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# The Interaction Effect of Task Experience and New Technology on Cognitive Beliefs

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### ABSTRACT

Models predicting technology acceptance (TAM, TTF) rely on task-doers' cognitive beliefs (along with other beliefs) about the technology and the fit between technology and task to predict technology use. Although these cognitive beliefs are theorized as depending on the interactions of technology, task, and individual characteristics, these interaction effects are understudied. This paper attempts to fill in this blank. We focus on task-doers' task experience with an old technology and changes in the knowledge necessary to perform the task brought by a new technology; we propose that their interactions will affect task-doers' cognitive beliefs of the new technology. Indications to theory and practices are suggested.

#### Keywords

Technology change framework, task experience, cognitive beliefs, task-technology fit

### INTRODUCTION

Originated in behavior theories in psychology, represented by Theory of Reasoned Action (Fishbein and Ajzen 1975), technology acceptance models project that a task-doer's cognitive beliefs about a technology affect his/her use behavior. Technology Acceptance Model (TAM) as in Davis et al. (1989) and the extended TAM as in Venkatesh and Davis (2000) theorize perceived usefulness (PU) and perceived ease of use (PEU) as two cognitive belief constructs that mediate other influences on use intention which leads to use behavior. Task-technology Fit (TTF) theory (Goodhue and Thompson, 1995; Goodhue, 1995) proposes that the fit between task, technology, and individual characteristics affect a task-doer's beliefs about using the technology. Hence, task-doers' beliefs toward a technology are critical in the chain from the advance in technology to task performance, especially when use is volitional rather than mandatory. Therefore, it is important to study task-doers' responses to technology advancement. For instance, do task-doers respond equally to different kinds of technology advances? This paper attempts to answer this question.

Advance in technology represents a primary force that drives productivity and quality improvement in products and services, at the mean time, it puts the burden of coping with changes on task-doers and their organizations. At the individual level, technology changes require corresponding changes in technology users' knowledge to use the new technology. The requested changes in knowledge differ in magnitude as well as along the dimension of component knowledge versus architectural knowledge (Sircar et al., 2001). Prior research suggests that the direct experience of using a technology serves as the basis of evaluating the old technology (Venkatesh, 2000) as well as any new technology applied to the same task (Dennis and Reinicke, 2004). We propose that potential technology users' cognitive beliefs about the new technology depend on his/her experience of doing the task and the intensity of change in knowledge as requested by the new technology.

The rest of the paper is organized as follows: we first discuss the two cognitive belief constructs and the theoretical underpinnings of this paper; this is followed by the presentation of the conceptual model and proposition development; a brief research method section follows to discuss the experiment design; the paper ends with a discussion of the theoretical contributions and practical insights.

### THEORETICAL BACKGROUNDS

#### Cognitive beliefs

Three types of beliefs are identified in the research of technology acceptance: cognitive beliefs that are based on users' expected consequences of technology utilization, normative beliefs that are represented by social norms, and control beliefs based on computer self-efficacy and perceived facilitating conditions (Taylor and Todd, 1995). The current study focuses on cognitive beliefs to study the influence of task experience and the characteristics of knowledge change as imposed by technology since we hypothesize that cognitive beliefs are likely to be affected by the interactions of experience and knowledge change, while the other two types of beliefs are not.

Davis (1989) developed cognitive belief constructs specific to the context of IT, namely, PU and PEU. The definitions of the two constructs as in Davis (1989) are provided below.

Perceived Usefulness – the degree to which a person believes that using a particular system would enhance his or her job performance.

Perceived Ease of Use – the degree to which a person believes that using a particular system would be free of effort.

TTF research points out that user evaluations of a technology as used in technology acceptance models should be theorized as subject to the interactions among the characteristics of the technology, the task, and the task-doer (Goodhue, 1995). To apply this contingent view, we first need to categorize task-doers and technologies. For a given task, we differentiate task-doers to the extent they have previous experience of doing the task using a given technology, we call those who have this experience experienced task-doers, and those who do not have this experience inexperienced task-doers. We differentiate new technologies presumably representing technological improvement over the old technology that is used in the same task performance basing on the intensity and the nature of change in knowledge requested by the new technology. A framework of these changes is provided in the next subsection.

### A framework of knowledge change

Technologies differ with respect to the intensity and nature of change they bring to the knowledge necessary for a task-doer to perform a task (Sircar et al., 2001). A process to perform a task can be described by the components of the process, and the architecture that specifies how the components fit together. A task-doer needs knowledge of both the components and the functional relationships among the components to perform the process. A framework of changes in knowledge required by new technologies as in Sircar et al. is presented in Figure 1.

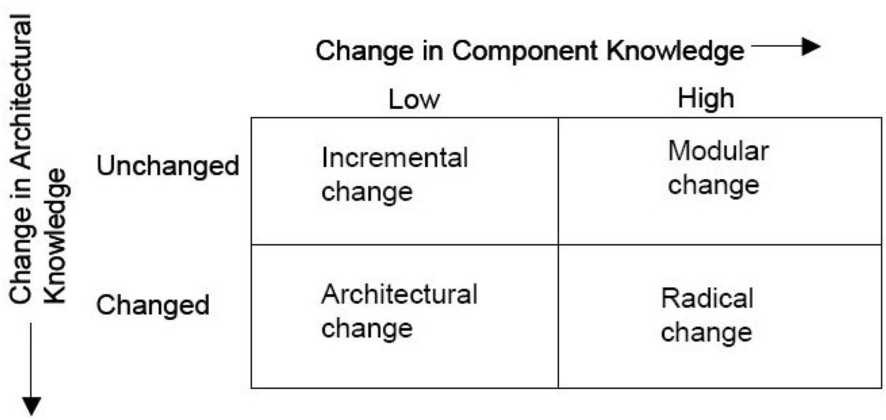


**Figure 1. Changes in Architectural and Component Knowledge (As in Sircar et al., 2001)**

Incremental change represents minor changes in components with no impact on the functional relations between components; modular change refers to radical change in the design of components, also with no influence on the functional relations between components; architectural change implies radical change in the functional relations among the components, without substantially altering the components; radical change signifies significant changes in both components and the ways they related to one another.

### Task-doer's experience

Task-doer's experience is recognized as affecting technology acceptance behavior (Agarwal, 2000). Experience of using the technology has been theorized as having a direct impact on use, having indirect effects on use through PU and PEU, or strengthening the links between cognitive beliefs to behavior intention (Karahanna et al., 1999; Thompson et al., 1994; Venkatesh, 2000). Previous task experience, not necessarily related to the use of a particular technology, is often considered as affecting task performance, however, the direction and significance of the impact are conflicting in empirical studies

(Fisher et al. 2003). Agarwal and Sinha (1996) postulated and empirically supported that task experience has a positive effect on performance only when there is a match between the knowledge gained from the experience and the nature of task; in other words, experience contributes to performance only when it provides knowledge that effectively supports the process of problem solving. They also explained that experience supports problem solving by providing "schemas" – generic knowledge structures, which help in the process that a task-doer forms a mental representation of the problem. Recent research suggests that the experience of using a technology to perform a task may form expectations of the work process and technology features that support this process, when a different technology is applied to the same task, these expectations are likely to be used as anchors to form evaluations of the new technology. If the new technology falls short of the expectations of supporting this process, the user's perception of the new technology is likely to be unfavorable (Dennis and Reinicke, 2004).

**PROPOSITION DEVELOPMENT**

Based on the aforementioned theoretical underpinnings, we develop a model to investigate individual task-doers' cognitive beliefs about a technology in the context of intellective tasks (McGrath 1984). The conceptual model is diagramed in the rectangle in Figure 2, the rest of the diagram depicts two other constructs and causal links that are critical in the acceptance models but not included in our model.

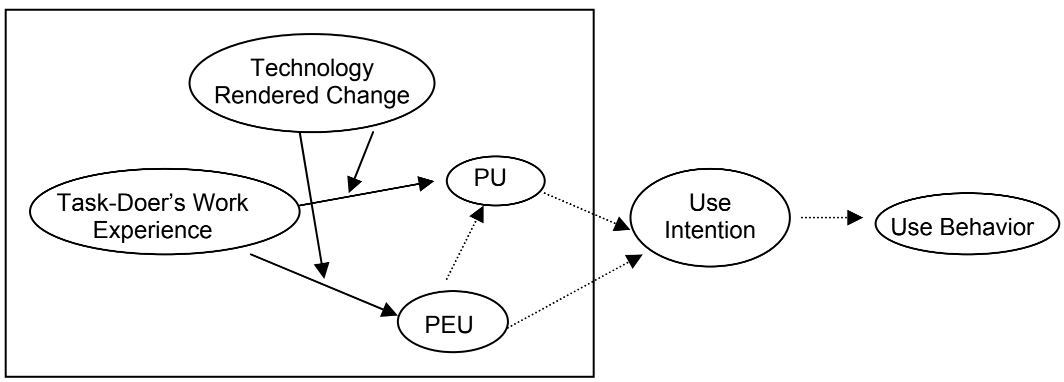


**Figure 2. The Conceptual Model (as depicted by constructs in the rectangle and the solid arrows)**

Agarwal and Sinha (1996) suggested that from the experience of doing a task, a task-doer gains knowledge about the task process in the form of knowledge of the functional units their functional relationships, this knowledge will guide the task-doer in future interpretations, inferences, expectations, and attention in similar tasks. When an experienced task-doer is faced with the same task and a technology that represents incremental change (minor change in component knowledge), the existing knowledge serves as an interpretation and learning basis of the new technology, using the new technology is likely to be perceived as easy since it requires accommodating minor changes in familiar components. Inexperienced task-doers lacking this knowledge basis are faced with more difficulty of learning to use a new technology, and both component knowledge and architectural knowledge of the task process.

Proposition 1. For technologies characterized by incremental change, a task-doer's previous task experience is positively associated with PEU of the technology.

New technology characterized by incremental change supports the same task performing process as the old technology, the component and architectural knowledge possessed by experienced task-doers is in agreement with the new technology, the technology is perceived as capable of supporting the task process, and therefore, useful.

Proposition 2. For technologies characterized by incremental change, a task-doer's previous task experience is positively associated with PU of the technology.

Technologies that are characterized by modular change represent critical changes in the components of the task process, technologies characterized by architectural change represent critical changes in the functional relations among the components, technologies characterized by radical change represent dramatic changes in both process components and their functional relations. Existing knowledge about the task process gained in previous experience is at odds with the changed requirements. Prior research suggests that previous experience that is contrary to the task request creates hurdles that hamper task performance (Agarwal and Sinha, 1996), and serves as anchors of expectations against which the new technology is evaluated, which is likely to result in unfavorable perceptions (Dennis and Reinicke, 2004).

Proposition 3. For technologies characterized by modular, architectural, or radical changes, a task-doer's previous task experience is negatively associated with PEU of the technology.

Proposition 4. For technologies characterized by modular, architectural, or radical changes, a task-doer's previous task experience is negatively associated with PU of the technology.

## RESEARCH METHOD

We intend to use lab experiment to test the propositions. We will use two groups of subjects. One group is trained to use both the old technology and the new technology to perform the task, they will be our experienced task-doers; the other group will be trained to use only the new technology, they would be our inexperienced task-doers. To prevent the effects being confounded by task-doers' experience with other technologies, neither group can have performed the task before. Survey instruments will be used to measure PU and PEU. Regression analysis will be performed to test the effect of the interaction between the experience with the old technology and the change in knowledge required by the new technology on PU and PEU. To keep the scope of the experiment under control, for proposition 3 and 4, we focus on technology characterized by architectural change rather than conduct an experiment for all three types of technology change (modular, architectural, and radical). The task, old technology, and new technology are identified for the experiment in Table 1.

| Type of Change | Task | Old Technology | New Technology |
|---|---|---|---|
| Incremental | information retrieval | non-integrated database and SQL | integrated database and SQL |
| Modular | | | |
| Architectural | System Analysis and Design | Procedure-oriented Methodology | Object-oriented Methodology |
| Radical | | | |

**Table 1. Experiment Design**

## DISCUSSION

Task-doer's cognitive beliefs about using a technology are important antecedents to use behavior. This paper contributes to the knowledge of technology acceptance by addressing the interaction effect of a task-doer's previous task experience and the intensity of change in knowledge resulted by a new technology on the task-doer's cognitive beliefs toward the new technology. We propose, when a technology represents incremental changes, previous task experience is likely to result in favorable cognitive beliefs; while in the cases of radical changes in either component knowledge or architectural knowledge, or both, previous task experience is likely to result in negative cognitive beliefs. These types of interacting effects are not addressed in existing technology acceptance models. Our study has practical implications as well. If verified, the results will provide insights to training strategies when new technologies are adopted in an organization. For example, when radical changes are introduced by a new technology, effort should be directed to enhance the change of mindset of task-doers experienced with old technologies. Also, mandatory use may be necessary to insure initial adoption of the new technology. For marketing strategies of new technologies involving intensive change in knowledge, avoiding user groups that have enormous experience with old technologies may prove to be beneficial.

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