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Evaluating the effects of task–individual–technology fit in multi-DSS models context: A two-phase view

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A B S T R A C T

We investigate the effects of individual difference with the framework of task–individual–technology fit under a multi-DSS models context using a two-phase view. Our research question is: in addition to task–technology fit, does individual–technology fit or individual–task fit matter in users' attitude and performance in the multi-tasks and multi-DSS models context? We first divide the concept of task–individual–technology fit into three dimensions – task–technology fit (TTF), individual–technology fit (IT_eF), and task–individual fit (T_aIF) – so that we can explore mechanisms and effects of interaction among these factors (i.e., task, individual difference, and technology). We then propose a two-phase view of task–individual–technology fit (i.e., pre-paradigm phase and paradigm phase) based on Kuhn's concept of revolutionary science. We conducted a controlled laboratory experiment with multiple DSS models and decision-making tasks to test our hypotheses. Results confirmed our arguments that in the paradigm phase, the effects of individual differences on user attitudes toward DSS models can be ignored and that in the pre-paradigm phases individual differences play an important role. In addition, we found that effects of individual difference can be a two-blade sword: IT_eF can enhance but T_aIF can diminish users' attitude to DSS model (i.e., technology). Our results also suggested that different dimensions of fit may affect performance directly or indirectly.

1. Introduction

Throughout the history of information systems (IS) development, there has remained great interest in developing accurate insights into how individuals interact with information technology (IT) to complete varying tasks [8,25,32,34]. Myriad studies have proposed a variety of "fit models" to describe and explain these complex interrelations including various forms of cognitive fit [59,60], task–technology fit [18,19], user style–task structure–information support fit [46], agent–task–technology fit [11], and capability–task–strategy fit [16,56]. While these models help our understanding of the "IT fit" phenomena, they commonly have underlying limitations. For example, previous fit models have been criticized for: (1) applying only to low-level spatial and symbolic tasks, (2) having decidedly rational perspective, (3) having not touched core individual differences, and (4) being without sufficient empirical support [e.g., 18,56]. We consider various shortcomings of the literature to date which, together, suggest that there remains significant need and opportunity for researchers to advance the knowledge in the area of task–individual–technology fit.

We begin by noting a major limitation to date in the literature on human–technology interaction which has been the use of an oversimplified focus on *what* factors should be included or excluded while ignoring *how* factors interact with each other. A rather old, but still valid example is the unresolved debate over whether individual differences should be considered for IS design [see 26,45]. We suggest that this debate is more salient in the context of decision support systems (DSS), where researchers question whether we should design a DSS to fit needs of each type of decision makers [30] or we should not [26]. We conjecture that a better starting point to address this issue is to carefully investigate how the individual difference factor interacts with other relevant factors from a fit perspective. As some authors have pointed out: "the quality of interaction, […] between human and computer […] is affected very slowly, if at all, by technological advance" [5]. Thus, in this study we investigate the effects of individual difference with the framework of task–individual–technology fit using a two-phase view. Because DSS models are in the core of decision support systems, we investigate the phenomenon under a multi-DSS models context. Our research question is: in addition to task–technology fit, does individual–technology fit or individual–task fit matter in users' attitude and performance in the multi-tasks and multi-DSS models context?

In order to answer this question, we first divide the concept of task–individual–technology fit into three dimensions – task–technology fit

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(TTF), individual–technology fit (IT_eF), and task–individual fit (T_aIF) – so that we can explore mechanisms and effects of interaction among these factors (i.e., task, individual difference, and technology). While prior fit studies [e.g., 18,46] considered interactions among task, individual difference, and technology at the same level, we propose a two-phase view and contend that those above-mentioned fit dimensions take effect differently in different phases. The two-phase view is based on Kuhn's concept of revolutionary science [33]. Kuhn defined a paradigm as what members of a scientific community, and they alone, share. According to Kuhn, there are pre-paradigm and paradigm phases. In the pre-paradigm phase, there are several incompatible and incomplete theories and there is no consensus on any particular theory. If the actors in the pre-paradigm community eventually reach a consensus, then the phase, paradigm phase (or normal science), begins. Basically, this paradigm revolution view postulates that science activities present different characteristics in different phases. In the paradigm phase, the focus is problem-solving with accepted paradigm; in the pre-paradigm phase, however, problem-solving is less efficient and the major focus is paradigm competition.

Traditionally, tasks can be characterized as structured, semi-structured, and unstructured based on whether we can clearly define a task and identify a process to complete the task [20]. Our two-phase view of task–individual–technology fit refers to the first phase as the pre-paradigm phase where tasks are not clearly defined and problem-solving processes are hardly specified (so called semi- and unstructured task setting). We refer to the second phase as the paradigm phase where tasks are structured and problem-solving processes are specified so that technologies can be designated to carry out specific tasks (so called structured task setting). We suggest that the two-phase view can facilitate a better lens to examine conflicting arguments and provide new insights on the effects of individual difference on IS design. We further elaborate on the mechanisms under each phase in the next section.

The remainder of the paper is organized as follows. Section 2 presents research background and theoretical foundation for our work. Section 3 introduces a variety of specific research hypotheses. Sections 4 and 5 discuss methodology and experiment results, respectively. Section 6 indicates limitations of this research and directions for future research. The final section concludes this study.

2. Research background and theoretical bases

2.1. Task characteristic, individual difference, and DSS models

Task characteristic and individual difference are two factors widely studied in DSS research. Scholars investigated their interaction with DSS from varying perspectives, including technology use [14,17,29,36], decision-making effectiveness [10,38], performance [3,37,47,52], implementation [2], model formulation [4], and decision-making process [58]. The effects of interaction between task and DSS (i.e., technology) are generally consistent, as can be seen in the research stream on task–technology fit [13,19,31,34]. But the impacts of interaction between individual difference and DSS, and between individual difference and task remain elusive with both significant and insignificant findings reported [see 2 for a review].

DSS can be used to solve problems with varying degrees of structuredness: structured [55], semi-structured [30], and unstructured problems [6]. Although many authors argue that DSS should focus on semi- or unstructured tasks, empirical evidence appears to provide little support for this argument [48]. Therefore, we argue that all different task characteristics should be taken into account for investigating their effects on users' attitude and performance.

One commonly noted category of individual difference is cognitive style, defined as "characteristic models of functioning shown by individuals in their perceptual and thinking behavior" [64, p. 967]. Cognitive style identification has been assessed as "a huge forward step in the understanding of the relations of personalities to their environment" [63, preface]. There was a wave of cognitive style research in psychological science from 1950s to 1970s, and the area still receives significant attention in IS research. In fact, understanding of human–computer interaction has become even more important as user friendliness and customization have become widely cited factors that impact individuals' information technology utilization [8,16,36,40].

DSS models and related research have a long history [see 15,44 for a review]. Yet unlike other applications, such as word processing, accounting software, email and web-browsing, our understanding of interaction between human and DSS model is very limited [5]. There seems to be a significant lag and imbalance between research of DSS model applications (such as proposing a new DSS model for problem-solving) and research on user interactions with DSS models. For example, there have been studies proposing broad ranges of DSS models including normative analyses (e.g., multi-attribute utility, decision-tree analysis, and Bayesian networks) and descriptive analyses (e.g., heuristics and biases, fast and frugal heuristics, and naturalistic decision making) [49]. However, there have been only a few interaction studies including some focusing on the acceptance of the models [36] and some on how users formulate DSS models to solve problems [4]. To begin to fill this research gap, this study investigates a variety of DSS models and examines the interactions between differing individuals, task characteristics, and DSS models.

2.2. Concept of fit

According to Merriam-Webster Online Dictionary [42], the verb form of fit means "to conform correctly to the shape or size of". From our point of view, this definition is especially suitable for studying the interaction between individual differences and DSS models. As cited in Keen and Morton [30], Mason and Mitroff [39] argued the following:

> "What is information for one type will definitely not be information for another. Thus, as designers of MIS, our job is not to get (or force) all types to conform to one, but to give each type the kind of information he is psychologically attuned to and will use most effectively" (p. 478).

In our interpretation, the concept of fit indicates a "match" or a "contingent" perspective between individual differences and DSS models. That is, there are not "always good" characteristics of individuals and a DSS model. In a context of decision making, individuals possess different knowledge and diverse experiences on different topics. They are likely to have distinct needs for decision making and likely to use decision making aids differently.

There have been two key approaches for operationalizing fit. The first focuses on *category match* between individuals, tasks, and technologies [e.g., 59,60], such as "analytic individuals matching structured tasks and tabular format" and "intuitive individuals suiting unstructured task with graphic format" [46]. That is, fit matches unique capabilities and needs of decision makers with appropriate DSS models/decision aids for varying task types. The second approach focuses mostly on *support fit* from IS, including aspects such as accessibility, ease of use, and system reliability [18,19]. An obvious issue with this view of support fit is that the focus is on factors related to efficiency, such as systems reliability and ease of use, but it says nothing about effectiveness (such as better understanding of decision problems), one of the cores of DSS [30]. Given that we are interested in different types of decision-making tasks, we focus and investigate the phenomena of fit as a *category match*.

2.3. Two-phase view of task–individual–technology fit

We consider fit as consisting of three two-way interactions. Task–technology fit (TTF) refers to the degree to which characteristics of technologies fit the needs for carrying out certain tasks. Task–individual