Computers in Human Behavior 59 (2016) 283–294

Contents lists available at ScienceDirect

Computers in Human Behavior

journal homepage: www.elsevier.com/locate/comphumbeh

Full length article

Tool choice in innovation diffusion: A human activity readiness theory

Jun Sun

University of Texas Rio Grande Valley, 1201 W University Drive, Edinburg, TX 78539, USA

ARTICLE INFO

Article history:
Received 16 March 2014
Received in revised form
18 January 2016
Accepted 4 February 2016
Available online xxx

Keywords:
Activity Theory
Innovation diffusion
Tool readiness
User characteristics
Tool experiences
Task situations

ABSTRACT

The short product life cycle of information and communication technology (ICT) applications makes it critical for developers to expedite the diffusion process by reducing user resistance. At the individual level, the adoption of an ICT application largely depends on how a person is ready to use the computerized tool in place of the corresponding traditional method for a certain purpose. To find out how to facilitate the transition, this study investigates the human choice behavior involved in technology adoption with the Activity Theory that allows for the inclusion of different tools in one unit of analysis. The understanding of user situated experiences from the activity perspective leads to hypothesized relationships between user-, tool- and task-related factors and the dependent variable in terms of tool readiness. The empirical results support that tool experiences have stronger effects on specific tool readiness at the within-subject level, user characteristics have weaker effects on general tool readiness at the between-subject level, and task situations influence both levels of tool readiness. The findings provide insights on how to facilitate innovation diffusion for different tools, tasks and users.

1. Introduction

The advances in information and communication technologies (ICT) allow people to do things in computerized manners rather than traditional ways for personal, social and professional purposes. Compared with paper accounting ledgers, for instance, modern accounting information systems greatly improve job effectiveness and facilitate information sharing among accountants, managers and auditors. For another example, people do not need to exchange paper business cards to leave contact information nowadays but they can just use their smart phones to send and receive electronic business cards that include additional features such as pictures, website links and social network accounts. The introduction of all kinds of ICT applications has transformed many aspects of human life and dramatically increased organizational productivity (Hanna, 2010). However, the sheer number of such innovations emerging everyday cuts short the product life cycle significantly, and it is critical for developers to expedite the diffusion process and expand user base as fast as possible (De Marez & Gino, 2004).

The diffusion of ICT applications largely pertains to how people are willing to do things in computerized ways rather than conventional ways. When Rogers (1962) proposed the innovation diffusion theory half a century ago, however, he did not specifically investigate such human choice behavior. Rather, the terms he used to describe people who adopt new technologies at different stages in the S-curve, such as innovators and laggards, have the connotation of being associated with personal characteristics. It might be true that some people tend to adopt innovations quicker than others, but the age-old puzzle still remains whether innovators are born or made.

When there are both traditional and computerized methods available for a task, an individual's choice among them depends on the direct and indirect experiences with each in comparable contexts. In this sense, an individual's adoption of an innovation may depend on his/her situated experiences with different options. Nevertheless, most existing studies only focus on the innovations in question. For instance, Rogers (1995) introduced the concept Relative Advantage to capture the "degree to which an innovation is perceived as being better than the idea it supersedes" (p. 212). The use of such a relative perception implies that only the innovation in question be included in actual analysis without making the alternative an equivalent option to participants.

In the study of innovation diffusion, the bottom-line question is: what make people hesitant to adopt ICT applications in place of traditional methods? If it is not all about personal characteristics, what are other factors and their roles? This research question is important as researchers have found that people are less open to

E-mail address: jun.sun@utrgv.edu.

http://dx.doi.org/10.1016/j.chb.2016.02.014
0747-5632/

ICT applications when they are more comfortable with traditional methods (Joshi, 2005; Norzaidi, Chong, Salwani, & Rafidah, 2008). People have preconceived mental representations of how everyday artifacts work that are hard to change (Norman, 1988). If users' experiences with an innovation lead to a huge discrepancy from their routines or expectations, they may not be willing to embrace the changes. Such resistance to new technologies leads to high opportunity costs to modern organizations and societies due to reduced efficiency, increased errors and wasted resources (Fisher & Wesolkowski, 1999). Thus, it is important to find out what really matters in people's switching from old to new ways of doing things and how to facilitate the transition through efforts such as customized design and task-oriented training (Brynjolfsson & Hitt, 1998; Malhotra & Galletta, 2004). Based on Norman (1988) user-centered design principle, the understanding of people's experiences with traditional methods provides practitioners the clues on how to implement innovations. For example, the Apple's iOS human interface guidelines are largely based on the metaphors between virtual and real objects/actions, such as flicking through pages (Apple, 2012).

The existing research stream conceptually related to the issue of user resistance is the technology acceptance research that focuses on whether a user intends to use to an ICT application or not (Venkatesh, Morris, Davis, & Davis, 2003). For example, Davis (1989) technology acceptance model (TAM) suggests that such a behavioral intention depends on the perceived ease-of-use and usefulness of an application. This stream is good at explaining user behavior in the environment where there are few other options except for the application in question (e.g. an ERP system in an organization). However, user resistance largely comes from the hesitancy to replace traditional methods with computerized alternatives when both are available. Due to the whether-or-not conceptualization of the dependent variable "intention to use an information system", the technology acceptance research framework is not well-suited for investigating how people make choices among different options (Benbasat & Barki, 2007).

The limitation is due to the socio-psychological paradigm upon which the original root of technology acceptance research – theory of reasoned action (TRA, Fishbein & Ajzen, 1975) – was developed. The unit of analysis under this paradigm is an action between a subject and an object, and the dependent variable is typically the behavioral intention targeting such an object. From this action-based perspective, both ICT applications and traditional methods are regarded as the objects that a person uses. As different options have to be included in separate units of analysis based on this conceptualization, it is hard to examine how people make choices.

Another issue with existing models in the investigation of such human choice behavior concerns the different constructs used to capture user perceptions of alternatives. For traditional methods, Theory of Reasoned Action and the extended Theory of Planned Behavior (Ajzen, 1991) use constructs such as perceived behavioral control and subjective norms to predict behavioral intention. They are quite different from the constructs used in technology acceptance research, such as perceived ease-of-use and usefulness, for ICT applications. The use of different variables makes it difficult to compare people's experiences and predict their choices.

This study adopts Activity Theory, a meta-theory that does not require the use of an action as the unit of analysis, to examine the choice behavior in innovation diffusion. The understanding leads to the identification of user-, tool- and task-specific factors that may affect how people are willing to replace traditional methods with ICT applications. Then, it discusses the relationships between these factors and user attitude toward using each tool for a certain type of tasks, and describes an empirical study to test the hypothesized relationships.

2. An activity perspective of innovation diffusion

Activity Theory, rooted in Hegelian and Marxist philosophies, emphasizes the development of human subjects in their interaction with the material environment (Kuutti, 1996). The unit of analysis under this framework is an "activity", which carries the connotation of motivation in its original Russian term. The motive of an activity is to transform an object into an outcome, which is made possible through the use of tools (Vygotsky, 1978, 1981). An activity comprises a series of actions, each of which is what a subject is conscious of doing to attain an immediate goal (Leont'ev, 1978).

The concept of tool in Activity Theory is very broad, including technical tools (e.g. machines) and psychological tools (e.g. languages) (Vygotsky, 1986). From this perspective, both ICT applications and traditional methods are the tools that people use to accomplish a certain task. For the same purpose, there may be both computerized and traditional tools available. Whereas computerized tools are considered technical (e.g. calculator), traditional tools can be either technical (e.g. abacus) or psychological (e.g. mental arithmetic). Under the common task context, it is possible to compare user experiences with different options.

Activity Theory emphasizes that a human activity needs to be examined under the behavioral context defined by its motive (Nardi, 1996). This allows the inclusion of different tools in one unit of analysis to study user choice behavior. When a person has both traditional and computerized options for a certain purpose, his/her tool preference depends on the situated experiences with them. This activity perspective of this tool choice behavior reveals the relationships among user, tool and task, as depicted in Fig. 1. A *user* may engage in a *task* to transform an object to an outcome with traditional or computerized *tools*. The choice largely depends on the three sources of influence.

To predict human overt behavior and explain how it is influenced by various factors, the concept of attitude has been widely used in behavioral research (Eagly & Chaiken, 1993). An attitude object is what an attitude is directed to, and it is different from the concept of object in Activity Theory. In this study, the attitude objects are traditional and computerized methods that people use for certain purposes. From the activity perspective, of course, they are not real objects but tools.

Personality traits contribute to individual differences in human attitudes toward the same attitude objects (see Eysenck & Eysenck, 1985). In a tool choice activity, these user-specific factors can be denoted as user characteristics. Experiences with attitude objects in form of relevant perceptions from cognitive, affective and behavioral processes lead to the formation of attitudes (Eagly & Chaiken, 1993; Fazio & Zanna, 1981). Such perceptions from the use of each tool are tool-specific factors and can be named as tool experiences. Finally, the perceptions of the behavioral settings in which subjects have experiences with attitude objects regulate human attitude (Barwise & Perry, 1981; Streitfeld & Wilson, 1986). The situational perceptions of a task context are task-specific factors, and can be called task situations.

To capture the effects of user characteristics, tool experiences and task situations on people's choices between traditional and computerized tools, it is important to use an appropriate attitudinal construct as the dependent variable to predict such human behavior. Tool readiness, a construct developed based on the premises of Activity Theory, is used in this study as it indicates how willing and prepared an individual is to employ a tool for a certain purpose (Sun, 2011). Corresponding to the general actions of making the effort to use a tool, following the rules in using it and utilizing the outcome from the use of it, there are three underlying factors of this latent construct: effort willingness, outcome acceptance and rule observance.