A heuristic–systematic model of end-user information processing when encountering IS exceptions

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ABSTRACT

IS exception management often relies on end-users for success. A key aspect of end-user management of IS exceptions is sufficient information processing before responding. However, end-users process information dynamically across different judgmental contexts and sometimes favor effort reduction over accuracy maximization. With today's IS tightly meshed with underlying organizational business processes, inappropriate end-user responses pose organizational risks. We therefore developed a theory-based research model which was designed to uncover the motivational mechanisms needed to provide effective information processing in this context. Empirical testing using 318 experienced users of Microsoft Excel supported our model.

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1. Introduction

We know little about how individuals interact with IS [2,3,15]. A primary reason for this is the fact that researchers have placed emphasis on the *amount* of IS use rather than the *nature* of its use. Consequently, there has been a suggestion that we need an expanded behavioral view of IS use that considers activities and features commonly encountered during use of the IS: a particularly important facet of this, which has received little attention, is end-user management of IS exceptions. These are *extraordinary information processing situations that cannot be handled routinely by the IS* [16]; they are an almost-inevitable part of system use [8].

With organizational IS tied to the business processes of the firm [14], IS exceptions can be serious vulnerabilities, to which inappropriate end-user reaction can impede business processes and/or lead to economic loss. An IS exception is generally unique to the application, data, and processing task involved; thus there is no standard response to it. Furthermore, IS exceptions frequently are discovered by the end-user in a manner far removed from the initial cause [10], making their management difficult, even in relatively simple applications. Thus, sound management of IS exceptions requires human judgment, which often requires information processing prior to responding [9].

Researchers and practitioners have worked to establish best practices in software design for alerting users when an exception

has occurred and equipping them with diagnostic resources. However, theory and past research on behavioral judgment formation see judgment formation as a dynamic and complex process in which individuals change their information processing strategies to minimize the costs of cognitive effort and judgment inaccuracy. Individuals often attempt to reduce their effort rather than maximize accuracy when processing information. End-user bias toward effort reduction can result in habitual patterns of responding and treating IS exceptions as something to ignore, by clicking 'OK' and hoping the situation will disappear [1]. Thus, system alerts and supplementary resources are important but insufficient to promote effective end-user behavior.

Work is therefore needed to determine the motivational mechanisms behind end-user information processing. We decided to investigate the motivational mechanisms that underpin effective information processing when IS exceptions occur. Overall, we addressed the question:

What motivates end-users' effortful information processing when encountering IS exceptions?

2. Theoretical foundation

2.1. The heuristic–systematic model of information processing

The heuristic–systematic model (HSM) of information processing is a dual-process theory that addresses information processing during judgment formation [13]. Dual-process theories argue that individuals are often engaged in validity-seeking contexts in which they try to understand the situation [11]; they also assume that

judgment formation involves two different types of information processing (implicit and explicit) requiring different degrees of cognitive effort. We chose HSM as the theoretical basis for our study for two reasons. First, it was designed to be applicable to a wider range of validity-seeking contexts and information processing activities than other dual-process theories [17]. Thus studies have used it to understand human information processing in several information adoption situations: online communities, videoconferencing, and inter-organizational collaboration. Second, HSM applies directly to communication contexts in which individuals are told about a situation in which they, colleagues, and events, must make a decision or formulate judgment. Thus HSM is particularly suited to the IS exception context, where task, user, and social factors affect the decision making process.

HSM argues that individuals can use two distinct information-processing modes when making judgments: systematic or heuristic processing. *Systematic* processing is information intensive and analytically oriented. *Heuristic* processing focuses on easily acquired and processed information with simple decision rules. When systematically processing information, decision-makers access and scrutinize various information sources for relevance and importance in the decision before using it.

HSM further asserts that decision-makers prefer low-effort processing. They try to strike a balance between minimizing effort and maximizing judgmental confidence. Thus, one of the most important questions for any dual-process model relates to the triggering conditions for a given processing mode. This was termed *satisficing* by Newell in the work resulting in his Nobel Prize.

Information sufficiency is the difference between the amount of information an individual thinks he or she needs to make an accurate decision and the amount of information currently held. Motivation to obtain additional information increases when information sufficiency is not achieved. Thus, processing effort can be viewed as a function of the amount of discrepancy between actual and desired confidence.

2.2. HSM, information sufficiency, and IS exception management

While the sufficiency principle can be used to predict systematic as well as heuristic processing modes, we were mainly concerned with systematic processing in our study. Therefore, our application of HSM centered on the relationship between information sufficiency and systematic processing. In addition to this relationship, HSM suggests that other factors can influence systematic information processing through their direct influence on desired and/or actual confidence. In the IS exception management context, three categories of factors motivate processing: the exception message provided to the user, the computing task being performed at that time, and the user who must respond.

3. The conceptual model

Our conceptual model (Fig. 1) shows desired confidence and actual confidence as the direct determinants of systematic information processing. In addition, the model shows message-, task-, and user-related factors as the *indirect* antecedents of systematic information processing through their *direct* influence on the confidence variables.

3.1. Message-related factors

3.1.1. Perceived message severity
Because exception messaging conveys important information about the situation, the information provided should bear
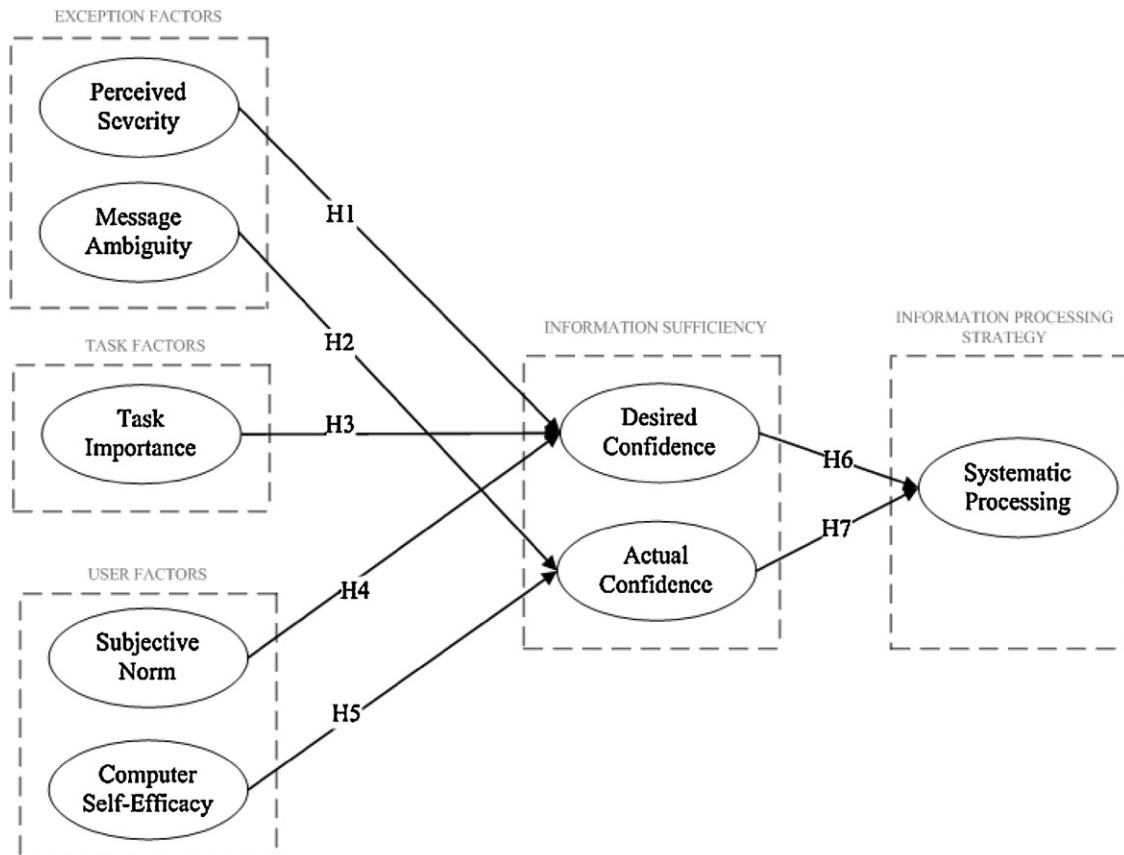

Fig. 1. Theoretical model.