User knowledge transformation through design: A historical materialism perspective

Yutaka Yamauchi *

Kyoto University Graduate School of Management, Yoshida-Honmachi, Sakyo-ku, Kyoto 606-8501, Japan

A R T I C L E   I N F O

A B S T R A C T

Through observation of an accounting system development project, this study examines how user knowledge of work, organization, and information system is transformed. The study employs the framework of historical materialism to explicate the interplay of knowledge and material conditions. The findings suggest that contradictions within the material condition, both in the resulting designs and in relations between users and developers, engender crises and trigger alteration of existing knowledge, and that new knowledge is created and validated through negotiating and specifying material designs. Knowledge transformation is shown to be historical in that knowledge is based on material condition at a certain moment and therefore is subject to change due to contradictions in the material condition. Therefore, often knowledge is transformed only partially as users and developers settle on a design to replicate existing practices with new features designed for different practices, producing contradictions for further transformation. The historical interplay of knowledge and material conditions paints a holistic picture of knowledge transformation through information system design.

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1. Introduction

In designing a new information system, users often have to transform their knowledge of existing work, organization, and technology; a new information system tends to contradict the previously established ways of working. Scholars have discussed how knowledge transformation is accomplished for both users and IT developers. This includes constructive conflict resolution to help overcome user resistance (Robey & Farrow, 1982; Robey, Farrow, & Franz, 1989). Barki and Hartwick (2001, p. 202) discussed the problem solving

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* Tel./fax: +81 75 753 3536.
  E-mail address: yamauchi@gsm.kyoto-u.ac.jp.

approach, wherein "a synthesis is sought, integrating all parties' perspectives," is critical to resolving conflicts. Open communication whereby participants can voice opinions freely is considered a key process in conflict resolution (Barki & Hartwick, 1994; Robey & Farrow, 1982; Robey et al., 1989; Salaway, 1987). An important aspect of this interaction is users' reflections on their assumptions (Boland, 1978; Bostrom, 1989; Majchrzak, Lim, & Chin, 2005; Urquhart, 2001). In the participatory design tradition, transformation of user knowledge has been central. Most users are unfamiliar with the possibilities that new technologies offer (Ehn, 1993; Greenbaum & Kyng, 1991). The challenge is that learning these new possibilities involves "transcendence" (Greenbaum & Kyng, 1991, p. 277) of deeply ingrained knowledge.

This study applies the theory of knowledge transformation to information system design. Carlile (2002, 2004) offered a comprehensive theory of knowledge transformation with an emphasis on boundary objects. Although the present study does not address boundary spanning specifically but is about processes of information system design, the core thesis of knowledge transformation can be applied to information system design. Carlile wrote that transforming knowledge "refers to a process of altering current knowledge, creating new knowledge, and validating it within each function and collectively across functions" (Carlile, 2002, p. 445). He interpreted knowledge transformation as political because knowledge invested in practice is at stake; hard-won knowledge needs to be surrendered. When novelty arises in a situation, "the path-dependent nature of knowledge has negative effects" (Carlile, 2004, p. 557) and knowledge transformation is triggered. Therefore, knowledge transformation encompasses alteration of existing hard-won knowledge through political conflicts in contrast to simple learning.

He further explained that materiality played a critical role in transformation. Boundary objects, i.e., objects shared by involved parties across boundaries, help these persons understand and negotiate trade-offs as well as engage in collaborative design development of a system that functions for both parties involved. If one party makes a change in the object, the consequence of this change for the other party can be made visible. Parties then can negotiate using this object. Bechky (2003) additionally showed that different occupational members overcome mutual misunderstandings by transforming their understanding using boundary objects. In the information system design context, Levina and Vaast (2005, p. 335) discussed the manner in individuals become boundary spanners who produce locally useful boundary objects. These objects do not automatically lead to transformation. Levina (2005) demonstrated that diverse players in collaborations sought control by responding to an object that others had produced. This insight that material objects play a key role in creation and validation of new knowledge is important in the information system context.

While theories of knowledge transformation provide clear explanation of how knowledge is transformed once the transformation is initiated by novelty, it remains unclear how knowledge transformation unfolds throughout the design process. Particularly, the relationship between design and knowledge transformation remains to be explored. While we know that novelty triggers knowledge transformation, we know less when and how the novelty arises. We need to examine what conditions within information system design make novelty arise. Furthermore, boundary objects are used to negotiate and resolve conflicts, but often conflicts probably cannot reach a finite resolution. In such a case, how is design determined without conflicts being resolved? The relationship of design and knowledge transformation is complicated because even if knowledge is transformed, a workable design may not be derived, and even if a design is derived, knowledge may not be completely transformed. We do not know how these two factors unfold in interaction with each other, thus a holistic framework is needed to understand knowledge transformation in information system design.

Historical materialism, a Marxian theory of applying dialectics to concrete, material society, offers a framework to explicate these aspects in a holistic manner. This perspective helps elucidate how knowledge transformation proceeds in interaction with transformation of material conditions (Marx, 1992; Marx & Engels, 1976). Specifically, the historical and dialectical perspective suggests that material conditions and knowledge transformation are reflexively related. From this, it becomes clear that knowledge transformation cannot take place all at once; knowledge is tied to the material conditions in which contradictions remain and trigger further transformation of knowledge. Power relations and conflicts are also intertwined to the material conditions and thereby subject to change as material conditions change. The historical perspective offers a holistic picture of knowledge transformation in information system design.

This study analyzes how users transform knowledge and design information systems. For this purpose, the author investigated an accounting information system development project; real-time interactions between users and developers were observed and recorded throughout the design phase. Although the analysis