capabilities of the user (Gibson 1986). Using an affordance lens, future research can expand on the range of media capabilities used during interruption episodes and provide insights into why interrupted individuals use particular capabilities.

Conclusion

At a time of ever-proliferating e-mail interruptions at work, it becomes critical to understand the different types of interruptions and their implications for cognitive and behavioral outcomes. Our study develops a nomological network showing that exposure to incongruent and congruent interruptions are related to performance through different paths. We also identify the effects of the e-mail capabilities used during interruption episodes. Overall, this study is an initial attempt to conceptualize e-mail interruptions, examine how they occur in real organizational settings, and understand how they affect performance. We hope that the ideas developed and tested in this paper will stimulate research on IT-mediated interruptions and, more broadly, on the double-edged nature of IT. We know a lot about the negative effects of IT-mediated interruptions. This study should spur interest in investigating and further understanding the beneficial side of interruptions at work.

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RESEARCH ARTICLE

E-MAIL INTERRUPTIONS AND INDIVIDUAL PERFORMANCE: IS THERE A SILVER LINING?

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Appendix A

Constructs and Measures

Construct Definition	Operationalization	Source	Measurement Instrument
E-mail interruptions: Externally triggered temporary suspensions of an individual's primary task activities to process the content of one or more incoming e-mail messages.	We focus on **exposure to e-mail interruptions**, which represents the extent to which individuals are interrupted by e-mail over a period of time (across multiple interruption episodes). Exposure is a composite of the following dimensions (Monk et al. 2008; Stutts et al. 2005):		
	Frequency: The perceived rate at which an individual temporarily suspends his or her primary activities to handle (read, respond to and/or act upon) incoming e-mail messages.	Ratio measure; wording refined based on card sorting (n = 20) and pretests (n = 10).	Respondents were asked to indicate the number of times they temporarily suspended their primary selling activities to process (read, respond, act upon) incoming e-mails over the past work week (survey study), or work day (diary study).[1]
	Duration: The average duration of time spent by an individual each time he or she suspends the primary task activities to handle (read, respond to and/or act upon) incoming e-mail messages.	Ratio measure; wording refined based on card sorting and pretests.	Respondents were asked to indicate the average duration (in minutes) of a single typical suspension of their primary selling activities so as to process incoming e-mails.
We identify two interruption types based on the informational content of the messages and its relevance to primary activities:	Incongruent and congruent e-mail interruptions were operationalized by asking respondents to distinguish between two types of e-mails that interrupt their primary activities.[2]		

Incongruent e-mail interruptions: E-mail interruptions by messages that provide or request information or actions that are not relevant to, and that divert attention away from, primary activities.	**Exposure to incongruent e-mail interruptions:** Measured by capturing the frequency and duration of interrupting e-mails with contents related to secondary selling activities (e.g., servicing accounts; training/recruiting), or activities outside of the sales domain (e.g., general work; personal/social activities).	Ratio measure; wording refined based on card sorting and pretests.	For frequency, respondents were asked to distribute the total number of suspensions (indicated earlier) first among their primary selling activities, then among the two different types of incoming e-mail: primary and secondary e-mails. Decomposing the interruption event into subcategories and eliciting frequencies at the subcategory level helps increase recall accuracy (Menon 1997). For duration, respondents were asked whether the average duration reported earlier was similar for the two e-mail types. If a negative response was entered, the survey branched to a follow-up item that asked respondents to estimate the typical duration of each type of interruption.
Congruent e-mail interruptions: E-mail interruptions by messages that contain relevant information, reveal discrepancies, or request actions that are pertinent to performing primary activities.	**Exposure to congruent e-mail interruptions:** Measured by capturing the frequency and duration of interrupting e-mails with contents that are directly pertinent to performing the primary selling activities (e.g., information about prospect customer needs; feedback about one's selling performance).	Ratio measure; wording refined based on card sorting and pretests.	
E-mail capabilities: We focus on six e-mail capabilities used during interruption episodes:	We measured e-mail capabilities that are used during interruption episodes, the time elapsed between suspension of primary activities to process interruptions and the subsequent resumption of primary activities.		
Message organization actions: Leaving/ Deleting/ Foldering/ Archiving:† The extent to which, during interruption episodes, an e-mail recipient leaves messages in one's inbox, deletes them, or files them into folders or into archives.		Items based on definition, existing literature (e.g., Dabbish and Kraut 2006), card sorting, and pretests.	Respondents were asked how they filed— during interruption episodes—their incoming messages that interrupted their primary selling activities. They were asked to distribute 100 percentage points to indicate the proportion of messages that were filed according to each of the following options:[3] • Org1: Left incoming messages in inbox. • Org2: Filed incoming messages into folders based on message characteristics (topic, urgency, etc.). • Org3: Filed incoming messages into a general "Archive" folder (e.g., Google's Archive button). • Org4: Deleted incoming messages.
Reprocessing:† The extent to which, during interruption episodes, an e-mail recipient reexamines or processes e-mail messages (own or received from others) again.		Items based on definition, existing scales (Sarker et al. 2010; Tang et al. 2013), card sorting, and pretests.	7-point Likert-type scale (1 = Never—7 = Every time) Today, when I was processing (reading, replying to, forwarding, acting upon) the incoming e-mail messages that temporarily suspended my primary selling activities… • Rep1: I tended to revisit and re-examine the incoming messages or other related messages I stored. • Rep2: I reused information from previous related messages I saved. • Rep3: I retrieved and processed older messages again that might somehow be related to the incoming messages. • Rep4: I tended to re-read the incoming messages.

Rehearsing:† The extent to which an e-mail recipient rehearses or fine-tunes one's responses to incoming messages during interruption episodes, before sending the responses.		Items based on definition, existing scales (George et al. 2013), card sorting, and pretests.	7-point Likert-type scale (1 = Never—7 = Every time) Today, when I was processing (reading, replying to, forwarding, acting upon) the incoming e-mail messages that temporarily suspended my primary selling activities… • Reh1: I crafted my replies carefully to express my intended meaning. • Reh2: I considered how my replies might be interpreted. • Reh3: I took my time to think about my replies before sending them. • Reh4: I read my replies several times before sending them. • Reh5: I went back and corrected mistakes in my replies before sending.
Communicating in parallel:† The extent to which an individual engages in multiple e-mail conversations simultaneously (i.e., within some given interruption episode)		Items based on definition, existing scales (Sarker et al. 2010; Tang et al. 2013), card sorting, and pretests.	7-point Likert-type scale (1 = Never—7 = Every time) Today, when I was processing (reading, replying to, forwarding, acting upon) the incoming e-mail messages that temporarily suspended my primary selling activities… • Par1: I participated in several e-mail exchanges in parallel. • Par2: I communicated with multiple users at the same time. • *Par3: I carried multiple conversations simultaneously.* • *Par4: I communicated with only one person at a time. (r)*
Subjective workload: Refers to the perceived costs incurred by individuals in performing their activities (Hart and Staveland 1988). It is defined as the extent to which an individual feels his or her whole task execution (including primary activities and interruptions) is demanding (a) emotionally, (b) temporally, and (c) mentally.	We measured individuals' perceptions of their workload resulting from processing e-mail interruptions and performing their primary selling activities. Workload comprises three dimensions: emotional workload; temporal workload; mental workload.	Items based on definition, the modified NASA TLX index (Adamczyk and Bailey 2004), card sorting, and pretests.	7-point Likert-type scale (1 = Strongly disagree—7 = Strongly agree) • SW1: I felt annoyed. • SW3: I felt frustrated. • SW5: I felt that my workload is substantial. • SW6: I felt stressed. • SW8: I felt fatigued. • SW9: The rate at which my activities occurred made me feel pressured. • *SW10: I felt energized. (r)*
Mindfulness: A situation-specific state of cognitive functioning through which an individual performing his or her primary activities exhibits alertness to distinction, openness to novelty, orientation in the present, and implicit, if not explicit, awareness of multiple perspectives.	Respondents were asked to report on their cognitive state after processing the interrupting e-mails. Measured via four dimensions: novelty seeking; novelty producing; flexibility; engagement (Langer 1989).	Items based on definition, the Langer Mindfulness Scale (Langer 1989; 2004), card sorting, and pretests.	7-point global scale adapted from Langer (2004) (1 = Strongly disagree—7 = Strongly agree) After processing the incoming messages that temporarily suspended my activities… • Min1: I tended to investigate new issues that emerged in my primary selling activities. • Min2: I tried to think of new ways of doing my primary selling activities. • Min3: I became open to new ways of doing my primary selling activities. • Min4: I developed an open-mind about the issues I faced, even things that challenged my core beliefs. • Min5: I found myself very curious about issues that I faced. • Min7: rarely attended to new developments in my primary selling activities. (r)

Individual performance: The aggregated value of the behaviors that an individual performs on one's core work activities over a given interval of time.	Following prior literature (e.g., Hunter and Goebel 2008), we measured salespersons' perceived behaviors regarding their time-based efficiency and effectiveness at achieving sales objectives in their primary selling activities.[4] Salesperson performance was operationalized using two different time references in the two studies: weekly performance (survey study) and daily performance (diary study). To capture its multidimensional nature, salesperson performance was specified as a second-order formatively measured latent variable. The first-order factors had causal-formative indicators in the survey study and reflective indicators in the diary study.[5]	Items based on definition, sales literature, existing scales (Behrman and Perreault 1984; Hunter and Goebel 2008), card sorting, and pretests. In generating the survey study items, we made sure that they covered the entire content domain of primary selling activities, from prospecting to closing a sale.	7-point comparative scale. **Survey study (reference period = 1 workweek):** • Efc1: Timeliness in prospecting for potential customers. (a) • Efc2 : Efficiency in delivering sales presentations or materials. (b) • Efc3: Managing time well across the primary selling activities. (c) • Efc4: Timeliness in providing information to prospect customers. (a) • Efc5: Speed of identifying and solving prospect customer issues. (a) • Efc6: Speed of generating sales from prospect customers. (a) • Eff1: Interacting effectively with prospect customers. (c) • Eff2: Avoiding mistakes in sales presentations or materials. (c) • Eff3: Communicating my sales presentations clearly and concisely. (c) • Eff4: Solving prospect customers' problems or objections. (c) • Eff5: Developing new customers from established contacts. (c) • Eff6: Accuracy in matching prospect customer requirements with available product offerings. (c) **Diary study (reference period = 1 work day):** • Efc1: Timeliness in completing primary selling tasks. (d) • Efc2: Efficiency in carrying out primary selling activities. (d) • Efc3: Managing time well across the primary selling activities. (d) • Efc4: Speed of executing primary selling tasks. (d) • Eff1: Adequacy of my primary selling results. (d) • Eff2: Fulfillment of primary selling responsibilities. (d) • *Eff3: Negligence in executing my primary selling activities. (r) (d)* • Eff4: Avoiding errors in my primary selling activities. (d) • Eff5: Quality of my primary selling outcomes. (d) • Eff6: Success in achieving primary selling goals. (d) • Perf1: Overall, how do you rate your primary selling performance today? (d) • Perf2: In general, how well did you execute your primary selling tasks today? (d)
Control variables Knowledge: 4 items measured on a 7-point Likert-type scale; influences individual performance (e.g., Rapp et al. 2006) Effort: 3 items measured on a 7-point Likert-type scale; influences individual performance (e.g., Jaramillo and Mulki 2008) Perceived control over e-mail: 5 items measured on a 7-point Likert-type scale; influences subjective workload (e.g., Rapp et al. 2006), mindfulness (e.g., Louis and Sutton 1991), and individual performance Multitasking self-efficacy: 4 items measured on a 7-point Likert-type scale; influences subjective workload and individual performance (e.g., Basoglu et al. 2009)			
Marker variables Disposition to trust (Gefen et al. 2000): 5 items answered on a 7-point Likert-type scale (strongly disagree–strongly agree) Social desirability (Strahan and Gerbasi 1972): 10 items answered on a true/false scale (scores summed up to create overall score)			

Notes

(italics) Item dropped from final measurement scale after testing of measurement properties.
(r) Reverse-coded item.
(a) 7-point Likert-type scale (1 = Much slower—7 = Much faster)
(b) 7-point Likert-type scale (1 = Much lower—7 =Much higher)
(c) 7-point Likert-type scale (1 = Much worse—7 =Much better)
(d) 7-point Likert-type scale (1 = Far below average—7 = Far above average)
[†]Diary study only

[1]We used the term *temporary suspension* instead of *interruption* to avoid the negative connotation that comes with the latter term.

[2]To ensure we were measuring interruptions and not simply emails handled at convenient or periodic intervals outside of the primary task domain, we explicitly asked respondents to report only on the emails that led to "temporary suspensions" of their primary selling activities. Additionally, we confirmed that respondents had access to real-time notifications to their incoming messages.

[3]Since these items represent compositional data that add up to a constant sum, we transformed the data using the centered logratio transformation before using them as predictors in the model (Wang et al. 2013).

[4]We focus on behavioral–rather than outcome—performance since it is more granular representation reflecting behaviors that are assessed in terms of their contribution to sales goals, is totally under the respondent's control, and has been consistently used in the sales literature (e.g., Hunter and Goebel 2008). Also, the effects of e-mail interruptions are more likely to manifest in the more proximate behavioral components of performance, and there are many steps that come between a salesperson's behaviors and his or her end performance (Churchill et al. 1985; Hunter and Goebel 2008). We used self-reported, subjective performance measures. First, empirical evidence shows that these measures perform no worse than objective measures and have less leniency and halo errors than supervisor ratings (Churchill et al. 1985). Objective measures also introduce inequalities among sales regions, product lines, and customer accounts, and may be attributable to factors beyond the salesperson's control (Behrman and Perreault 1984). Second, self-reported subjective measures are more appropriate for evaluating behavioral outcomes of boundary-spanning individuals such as salespeople (Behrman and Perreault 1984) who perform behaviors that are less observable by managers (e.g., e-mail interactions with customers), and that do not typically reflect in performance reports. Finally, self-reported measures are more readily available and are commonly used in the sales literature (Behrman and Perreault 1984; Sujan et al. 1994).

[5]Because the survey captured experiences over an extended period of one workweek, we assumed—based on our observations in the pretesting phase—that the respondents performed the entire gamut of their primary selling activities. We thus used causal-formative indicators that tap into the different activity domains. Since the diary study captured experiences over a shorter period (two consecutive workdays), we used reflective indicators that tap into more general performance aspects.

Appendix B

Empirical Results on IT Interruption Effects

(1) Incongruent Interruptions (Interruptions Pertaining to Non-Primary Activities)		
Effects on Workload	**Effects on Performance Efficiency**	**Effects on Performance Effectiveness**
Emotional load: negative effects • Increased annoyance (Adamczyk and Bailey 2004; Bailey and Konstan 2006; Gievska et al. 2005) • Increased anxiety (Bailey and Konstan 2006) • Increased frustration (Adamczyk and Bailey 2004; Gievska et al. 2005) • Increased irritation (Baethge and Rigotti 2013; Grebner et al. 2003) • Negative emotions and well-being (Zijlstra et al. 1999) • Decreased respect (Adamczyk and Bailey 2004) ***Cognitive load: negative effects*** • Increased distractiveness (Gievska et al. 2005) • Increased cognitive load (Adamczyk and Bailey 2004; Basoglu et al. 2009; Gievska et al. 2005) ***Temporal load: negative effects*** • Increased time pressure (Adamczyk and Bailey 2004; Baethge and Rigotti 2013) ***Overall subjective workload: negative effects*** • Increased subjective workload (Galluch et al. 2015; Gupta et al. 2013; Mark et al. 2008; Baethge and Rigotti 2013)	***Task resumption time (lag): negative effects*** • Increased lag (Cades et al. 2006; Hodgetts and Jones 2006; Iqbal and Horvitz 2007; Jackson et al. 2003; Marulanda-Carter and Jackson 2012; Monk et al. 2008; Trafton et al. 2005; Zijlstra et al. 1999). – Effect is stronger for increasing difficulty of next subtask and high data carry over across task boundaries (Iqbal and Horvitz 2007), as well as for longer and more complex interruptions (Hodgetts and Jones 2006). There is also a carryover effect: effect increases eightfold by increasing interruption frequency from 1 to 3 (Zijlstra et al. 1999). – Effect is weaker for more frequent interruptions, as people learn to work faster (Cades et al. 2006), as well as for introducing blatant cues after the interruption (Trafton et al. 2005). ***Task completion time: mixed effects*** • Increased completion time (Arroyo and Selker 2003; Bailey and Konstan 2006; Burmistrov and Leonova 2003; Eyrolle and Cellier 2000; ; Jackson et al. 2003; Marulanda-Carter and Jackson 2012; McFarlane et al. 2002; Speier et al. 1997). – Effect is significant for interruptions from peers (Gupta et al. 2013), nonsignificant for simple interruptions (Burmistrov and Leonova 2003), and reversed (i.e., people work faster) for interruptions from supervisors (Gupta et al. 2013) and for simple primary tasks (Speier et al. 1997). – Effect is stronger for more frequent interruptions (Speier et al. 1997), interruptions on mobile devices rather than PC (Nagata 2006), and interruptions with thermal notification cues (Arroyo and Selker 2003) and weaker for anticipated interruptions (Nagata 2006) and interruptions similar to the primary task (Speier et al. 1997). – Simple interruptions requiring repetitive interactions are more disruptive than complex interruptions with less repetitive interactions (Nagata 2006). • No effect on completion time (Kapitsa and Blinnikova 2003). • Decreased completion time (Mark et al. 2008; Zijlstra et al. 1999). • Individuals develop strategies that over-	***Errors in task performance: mostly negative effects*** • Increased number/rate of errors (Arroyo and Selker 2003; Bailey and Konstan 2006; Burmistrov and Leonova 2003; Cades et al. 2006; Eyrolle and Cellier 2000; Hodgetts and Jones 2006; Kapitsa and Blinnikova 2003; McFarlane 2002; Monk et al. 2008; Speier et al. 1997; Trafton et al. 2005; Zijlstra et al. 1999: Russian subsample). – Effect is stronger for complex interruptions (Arroyo and Selker 2003; Bailey and Konstan 2006; Burmistrov and Leonova 2003; Eyrolle and Cellier 2000; McFarlane 2002; Speier et al. 1997) and weaker when complex interruptions are performed sequentially with the primary task (Kapitsa and Blinnikova 2003). • No effect on number/rate of errors (Hodgetts and Jones 2006; Mark et al. 2008; Zijlstra et al. 1999: Dutch subsample). ***Task omissions: negative effects*** • Increased number of task omissions (McFarlane 2002). ***Decision-making performance: negative effects*** • Decreased decision-making performance (Basoglu et al. 2009; Speier et al. 1997). – Effect is stronger for frequent interruptions (Basoglu et al. 2009; Speier et al. 1997) and reversed (i.e., people work more accurately) for simple primary tasks (Speier et al. 1997). ***Memory accuracy: negative effects*** • Decreased memory accuracy (Dodhia and Dismukes 2009; Edwards and Gronlund 1998; Oulasvirta and Saariluoma 2004). – Effect is significant when the primary task does not provide memory cues (Edwards and Gronlund 1998) and significant (Edwards and Gronlund 1998) or stronger (Oulasvirta and Saariluoma 2004; Baethge and Rigotti 2013) for interruptions similar to the primary task ***Task quality: negative effects*** • Decreased task quality (Gupta et al. 2013).

	compensate for the performance decline (Zijlstra et al. 1999). ***Total work time: negative effects*** • Increased total work time (Kapitsa and Blinnikova 2003; Zijlstra et al. 1999)	
(2) Congruent Interruptions (Interruptions Pertaining to Primary Activities)		
Effects on Workload	**Effects on Performance Efficiency**	**Effects on Performance Effectiveness**
Emotional load: mostly negative effects • Increased irritation (Baethge and Rigotti 2013; Grebner et al. 2003) • Decreased annoyance for interruptions that match attentional draw to utility (Gluck et al. 2007) ***Stress: mostly negative effects*** • Increased stress for pessimistic individuals and for negative feedback that turns attention to self (Szalma et al. 2006) • Compared to off-task interruptions, on-task interruptions provide instrumental support that decreases perceptual conflict and strain (Galluch et al. 2015) ***Cognitive load: mostly negative effects*** • Increased cognitive load for high-intensity interruptions (Robertson et al. 2006), but the effect is non-significant for interruptions that match attentional draw to utility (Gluck et al. 2007) ***Overall subjective workload: negative effects*** • Increased subjective workload (Galluch et al. 2015; Mark et al. 2008; Baethge and Rigotti 2013)	***Task resumption time (lag): mostly no effects*** • Increased completion time for interruptions occurring too early before needed (Miller 2002). • Interruptions with relevant information are less disruptive than those with irrelevant information (Czerwinski et al. 2000). ***Task completion time: mostly no effects*** • Increased completion time for interruptions occurring too early before needed (Miller 2002). ***Information processing efficiency: mostly no effects*** • Increased efficiency (Mark et al. 2008). • Decreased efficiency for negative feedback that turns attention to self and causes stress (Szalma et al. 2006).	***Errors in task performance: no effects*** • No effect on number/rate of errors (Mark et al. 2008). ***Perceived effectiveness: positive effects*** • Increased perceived effectiveness (Ang et al. 1993), especially for interruptions that match attentional draw to utility (Gluck et al. 2007). • Effect is stronger for IT-mediated interruptions as opposed to face-to-face interruptions (Ang et al. 1993). ***Decision-making performance: mostly positive effects*** • Increased decision-making performance (Earley et al. 1990), but the effect is non-significant for interruptions occurring too early before needed (Miller 2002). ***Sensitivity to error: positive effects*** • Increased sensitivity to error for composite feedback that turns attention to task and raises effort commitment (Szalma et al. 2006). ***Learning: positive effects*** • Increased learning (Robertson et al. 2004). – Effect is stronger for negotiated-style interruptions (Robertson et al. 2004). ***Objective performance: no effects*** • No effect on objective performance (Ang et al. 1993).

Appendix C

Sample Demographics

	Survey Study	Diary Study
Female/male ratio	0.76	0.46
With post-secondary degree	87%	84%
Age category mostly represented	30-39 (34%)	50-59 (35%)
Sales experience category mostly represented	10+ years (60%)	10+ years (71%)
> 5 years experience in sales	85%	79%
Positions strongly represented	Sales manager (20%); Account manager (13%); Sales rep (13%)	Sales manager (20%); Sales rep (15%); Account manager (14%)
Industries strongly represented	Retail (17%); Computer Hardware/ Software (16%); Finance, Insurance, or Real Estate (15%)	Manufacturing & Processing (16%); Finance, Insurance, or Real Estate (15%); Retail (11%)

Appendix D

Assessment of Common Method Bias Using the Marker Variable

	Survey Study						Diary Study					
Fisher-weighted mean correlation between marker items and study items	0.043						0.059					
Correlation range	From -0.261 to 0.208						From -0.203 to 0.234					
	Baseline model			Marker variable model			Baseline model			Marker variable model		
Paths	**Est.**	**SE**	**sig.**	**Est.**	**SE**	**sig.**	**Est.**	**SE**	**sig.**	**Est.**	**SE**	**sig.**
***Direct and indirect effects of exposure to e-mail interruptions*:**												
IEI → PERF (H1)	-0.03	0.04	.380	-0.03	0.04	.362	-0.13	0.05	.003	-0.13	0.05	.004
CEI → PERF (H2)	-0.04	0.04	.346	-0.04	0.04	.317	0.16	0.05	<.001	0.15	0.05	.001
IEI → SW (H3)	0.40	0.05	.000	0.40	0.05	.000	0.19	0.06	.001	0.19	0.06	.001
CEI → SW (H4)	0.07	0.05	.100	0.07	0.04	.103	0.15	0.06	.012	0.15	0.06	.011
SW → PERF (H5)	-0.14	0.06	.025	-0.14	0.06	.012	-0.21	0.05	<.001	-0.21	0.05	<.001
CEI → MIN (H6)	0.16	0.08	.032	0.16	0.07	.035	0.24	0.05	<.001	0.22	0.05	<.001
MIN → PERF (H7)	0.12	0.06	.049	0.12	0.06	.045	0.12	0.05	.011	0.11	0.05	.024
***Effects of e-mail capabilities*:**												
REP → SW (H8)	N/A	N/A	N/A	N/A	N/A	N/A	0.03	0.07	.680	0.05	0.07	.530
REH → SW (H9)	N/A	N/A	N/A	N/A	N/A	N/A	-0.02	0.06	.802	-0.03	0.08	.700
PAR → SW (H10)	N/A	N/A	N/A	N/A	N/A	N/A	0.32	0.07	<.001	0.31	0.07	<.001
LVE → SW (H11a)	N/A	N/A	N/A	N/A	N/A	N/A	0.13	0.07	.045	0.14	0.07	.036
DEL → SW (H11b)	N/A	N/A	N/A	N/A	N/A	N/A	-0.22	0.07	<.001	-0.22	0.07	.001
FOL → SW (H11c)	N/A	N/A	N/A	N/A	N/A	N/A	-0.03	0.08	.689	-0.03	0.08	.720
REP → MIN (H12)	N/A	N/A	N/A	N/A	N/A	N/A	0.21	0.05	<.001	0.22	0.05	<.001
REH → MIN (H13)	N/A	N/A	N/A	N/A	N/A	N/A	0.27	0.05	<.001	0.24	0.05	<.001
***Control variable effects*:**												
PC → SW	-0.07	0.04	.115	-0.07	0.04	.080	-0.13	0.06	.023	-0.13	0.06	.023
MSE → SW	-0.33	0.04	.000	-0.34	0.04	.000	-0.19	0.06	<.001	-0.19	0.06	.001
PC → MIN	0.34	0.14	.016	0.33	0.14	.016	0.03	0.06	.550	0.02	0.05	.701
PC → PERF	0.09	0.05	.075	0.08	0.05	.067	-0.03	0.06	.563	-0.04	0.06	.502
MSE → PERF	0.20	0.05	.000	0.19	0.05	.000	0.10	0.05	.068	0.10	0.06	.064
EFR → PERF	0.20	0.06	.000	0.20	0.06	.000	0.06	0.06	.311	0.05	0.06	.443
KNW → PERF	0.16	0.06	.006	0.15	0.06	.010	0.07	0.06	.270	0.07	0.06	.261

Notes:
IEI = Incongruent e-mail interruptions; CEI = Congruent e-mail interruptions; SW = subjective workload; MIN = mindfulness; PERF = individual performance; REP = reprocessing; REH = rehearsing; PAR = communicating in parallel; LVE = leaving messages in the inbox; DEL = deleting messages; FOL = foldering messages; PC = perceived control; MSE = multitasking self-efficacy; EFR = effort; KNW = knowledge.

Appendix E

Correlation Matrix and Composite Reliability Scores for Reflectively Measured Constructs

Table E1. Survey Study

Construct[a]	Reliability	Average variance extracted (AVE)	Mean	STD	SW	MIN	PERC	SOCC	MSE	EFR	KNW
Subjective workload (SW)	0.89	0.59	3.91	1.20	**0.77**						
Mindfulness (MIN)	0.87	0.54	5.58	0.85	-0.22**	**0.73**					
Perceived control/ personal (PERC)[+]	N/A	N/A	4.55	1.30	-0.24**	0.26**	**N/A**				
Perceived control/ social (SOCC)[+]	0.78	0.48	3.45	1.14	-0.14**	-0.26**	-0.02	**0.70**			
Multitasking self-efficacy (MSE)	0.88	0.64	5.48	1.04	-0.43**	0.40**	0.24**	0.01	**0.80**		
Effort (EFR)	0.78	0.55	5.58	0.95	-0.11*	0.53**	0.16**	-0.16**	0.34**	**0.74**	
Knowledge (KNW)	0.90	0.70	5.79	0.94	-0.25**	0.53**	0.17**	-0.14**	0.48**	0.50**	**0.83**

[a]The interruptions and individual performance constructs are not included in this table because they are not reflectively measured constructs.
**Significant at $p < 0.01$; * Significant at $p < 0.05$.
[+]PERC and SOCC are the first-order dimensions of perceived control (PC).
Bold numbers on the diagonal show the square root of the AVE. Numbers below the diagonal represent latent variable correlations.

Table E2. Diary Study

Construct[a]	Reliability	Average variance extracted (AVE)	Mean	STD	EFF	EFC	SW	MIN	PAR	REH	REP	PERC	SOCC	MSE	EFR	KNW
Individual performance/ effectiveness (EFF)	0.94	0.75	4.75	0.82	**0.87**											
Individual performance/ efficiency (EFC)	0.96	0.87	4.66	0.90	0.88**	**0.93**										
Subjective workload (SW)	0.96	0.79	3.56	1.22	-0.12	-0.19**	**0.89**									
Mindfulness (MIN)	0.91	0.66	4.32	0.93	0.43**	0.41**	0.12	**0.81**								
Communicating in parallel (PAR)	0.92	0.84	3.39	1.18	-0.06	-0.04	0.33**	0.31**	**0.92**							
Rehearsing (REH)	0.93	0.73	4.90	1.20	0.07	0.04	0.05	0.41**	0.17*	**0.86**						
Reprocessing (REP)	0.91	0.72	3.45	0.97	0.03	0.04	0.17*	0.35**	0.52**	0.26**	**0.85**					
Perceived control/ personal (PERC)[+]	N/A	N/A	4.19	1.40	-0.01	-0.04	-0.11	0.12	-0.05	0.06	0.02	**N/A**				
Perceived control/ social (SOCC)[+]	0.79	0.49	3.82	1.19	0.00	0.03	-0.25**	-0.12	-0.07	-0.07	-0.19**	0.35**	**0.70**			
Multitasking self-efficacy (MSE)	0.89	0.67	5.49	0.96	0.29**	0.30**	-0.20**	0.19**	0.07	0.05	0.02	0.11	0.21**	**0.82**		
Effort (EFR)	0.84	0.64	5.57	0.93	0.28**	0.23**	0.07	0.33**	0.14*	0.17*	0.10	0.00	-0.12	0.31**	**0.80**	
Knowledge (KNW)	0.87	0.62	5.63	0.90	0.28**	0.25**	0.09	0.29**	0.08	0.12	0.03	-0.02	-0.14*	0.34**	0.51**	**0.79**

[a]The interruptions and message organization constructs are not included in this table because they are not reflectively measured constructs.
**Significant at $p < 0.01$; *Significant at $p < 0.05$.
[+]PERC and SOCC are the first-order dimensions of perceived control (PC).
Bold numbers on the diagonal show the square root of the AVE. Numbers below the diagonal represent latent variable correlations.

Appendix F

Outer Model Loadings and Cross-Loadings

Table F1. Survey Study

Item	SW	MIN	PERC	SOCC	MSE	EFR	KNW
SW1	**0.78**	-0.27	-0.19	-0.02	-0.36	-0.08	-0.23
SW3	**0.83**	-0.23	-0.15	-0.09	-0.33	-0.08	-0.22
SW5	**0.41**	0.05	-0.04	-0.15	-0.12	0.09	0.07
SW6	**0.83**	-0.14	-0.18	-0.14	-0.33	-0.02	-0.16
SW8	**0.82**	-0.25	-0.22	-0.11	-0.41	-0.16	-0.27
SW9	**0.83**	-0.17	-0.18	-0.16	-0.34	-0.14	-0.22
Min1	-0.16	**0.73**	0.18	-0.22	0.30	0.47	0.42
Min2	-0.11	**0.81**	0.21	-0.23	0.26	0.41	0.41
Min3	-0.25	**0.81**	0.18	-0.20	0.32	0.39	0.37
Min4	-0.16	**0.74**	0.21	-0.23	0.29	0.36	0.40
Min5	-0.16	**0.72**	0.17	-0.17	0.31	0.38	0.34
Min7*	-0.26	**0.58**	0.19	-0.04	0.29	0.33	0.39
PC2	-0.22	0.26	**N/A**	0.02	0.24	0.16	0.17
PC3*	-0.23	-0.01	0.11	**0.47**	0.23	0.10	0.09
PC4*	-0.06	-0.22	-0.05	**0.80**	-0.07	-0.24	-0.18
PC5*	-0.04	-0.22	-0.01	**0.82**	0.01	-0.07	-0.09
PC6*	-0.18	-0.17	0.08	**0.62**	0.03	-0.10	-0.10
MSE1	-0.30	0.29	0.21	-0.03	**0.73**	0.26	0.37
MSE3	-0.28	0.28	0.17	0.05	**0.82**	0.25	0.39
MSE4	-0.33	0.39	0.23	-0.01	**0.84**	0.33	0.43
MSE5*	-0.45	0.31	0.17	0.02	**0.81**	0.24	0.36
Efr1	-0.07	0.40	0.14	-0.15	0.24	**0.80**	0.38
Efr2	-0.10	0.42	0.12	-0.09	0.20	**0.70**	0.36
Efr3	-0.07	0.37	0.10	-0.10	0.30	**0.72**	0.37
Knw1	-0.23	0.39	0.16	-0.05	0.40	0.38	**0.77**
Knw3	-0.19	0.45	0.14	-0.19	0.38	0.42	**0.87**
Knw4	-0.19	0.48	0.15	-0.15	0.38	0.41	**0.87**
Knw5	-0.22	0.44	0.13	-0.07	0.43	0.44	**0.82**

*Reverse-coded item.

SW = subjective workload; MIN = mindfulness; PERC = perceived control/personal; SOCC = perceived control/social; MSE = multitasking self-efficacy; EFR = effort; KNW = knowledge.

Table F2. Diary Study

Item	EFF	EFC	SW	MIN	PAR	REH	REP	PERC	SOCC	MSE	EFR	KNW
Eff1	**0.92**	0.85	-0.09	0.37	-0.04	0.04	0.05	-0.02	-0.04	0.27	0.24	0.27
Eff2	**0.93**	0.85	-0.08	0.41	-0.04	0.05	0.01	0.01	0.04	0.29	0.29	0.29
Eff4	**0.55**	0.42	-0.14	0.27	-0.13	0.05	0.10	0.06	-0.04	0.11	0.15	0.09
Eff5	**0.94**	0.80	-0.13	0.44	-0.06	0.08	0.00	-0.05	0.00	0.31	0.27	0.27
Eff6	**0.94**	0.82	-0.11	0.39	-0.04	0.09	-0.01	-0.02	0.03	0.26	0.26	0.24
Efc1	0.80	**0.92**	-0.12	0.40	0.03	0.04	0.06	-0.08	-0.02	0.26	0.25	0.25
Efc2	0.85	**0.95**	-0.20	0.39	-0.05	0.03	0.05	-0.05	0.03	0.30	0.23	0.22
Efc3	0.81	**0.92**	-0.19	0.38	-0.05	0.05	0.00	-0.01	0.07	0.32	0.17	0.21
Efc4	0.82	**0.94**	-0.20	0.38	-0.08	0.02	0.04	-0.01	0.04	0.24	0.20	0.26
SW1	-0.12	-0.17	**0.88**	0.12	0.31	0.05	0.16	-0.08	-0.23	-0.17	0.08	0.10
SW3	-0.09	-0.16	**0.93**	0.13	0.31	0.04	0.16	-0.07	-0.21	-0.18	0.05	0.07
SW5	-0.14	-0.20	**0.94**	0.04	0.28	0.00	0.15	-0.13	-0.26	-0.25	0.05	0.05
SW6	-0.15	-0.18	**0.88**	0.07	0.31	0.02	0.18	-0.11	-0.16	-0.15	0.02	0.01
SW8	-0.12	-0.22	**0.90**	0.12	0.28	0.05	0.18	-0.12	-0.24	-0.21	0.09	0.08
SW9	-0.01	-0.08	**0.79**	0.15	0.26	0.14	0.10	-0.09	-0.21	-0.10	0.10	0.15
Min1	0.43	0.42	0.14	**0.85**	0.26	0.30	0.27	0.06	-0.13	0.18	0.23	0.35
Min2	0.40	0.39	0.09	**0.92**	0.28	0.36	0.29	0.16	-0.09	0.17	0.29	0.28
Min3	0.36	0.37	0.09	**0.92**	0.31	0.38	0.33	0.14	-0.07	0.19	0.31	0.22
Min4	0.38	0.34	0.13	**0.86**	0.31	0.38	0.37	0.06	-0.09	0.15	0.31	0.20
Min5	0.24	0.23	0.11	**0.80**	0.33	0.37	0.39	0.07	-0.10	0.15	0.24	0.18
Min7*	0.30	0.24	-0.03	**0.45**	-0.12	0.19	-0.04	0.13	-0.09	0.03	0.21	0.12
Par1	-0.06	-0.04	0.34	0.26	**0.94**	0.13	0.48	-0.04	-0.05	0.07	0.11	0.09
Par2	-0.06	-0.03	0.26	0.31	**0.90**	0.19	0.48	-0.04	-0.09	0.07	0.15	0.06
Reh1	0.07	0.04	-0.04	0.22	0.05	**0.82**	0.08	0.00	-0.06	0.10	0.19	0.15
Reh2	0.04	-0.01	0.08	0.34	0.16	**0.88**	0.13	0.02	-0.08	0.03	0.17	0.14
Reh3	0.02	0.02	0.03	0.38	0.18	**0.84**	0.37	0.08	-0.05	0.07	0.08	0.00
Reh4	0.07	0.02	0.10	0.34	0.11	**0.91**	0.15	0.01	-0.10	0.01	0.17	0.15
Reh5	0.10	0.07	0.03	0.42	0.19	**0.83**	0.32	0.12	0.00	0.04	0.14	0.12
Rep1	0.03	0.01	0.11	0.26	0.42	0.25	**0.84**	-0.02	-0.18	0.01	0.14	0.05
Rep2	0.08	0.08	0.21	0.35	0.48	0.22	**0.90**	0.05	-0.14	0.07	0.12	0.06
Rep3	-0.12	-0.10	0.09	0.14	0.24	0.29	**0.75**	-0.02	-0.18	-0.05	0.03	-0.04
Rep4	0.02	0.05	0.14	0.35	0.53	0.19	**0.90**	0.03	-0.17	-0.01	0.04	0.00
PC2	-0.01	-0.04	-0.11	0.12	-0.05	0.06	0.02	**N/A**	0.35	0.11	0.00	-0.02
PC3*	0.11	0.13	-0.27	-0.08	-0.06	-0.03	-0.14	0.19	**0.80**	0.32	0.03	0.00
PC4*	-0.03	-0.01	-0.08	-0.10	-0.06	-0.14	-0.23	0.29	**0.64**	0.00	-0.21	-0.16
PC5*	-0.12	-0.10	-0.14	-0.09	-0.05	-0.03	-0.18	0.32	**0.75**	0.06	-0.08	-0.18
PC6*	-0.06	-0.03	-0.10	-0.07	-0.03	-0.04	0.03	0.29	**0.61**	0.01	-0.26	-0.19
MSE1	0.15	0.14	-0.12	0.17	0.10	0.08	0.03	0.07	**0.03**	0.73	0.25	0.20
MSE3	0.26	0.25	-0.14	0.19	0.07	0.07	0.05	0.13	0.15	**0.86**	0.32	0.32
MSE4	0.31	0.29	-0.11	0.17	0.08	0.02	0.07	0.05	0.16	**0.85**	0.32	0.36
MSE5*	0.22	0.27	-0.26	0.11	0.02	0.03	-0.06	0.10	0.27	**0.83**	0.15	0.20
Efr1	0.28	0.24	0.10	0.31	0.11	0.10	0.03	-0.05	-0.11	0.27	**0.88**	0.47
Efr2	0.21	0.17	0.09	0.26	0.08	0.19	0.10	0.05	-0.07	0.25	**0.86**	0.43
Efr3	0.17	0.11	-0.05	0.20	0.16	0.13	0.13	0.03	-0.12	0.23	**0.64**	0.31
Knw1	0.14	0.15	-0.04	0.11	-0.03	0.07	0.00	-0.07	-0.03	0.31	0.35	**0.66**
Knw3	0.27	0.24	0.11	0.25	0.08	0.04	0.08	-0.01	-0.16	0.23	0.35	**0.85**
Knw4	0.24	0.21	0.08	0.25	0.03	0.17	-0.03	-0.03	-0.16	0.22	0.41	**0.88**
Knw5	0.20	0.19	0.08	0.26	0.15	0.12	0.03	0.04	-0.06	0.35	0.53	**0.75**

*Reverse-coded item.
SW = subjective workload; MIN = mindfulness; PERC = perceived control/personal; SOCC = perceived control/social; MSE = multitasking self-efficacy; EFR = effort; KNW = knowledge.

Appendix G

Validation Steps for E-Mail Interruptions Exposure

Step	Description of Validation Step/Result	Figures or Tables
1	Conducting two separate large-scale studies (survey study, n = 365; diary study, n = 212) that assess e-mail interruptions exposure, and replicating the results in both studies (external validity).	
2	Conducting an additional study that asked a smaller set of respondents to record their interruptions exposure using both a shorthand version of the main survey and a log to record each interruption (event-sampling design). Comparing the results of the two methods, we found that the measures of interruptions exposure were positively correlated and showed no significant differences.	Table G1 Table G2
3	Asking the main survey and diary respondents to answer the interruptions questions with care and to consult their e-mail in-boxes if necessary (82% of survey respondents reported storing most of their e-mails).	
4	Requiring the survey and diary respondents to allocate their estimates over primary/secondary e-mails, and—for the frequency measures—requiring the survey respondents to allocate their estimates over the set of primary selling activities they performed. This decomposition approach provides cues that coincide with the natural categories used by respondents to classify events, and thus helps them to better recall their interruption events (Menon 1997).	
5	Including a validation question that computes the total time spent on interruptions (frequency * average duration) based on the individual frequency/duration estimates for the past workweek (survey study) or workday (diary study). Respondents were allowed to adjust their individual estimates based on the total time estimate.	
6	Measuring indicator weights and finding all weights to be significant on their respective e-mail interruptions exposure constructs.	Figures G1 and G2
7	Measuring variance inflation factors (VIF) for the indicators and finding them to be below the stringent threshold of 3.33 (Cenfetelli and Bassellier 2009).	Table G3

Table G1. Description of Log Study Methodology

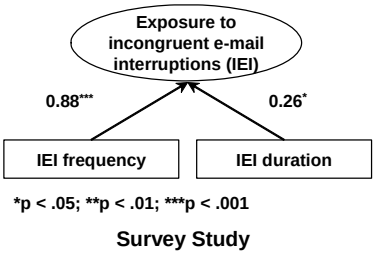
30 sales professionals completed a short online survey that included the e-mail interruptions questions from the main survey, and then completed an online log (that they were asked to print) to record all of their e-mail interruptions over a period of two workdays. The log was designed to be easy to use and minimally obstructive. It provided definitions of the key terms and asked participants to record each interruption event in a separate record by selecting the type of primary activity that was interrupted (prospecting; interacting; etc.), the type of e-mail interruption, and the start and end times of the interruption. Interruption frequency was calculated by averaging the total number of records of the two days, and duration was calculated by taking the average duration across the interruption occurrences. The responses collected through the two separate methods were correlated and tested for mean differences through a repeated measures t-test (see Table G2 for the results).

Table G2. Results of Log Study

	IEI Frequency		IEI Duration (min)		IEI Exposure		CEI Frequency		CEI Duration (min)		CEI Exposure	
	Survey	Log	Survey	Log	Survey	Log	Survey	Log	Survey	Log	Survey	Log
Mean	22.97	24.19	7.61	8.94	167.10	195.00	10.87	8.79	19.48	26.74	179.81	226.53
St Dev	14.31	9.21	5.03	8.36	180.83	132.88	5.43	4.28	21.93	11.78	143.66	162.77
Corr	0.462**		0.531**		0.771***		0.453**		0.733***		0.622***	
t-test	0.527		1.036		1.347		2.241*		2.602*		1.937	

*p < .05; **p < .01; ***p < .001

Notes: IEI = Incongruent e-mail interruptions; CEI = Congruent e-mail interruptions.



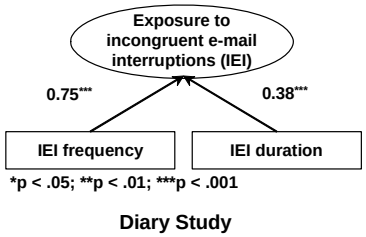
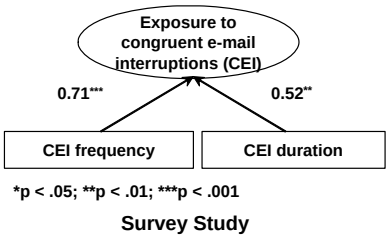


Figure G1. Indicator Weights of Exposure to Incongruent E-Mail Interruptions

Notes: IEI = Incongruent e-mail interruptions; CEI = Congruent e-mail interruptions.



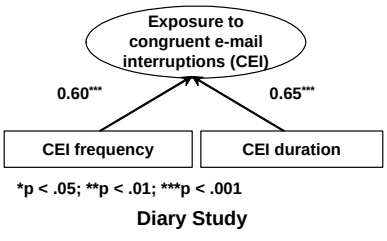


Figure G2. Indicator Weights of Exposure to Congruent E-Mail Interruptions

Notes: IEI = Incongruent e-mail interruptions; CEI = Congruent e-mail interruptions.

Table G3. Variance Inflation Factors for Exposure to Incongruent/Congruent E-Mail Interruptions

Components	VIF (Survey Study)	VIF (Diary Study)
CEI frequency	1.098	1.332
CEI duration		
IEI frequency	1.134	1.083
IEI duration		

Notes: IEI = Incongruent e-mail interruptions; CEI = Congruent e-mail interruptions.

Appendix H

Validation Steps for Individual Performance

Step	Description of Validation Step/Result	Figures or Tables
1	Ensuring through review of sales literature that the first-order constructs (efficiency/effectiveness) capture the content domain of the second-order construct (e.g., Jaramillo and Mulki 2008; Sujan et al. 1994).	
2	Establishing content validity via card-sorting analysis and pilot testing	
3	Ensuring that the indicators of efficiency and effectiveness (formatively measured in the survey study) cover the entire domain of sales activities (from prospecting to closing the sale; see Appendix A)	
4	Establishing the significance of path coefficients at the first-order level (survey study) and the second-order level (both studies, see Figure H1)	Figure H1
5	Measuring VIF at the first-order level (survey study) and the second-order level (both studies, see Table H1). With one exception, all values were below the stringent threshold of 3.33 (Cenfetelli and Bassellier 2009). VIF for effectiveness-efficiency in the diary study was 4.470. However, these dimensions were retained because they represent separate categories, as confirmed by the literature, the card sorting analysis, and the pre-tests.	Table H1

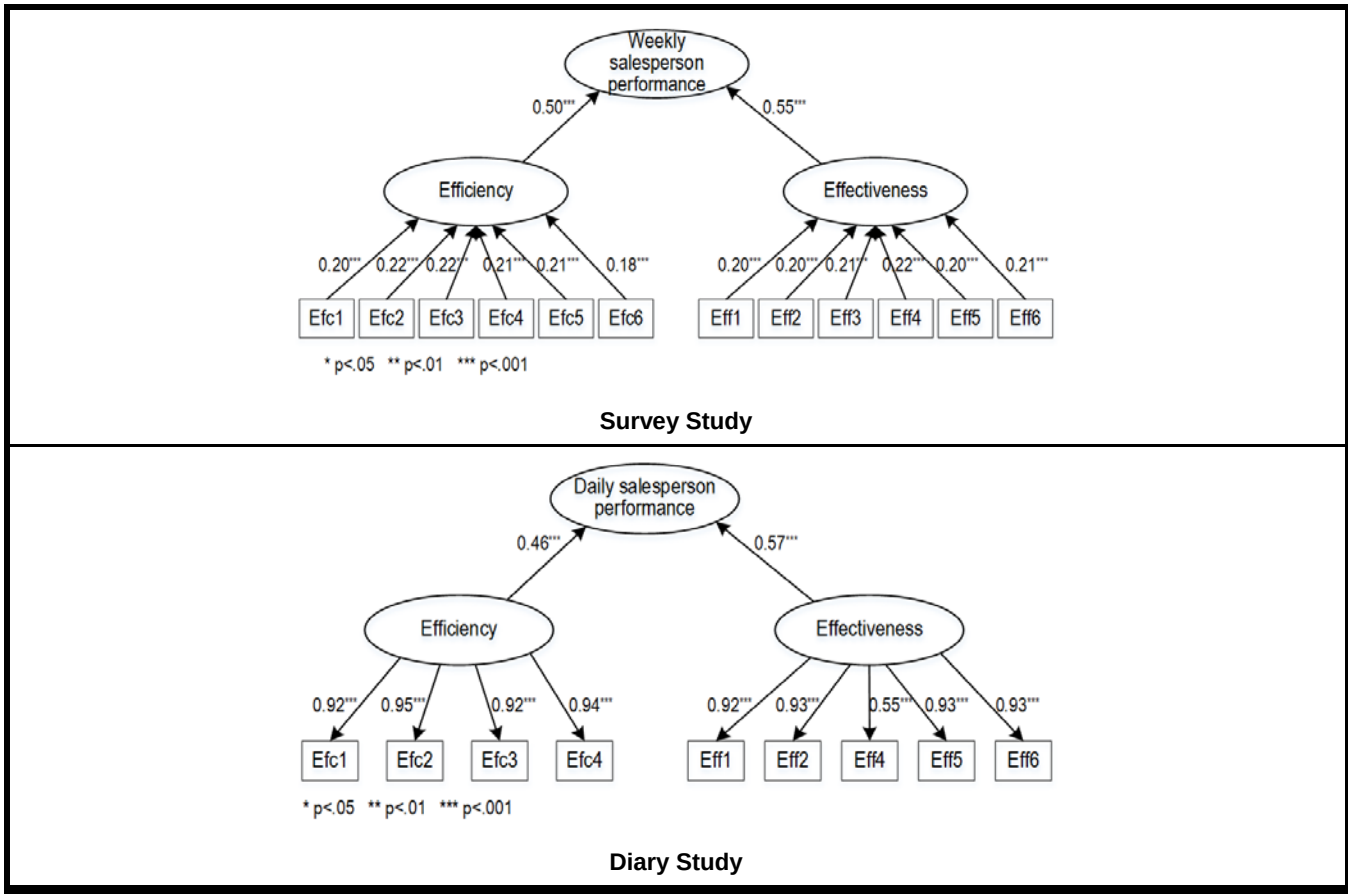


Figure H1. Path Coefficients of Individual Performance

Table H1. Variance Inflation Factors for Individual Performance		
Components	**VIF (Survey Study)**	**VIF (Diary Study)**
Efc1	1.854 - 2.332	N/A
Efc2		
Efc3		
Efc4		
Efc5		
Efc6		
Eff1	1.762 - 2.460	N/A
Eff2		
Eff3		
Eff4		
Eff5		
Eff6		
Efficiency	2.681	4.470
Effectiveness		

Appendix I

Fixed Effects, Random Effects, and Model Fit (Diary Study)

	Outcome		
	SW	**MIN**	**PERF**
Fixed Effects:			
Intercept	3.56*** (0.07)	4.32*** (0.06)	4.71*** (0.05)
IEI	0.19** (0.06)		-0.13** (0.05)
CEI	0.15* (0.06)	0.24*** (0.05)	0.16*** (0.05)
PAR	0.32*** (0.07)		
REP	0.03 (0.07)	0.21*** (0.05)	
REH	-0.02 (0.06)	0.27*** (0.05)	
LVE	0.13* (0.07)		
FOL	-0.03 (0.08)		
DEL	-0.22*** (0.07)		
SW			-0.21*** (0.05)
MIN			0.12* (0.05)
PC	-0.13* (0.06)	0.03 (0.05)	-0.03 (0.06)
MSE	-0.19*** (0.06)		0.10 (0.05)
KNW			0.07 (0.06)
EFR			0.06 (0.06)
Variance of Random Components:			
L1 variance (Residual)	0.567***	0.423***	0.324***
L2 variance	0.873***	0.426***	0.340***
Model Fit:			
R_1^2	0.123	0.089	0.036
R_2^2	0.254	0.321	0.339
Deviance	3249.5		
δDeviance	-1058.5***		

*p < .05; **p < .01; ***p < .001

IEI = incongruent e-mail interruptions (exposure); CEI = congruent e-mail interruptions (exposure); SW = subjective workload; MIN = mindfulness; PERF = individual performance; REP = reprocessing; REH = rehearsing; PAR = communicating in parallel; LVE = leaving messages in inbox; DEL = deleting messages; FOL = foldering messages; PC = perceived control; MSE = multitasking self-efficacy; EFR = effort; KNW = knowledge

Appendix J

Mediation Analyses

Table J1. Exposure to Incongruent E-Mail Interruptions and Individual Performance

	Survey Study			Diary Study		
Effect	**Est.**	**p-value[a]**	**CI[b]**	**Est.**	**p-value[a]**	**CI[c]**
Direct effect	-0.03	.522	[-0.16;0.05]	-0.13	.003	[-0.22;-0.05]
Indirect effect via subjective workload	-0.07		[-0.14;-0.01]	-0.04		[-0.07;-0.01]
Total effect	-0.09	.061	[-0.20;-0.02]	-0.16	<.001	[-0.24;-0.08]

[a]For the indirect effects, we do not provide a formal p-value since significance is based on the confidence interval.

[b]CI = bias corrected 95% confidence interval (5000 bootstrap samples).

[c]CI = 95% confidence interval estimated using the Monte Carlo method (10000 bootstrap samples).

Table J2. Exposure to Congruent E-Mail Interruptions and Individual Performance

	Survey Study			Diary Study		
Effect	**Est.**	**p-value[a]**	**CI[b]**	**Est.**	**p-value[a]**	**CI[c]**
Direct effect	-0.04	.567	[-0.11;0.13]	0.16	<.001	[0.07;0.25]
Specific indirect effect via subjective workload	-0.01		[-0.04;0.00]	-0.03		[-0.06;-0.01]
Specific indirect effect via mindfulness	0.02		[0.01;0.04]	0.03		[0.01;0.05]
Total indirect effect	0.01		[-0.03;0.03]	0.00		[-0.04;0.03]
Total effect	-0.03	.700	[-0.11;0.14]	0.14	.001	[0.08;0.21]

[a]For the indirect effects, we do not provide a formal p-value since significance is based on the confidence interval.

[b]CI = bias corrected 95% confidence interval (5000 bootstrap samples).

[c]CI = 95% confidence interval estimated using the Monte Carlo method (10000 bootstrap samples).

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