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Being Interrupted by Instant Messaging: Does it Matter Who is Interrupting - The Boss or The Coworker?

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ABSTRACT

Instant messenger is being rapidly deployed in the workplace. Current studies largely focus on the adoption of IM and how IM is used. Little research has been conducted to understand the potential impact of using IM in the workplace. This paper contributes to the literature on Instant Messaging and task performance by theorizing and empirically testing how some technological features of IM could intertwine with social characteristics and jointly influence user task performance and perceived workload. We also study the impact of perceived task complexity on task performance and perceived workload. The effect of interruption on task completion time is dependent upon the hierarchy level of message sender. Interruptions from a supervisor were found to reduce primary task completion time whereas interruptions from a peer increase primary task completion time. In addition, interruptions from a supervisor aggravate the negative impact of interruptions on task quality.

Keywords

Interruption, Instant Messaging, Perceived Task Complexity, Task Performance, Perceived Workload.

INTRODUCTION

Instant Messaging (IM) is a computer mediated communication medium that has been widely adopted for social communication in daily life and is now gaining popularity for workplace interactions at a phenomenal pace.. Several studies have been conducted to understand the application, adoption and potential negative consequences of IM in the workplace (Cameron and Webster, 2005; Hung, Kong, Chua and Hull, 2006). However, little empirical research has been conducted to assess the impact of IM and how they are actually used in organizations

The deployment of IM often creates a multitasking work environment (Cameron et al., 2005; Czerwinski, Cutrell and Horvitz, 2000; Rennecker and Godwin, 2005) where a sender can preempt a receiver from his or her ongoing tasks at any time period with message 'pop-up', thereby disrupting the processing of primary tasks. Due to the inherent presence awareness features of IM, senders (peers or supervisors) are usually aware of receivers' presence and, therefore senders expect their messages to be replied in a near-synchronous mode. This is rarely a problem with other technologies such as emails or phone where a receiver has a choice to process the message now or later due to the lack of such social awareness features.

Our approach takes into account some of the social characteristics of IM. The objective of this study is to investigate the impact of instant messaging in an experimental design setting. The study focuses on the impact of multitasking and interruptive nature of IM on the objective task performance and work overload. In particular, our research questions are: 1) what is the impact of interruptions from IM on user performance and workload? 2) what is the impact of social influence of message senders on user performance and perceived workload? 4) how will perceived task complexity influence user performance and perceived workload?

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LITERATURE AND RESEARCH HYPOTHESES

In the work setting, instant messenger is often required to be left on while workers are performing some main tasks. Due to IM's built-in awareness features, recipients are usually expected to respond immediately. This may increase the disruptive nature of IM. Until now, few studies have empirically studied the impact of IM, considering the typical usage context of IM. In this study, we considered the usage context of IM to explore its potential impact on objective task performance and perceived mental workload. Objective task performance was gauged based on task time and task quality. The research model (proposed and discussed below – Figure 1) depicts how the interruptive features of IM may intertwine with the hierarchy level of message sender to jointly influence user performance and perceived workload.

Task Performance and Perceived Workload

The study used two objective measures of task performance: task time and task quality. Knowledge workers process some main tasks while responding to IM messages. We are interested in how interruption(s) from IM could influence the performance on the main task. Therefore, task time refers to the time to perform the main task excluding the spent on IM tasks and task quality was measured by the degree of correctness of the main task.

Perceived workload is another dependent variable used in this study. Work overload has been found to be the strongest predictor of the exhaustion of IT workers and further lead to high job turnover intention (Moore, 2000). In this study, we examined it as a dependent variable. Multitasking work setting resulting from deploying IM could have an impact on perceived workload of knowledge worker as well.

Interruptions

Interruptions have been defined in several different ways. For example, according to distraction theory, an interruption is defined as "an externally generated, randomly occurring, discrete event that breaks the continuity of cognitive focus on a primary task" (Corragio, 1990). The timing of an interruption is usually random and beyond the control of a receiver. It breaks the attention of the message receiver and typically requires immediate switching from main task to the interruption task. Main task and interruption task compete for the limited cognitive processing resources of an individual. The performance of main tasks is likely to be compromised due to memory loss or reduced processing of information cues necessary for main tasks.

A majority of studies, such as (Speier, Vessey and Valacich, 2003), (Jett and George, 2003) etc., have examined the effect of interruptions at individual level. However, limited studies have examined interruptions from a social network perspective. The effect of interruptions should be investigated in the context of social ties between message senders and receivers. Our study focused on the frequency and social characteristics of interruptions. We compared the effects of low interruption frequency with high interruption frequency. For social characteristics of the interruption, we examined the effect of hierarchy level of message sender on task performance. The hierarchy level of a message sender may interact with the effect of interruptions on task performance. Interruption messages generated by a supervisor may have different impact on receivers' task performance from messages sent out from a peer or coworker. Message receivers are more likely to give a high priority to messages from a supervisor. The mechanisms used to process main task may be adjusted accordingly.

Interruptions and Hierarchy Level of Message Sender

According to distraction conflict theory (DCT) (Baron, 1986), interruptions could narrow one's attention or process fewer number of information cues. Such narrowing in attention or processing capacity will cause a decision maker either to adopt a heuristic information processing strategy or spend longer time on the primary task. With the increase in the frequency of interruptions, the heuristic information processing strategy will cause decision makers to reduce the time spent on primary task. Conversely, if the heuristic strategy is not used, frequent interruptions may cause longer time spent on the primary task. Extra time is often needed to recover memory cues relevant to the main task lost while interruption tasks are processed. When the interruption message is from a supervisor, message receiver may give a higher processing priority to interruption messages and likely use heuristic strategy to perform the primary task. Heuristic strategies may not eventually be utilized if message sender is a peer. Thus, the hierarchy level of the message sender may interact with interruption frequency and determine when heuristic processing takes place. Therefore, we hypothesize:

H1: The hierarchy level of message sender moderates the relationship between interruption and task time.

H1a: The higher the interruption frequency, the shorter the time spent on a primary task when the interruption message is sent from a supervisor.

H1b: The higher the interruption frequency, the longer the time spent on a primary task when the interruption message is sent from a peer.

Interruptions have also been found to influence task quality. Speier et al (Speier et al., 1999; Speier et al., 2003) found that interruptions could reduce task quality for complex tasks. Complex tasks require more cues to be processed than simple tasks. The narrowing in attention triggered by interruptions is likely to cause the omission of the necessary cues for the successful completion of the complex task. In this study, we examined the effect of interruption frequency while controlling for the perceived task complexity level. The increase in interruption frequency is expected to augment the degree of narrowing in processing attention and, at high interruption level, the task quality of all types of tasks may be compromised. Therefore, we have

H2: Interruption frequency has a negative impact on task quality.

In addition, the hierarchy level or position power of the message sender may also influence task quality. Interruption messages sent from a supervisor may be more disruptive than those from a peer. Knowledge workers are likely to allocate extra attention to respond to interruption messages generated by their supervisor and opt for a heuristic strategy to process the primary task. As a result, fewer information cues relevant to the primary task will be processed. The quality of a primary task is expected to be compromised more severely by the interruption from a supervisor than that from a peer.

H3: Position power of the message send has a negative impact on task quality.

Perceived workload is the perception that one has too much to work on (Leiter and Schaufeli, 1996). Perceived workload is a strong predictor of work exhaustion, which further influences the job turnover intention of IT workers (Ahuja, Chudoba and Kacmar, 2007; Moore, 2000). Interruptions of IM could also increase knowledge workers' perception of mental overload. Besides the increase in the number of information cues to be processed, interruptions from IM are more likely to trigger the feeling of time pressure than other asynchronous communication media. The presence awareness feature of IM urges the message receiver to immediately address IM messages. Under high interruption frequency, message receivers are likely to feel time-pressured and experience mental overload. Further, interruptions may share the same sensory channels as the primary task, causing potential loss of working memory or confusion of cues of different tasks (Speier et al., 2003), which suggests that interruption messages at a high frequency may increase the perceived mental overload. Therefore, we hypothesize

H4: Interruption frequency increases perceived workload.

Perceived Task Complexity

Recent studies have found that subjective task complexity is also an important determinant of task performance and the effect of objective task complexity is partially mediated through subjective task complexity (Maynard and Hakel, 1997). Individuals who perceive the task to be complex are more likely to exclude some information cues for consideration and focus their attention on cues that are perceived to be most relevant. As a result, cues that are necessary to correctly solve the primary task could get neglected. Due to absence of relevant information, workers will sub-optimize, thereby leading towards degradation in terms of task quality. Tasks that are perceived to be relatively complex will also require more time since more cues are needed to be processed. Conversely, the perception of a task being simple may encourage an individual to consider all available information cues or at least more cues for decision making. This also implies that individuals may feel more overloaded with information when too many cues are vying for their attention, which is a scarce resource, as is the case with a task perceived as complex. On the contrary, a task perceived as simple is less demanding and, therefore, is likely to lead to less mental workload. Therefore, we hypothesize,

H5: Perceived task complexity has a negative impact on the time spent on a primary task.

H6: Perceived task complexity has a negative impact on the quality of a primary task.

H7: Perceived task complexity has a positive impact on mental workload.

Besides the above independent variables, the research model consists of four control variables: gender, IM experience, previous experience of supply chain related tasks, and task motivation.

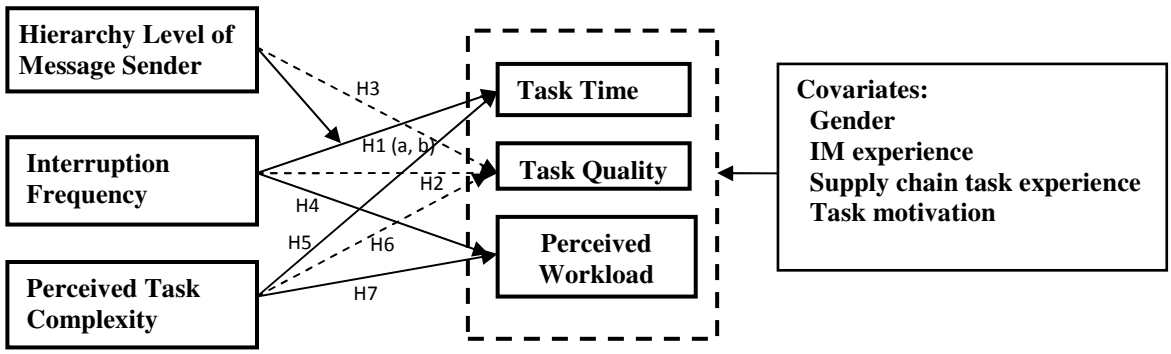

Figure 1. Research Model

RESEARCH METHODOLOGY

Experimental design was used to manipulate the frequency of the interruption and hierarchy level of the message sender. The frequency of the interruption was manipulated at two levels: low interruption and high interruption. The hierarchy level of message sender was manipulated at two levels: peer and supervisor. So, the two manipulated variables jointly form four treatment conditions. Student volunteers were randomly assigned to only one of four treatment conditions. Each subject assumed the role of a knowledge worker working on a group project that aimed to improve the supply chain of a company. The main task was to browse the websites of UPS and U.S. Postal Service and search for costs of shipping two types of packages to a warehouse. While subjects were performing the search tasks, they were interrupted by instant message(s) sent from their project member or project manager. Subjects were instructed to respond instant messages once they received them.

All latent constructs in the research model were measured using existing published scales. Some items were re-worded slightly to reflect the research context. Perceived task complexity and task motivation were measured using the instruments by Maynard and Hakel (Maynard et al., 1997). Perceived workload was adapted from the instruments by Moore (Moore, 2000). All these items were measured on a five-point Likert scale with 1 being strongly disagree and 5 being strongly agree. Objective performance was assessed using time and quality of completing the main task. The task quality was computed as the number of correct shipping costs found from the two websites.

DATA ANALYSIS

T-tests were conducted to check the manipulation on the hierarchy level of the message sender and interruption frequency and were found to be successful at p-value < 0.01 and 0.05 respectively. Partial least square (PLS) technique was performed to test the measurement model and research hypotheses. A sample size of 112 was found to be sufficient for PLS analysis. Results of testing the measurement model are available with the authors. Overall, these results indicate that our measurement model has adequate convergent and discriminant validity. So, the structural model can be examined further.

Hypotheses Testing Results

Figure 2 summarizes the results of testing the hypotheses. The model could explain 19.1% of the variance in the completion time of the primary task, 17.1% of the variance in the correctness of the primary task and 30.9% of the variance in perceived workload.

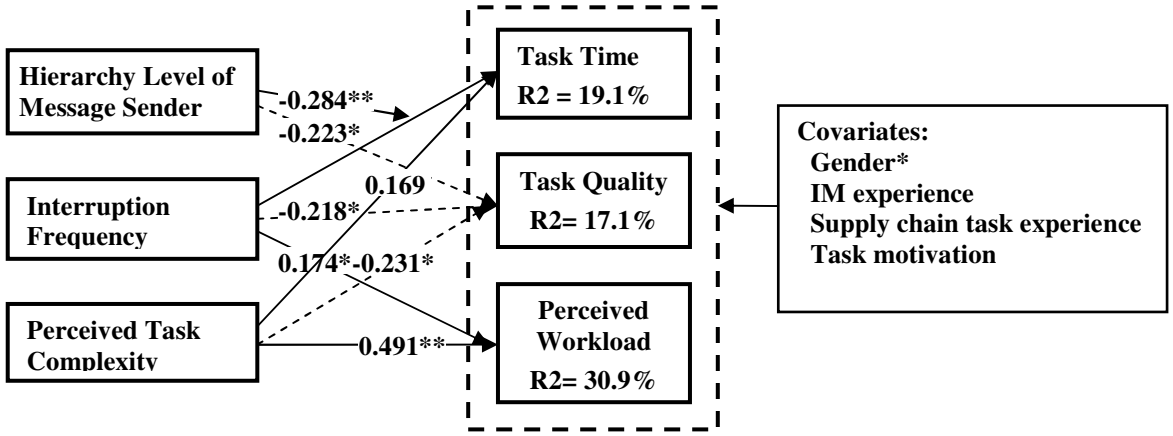

Figure 2. Results of Testing Hypotheses using PLS Analysis. Completely Standardized Estimates, Controlled for Covariates in the Research Model, *p < 0.05, **p < 0.01 (two-tailed).

We first analyzed the moderation effect of the hierarchy level of message senders or Hypothesis 1 and, then tested other main effect hypotheses. Following the procedures by Chin et al. (2003), we examined both effect size and statistical signification of the moderation effect. The effect size of interaction (f^2) was 0.09, which satisfies the 0.02 cutoff for small effect size (Cohen, 1988)[†]. The moderation effect is also found to be statistically significant ($p < 0.01$). Therefore, the effect of interruptions on task completion time is moderated by the position power of message senders. The interaction pattern is shown in Figure 3, which is consistent with the hypotheses. The utility by Preacher et al. (2003) was then applied to test statistical significance. We found that when the message sender is a supervisor, the relationship between interruption frequency and task time is negative and marginally significant ($p<0.1$). When the message sender is peer, the relationship was positive and statistically significant ($p < 0.05$). Overall, H1 was supported.

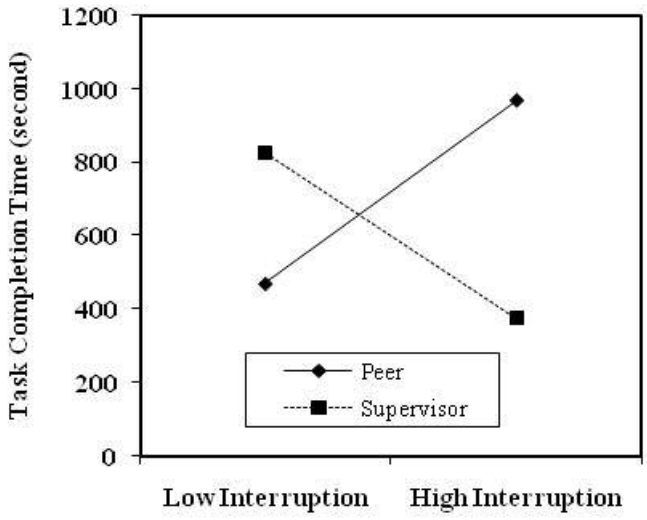

Figure 3. The Moderation Effect of the Hierarchy Level of Message Sender on the Relationship between Interruption Frequency and Main Task Completion Time.

[†] $f^2 = [R^2$ (interaction model) - R^2 (main effects model)] / [1- R^2 (main effects model)].

We went on to examine the other hypotheses. They were all found to be statistically significant except H5. Perceived task complexity is not found to significantly influence the task completion time. Overall, the research model is well supported. In addition, among the four covariates, gender was found to significantly increase task quality. The number of correct answers of female is significantly higher than that of male ($p < 0.05$).

DISCUSSIONS

Implications for Research

This study has important implications for research. Findings suggest that social influence could play an important role in the use of IM. Future IM studies are needed to have a better understanding of the effect of other social network features such as the strength of the social tie, density of the social network using IM, etc. Future studies could also examine other dimensions of IM interruptions such as duration, timing and complexity of IM tasks, etc.

Implications for Practice

The findings in this study also have important implications for organizations that deploy IM as an alternative communication channel. First, interruptions from IM could negatively influence the performance of knowledge workers. The negative impact is aggravated when the message sender has higher position power than the message receiver. Second, knowledge workers suffer from increased mental workload when receiving frequent IM messages. Companies may need to monitor IM messages received by employees and set up policies or use technical approach to control the frequency of IM usage. Third, organizations may need to first assess the perceived task complexity of different types of tasks and then use the information to decide which working divisions are good candidates for installing IM.

CONCLUSIONS

This paper contributes by increasing our theoretical and empirical understanding of the impact of IM on task performance and perceived workload. This paper focuses on the interruptive nature of IM technology and adopts a social network perspective. Interruption messages sent from IM are found to decrease task performance and increase mental workload. The position power of the message sender moderates the impact of interruptions on task time. Interruptions from a supervisor could reduce primary task completion time whereas interruptions from a peer increase primary task completion time. In addition, interruptions from a supervisor aggravate the negative impact of interruptions on task quality.

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