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Should I send this message? Understanding the impact of interruptions, social hierarchy and perceived task complexity on user performance and perceived workload

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ABSTRACT

Instant messenger technologies have become a common place for collaborative work and group decision support. Managers need to understand the potential impact of using IM in an organization. This paper contributes to the literature on instant messaging and primary task performance by theorizing and empirically testing how the interruption frequency of IM could intertwine with the social characteristics of IM communication and jointly influence user task performance and perceived workload. Using experimental design, we found that the effect of interruption on primary task completion time is dependent upon the hierarchical level of the message sender. Interruptions from a supervisor were found to reduce primary task completion time whereas interruptions from a peer increased primary task completion time. On the other hand, interruptions from a supervisor aggravated the negative impact of interruptions on task quality. Thus, it may be important for members and leaders of group decision teams to be more careful in the use of instant messaging with their peers and subordinates.

1. Introduction

As organizations become more virtual, their communication processes evolve over time [21]. The role of communications mode and its impact on organizational performance have been studied for quite some time in decision support literature. For example, Fjermestad [23] reported on a meta-analysis of 145 experiments on communication mode in group support systems. Barkhi et al. [6] studied the influence of communication mode and incentives on group decision support (GDSS) process as well as outcomes. Another example of such studies is an experiment to study the impact of task type and communication media in GDSS [48]. Thus, the basic GDSS research has focused on communications media for a long time. Although many GDSS researchers focused on collaborative media such as decision rooms, the time/space framework described by DeSanctis and Gallupe [20] has become an acceptable way to recognize all collaborative systems. Bafoutsou and Mentzas [4] provide a good overview and classification of collaborative systems as well as a review of previous studies. Along with all the other collaborative technologies, they recognize instant messaging as one of the technologies that provides support for group work. Because of the ease of use, low bandwidth requirement and standardization, instant messaging has been widely adopted for social communication in daily life, but its popularity for more formal as well as complex workplace interactions is also increasing at a phenomenal pace. Osterman Research [44] found that more than 90% of organizations in North America use instant messaging (IM) in their networks. Gartner predicts that "by the end of 2011, IM will be the de facto tool for voice, video and text chat with 95 percent of workers in leading global organizations using it as their primary interface for real-time communications by 2013. The worldwide market for enterprise IM is forecast to grow from $267 million in 2005 to $688 million in 2010" [26]. According to the Pew survey report on IM usage in the United States [51], approximately 53 million American adults use instant messaging programs and about 11 million of them use IM at work. Several studies have been conducted to understand the application, adoption, and potential negative consequences of IM in the workplace [10,32]. Some recent studies on IM have focused on various decision making aspects such as selection of communication media at workplace [11], negotiation process using IM [33], deception detection using IM [57]. Though there is plenty of research on IM adoption in the workplace, for example related to usage characteristics and patterns, little empirical research has been conducted to assess the role that hierarchical level plays in influencing the performance in workplaces utilizing IM.

Several IM features can benefit workplace communication. For example, the ease of coordination and scheduling; its immediacy, with nearly-synchronous communication; its informal nature [8], its social presence features, and privacy make it a very useful tool. However,

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some of these features have actually started to result in inefficiencies related to their use in the workplace. The deployment of instant messenger often creates a multitasking work environment [10,16,50] where a sender can preempt a receiver from the receiver's ongoing tasks at any time period with a message 'pop-up,' thereby disrupting the processing of primary tasks. Because of the inherent presence awareness features of IM, senders are usually aware of the receiver's presence and therefore, expect responses in a near-synchronous mode. This is rarely a problem with other technologies such as emails or telephone calls, where the lack of such social awareness features enables a receiver to choose whether to process the message now or later. However, these features can be technically enabled within emails when used in certain contexts such as email embedded within a social networking platform such as Facebook. Our research aims to investigate some of the social characteristics of IM usage specifically at workplace and the impact of IM interruptions on the primary task performance and work overload. In particular, our research questions are 1) What is the impact of interruptions from IM on users' task performance as influenced by the sender's hierarchical level? 2) What is the impact of interruptions from IM on users' overall mental workload? and, 3) How does perceived primary task complexity influence user performance and overall perceived workload?

This study makes unique theoretical and research contributions. Through this study, we bring in one social characteristic of IM, i.e. the hierarchical level of message sender, in an interrupted work environment and understand the role it plays in influencing the impact of interruptions on individual performance and overall mental workload at workplace. Other studies on interruptions have focused on different aspects of tasks and GUI such as interruption task characteristics [27], presentation format and primary task characteristics [52,53], user interface development [40,41]. McFarlane [40] focuses on developing a user interface design that mitigates the negative effects of interruptions. Gillie and Broadbent [27] focused on interruption characteristics — length, complexity and similarity while conducting a series of four different experiments to find particular characteristics that influence disruptiveness. McFarlane and Latorella [41] and McFarlane [40] focused on developing user interface guidelines for four different types of interruptions — immediate, negotiated, mediated and scheduled. All these studies have not examined the hierarchical level, perceived complexity and any resulting interaction effects, which is the centerpiece of this study. Also, Speier et al. [53] looked into a work environment consisting of two levels of interruptions, i.e. interruptions vs. no interruptions. Our study looks at how the influence of (high vs. low) interruptions is moderated by an embedded social characteristic of the sender, i.e. the hierarchical level of the message sender.

Distraction conflict theory (DCT) [7] serves to provide a concrete theoretical foundation for this study. According to DCT, in the presence of interrupters, an individual performing a task engages in attentional conflict between the interrupters and the task. This, in turn, heightens the arousal level of the individual (i.e. the status of being alert and vigilant) and facilitates the performance of simple tasks. This study extends the existing research by adding the novel context of IM, which results in immediate interruption [40], and bringing in the social characteristics of the interruption. This study also provides important directions for future research of IM by emphasizing the fit between technology and the hierarchical level of the sender. This study focuses on the most prevalent situation at workplace where an interruption originates when a sender needs additional information from the receiver. Therefore, the scope of this study is restricted to conditions where an interruption task arrives at random and in nature is dissimilar to the ongoing primary task processing.

The remainder of the paper is organized as follows. In the next section we review the literature, and propose our research model and the hypotheses underlying the model. Next, we describe our experiment, followed by a discussion of the findings of this study. Finally, we present the limitations of the study, followed by concluding remarks.

2. Literature and research hypotheses

2.1. Usage of IM in workplace

Instant messaging is typically used to complement existing communication media such as email and telephone. In some companies, workers are required to leave their instant messenger client application running while performing other primary tasks. For example, Quan Haase et al. [47] found that employees in a high-tech firm are expected to log on to the IM once they are physically present in the company so others know who is available for contact. Instant messaging has built-in awareness features, and recipients are usually expected to respond immediately. This expectation may increase the disruptive nature of IM.

A majority of IM studies have focused on the nature of IM characteristics and usage practices in the workplace. For example, early research by Grinter and Palen [28] revealed IM's strength as a medium for social communication. Handel and Herbsleb [31] found that the content of IM tasks primarily focuses on discussing work tasks and negotiating availability. Likewise, an ethnographic study by Nardi et al. [43] found that IM tools are suitable for informal workplace communication. Though a plethora of studies look at issues such as IM acceptance and adoption e.g. [9,29], there is a paucity of research that empirically investigates both the positive and negative impact on knowledge worker performance within the typical IM usage and work relationship context. A recently published field study in *Decision Support Systems* on IM usage at workplaces reported the negative impact of interruptions as well as improved mutual trust and group outcomes [45]. Li et al. [36] investigated the polychronic behaviors of IM users in an interruption context and studied the influence of position powers on process satisfaction and perceived task complexity. Avrahami and Hudson [3] studied various sender–receiver interpersonal relationships such as work relationships and social relationships and found that underlying basic communication characteristics such as messaging rate and duration differ significantly across different relationships. Stephens [54] proposed a theoretical cost-optimizing framework for instant messaging use in the workplace without actually testing the framework. The study by Stephens [54] identified three separate components of costs associated with IM use: delay cost (e.g. composing the message, and seeking additional information for IM response), access cost (IM access and use), and error cost (discrepancies, misunderstandings, etc.). More interruptions through IM could increase one or more of the three cost components.

In our study, we consider the usage context of IM to explore its potential impact on primary task performance and mental overload. Fig. 1 describes the research model and various proposed hypotheses in the study. The research model depicts how the interruptive features of IM may intertwine with the hierarchiacial level of the sender and jointly influence user performance and mental overload.

2.2. Task performance and work overload

Our study uses two objective measures of primary task performance: primary task time and primary task quality. IM is typically used in a multitasking environment. Knowledge workers process some main tasks while responding to instant messages. We are interested in how interruption(s) from IM may influence the performance on the main task. Therefore, task time refers to the time to perform the main task excluding the time spent on IM interruptive tasks; task quality is measured by the degree of correctness of the main task.

Work overload 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 leads to high job turnover intention [42]. In this study, we examine overall mental workload as a dependent variable capturing the mental workload resulting from working on both the tasks — main task and IM task during the entire experimental experience. Multitasking resulting from deploying IM in the work setting