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Effects of user experience on user resistance to change to the voice user interface of an in-vehicle infotainment system: Implications for platform and standards competition

Dong-hyu Kim, Heejin Lee*

Graduate School of International Studies, Yonsei University, Republic of Korea

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ABSTRACT

This study examines the effects of user experience on user resistance to change—particularly, on the relationship between user resistance to change and its antecedents (i.e. switching costs and perceived value) in the context of the voice user interface of an in-vehicle infotainment (IVI) system. This research offers several salient findings. First, it shows that user experience positively moderates the relationship between uncertainty costs (one type of switching cost) and user resistance. It also negatively moderates the association between perceived value and user resistance. Second, the research test results demonstrate that users with a high degree of prior experience with the voice user interface of other smart devices exhibit low user resistance to change to the voice user interface in an IVI system. Third, we show that three types of switching costs (transition costs, in particular) may directly influence users to resist a change to the voice user interface. Fourth, our test results empirically demonstrate that both switching costs and perceived value affect user resistance to change in the context of an IVI system, which differs from the traditional IS research setting (i.e. enterprise systems). These findings may guide not only platform leaders in designing user interfaces, user experiences, and marketing strategies, but also firms that want to defend themselves from platform envelopment while devising defensive strategies in platform and standards competition.

1. Introduction

Omnipresent mobile connectivity has increasingly become a part of the fabric of everyday life, and it is seamlessly integrated into the in-vehicle environment in the form of infotainment systems. The concept of "infotainment" represents a marriage of information and entertainment; an in-vehicle infotainment (IVI) system not only provides users with navigation and traffic information, but also amuses them with music and videos. As a result, people have now started to see their car not merely as a means of mobility, but also as a versatile means of satisfying a variety of needs.

Recognizing burgeoning consumer demand, Apple, one of the world's leading information technology (IT) firms, introduced CarPlay to the IVI system market, in March 2014. CarPlay allows access to Apple devices based on its operating system (iOS), via display units on automobile dashboards. Its user interface is consistent with that seen on other Apple iOS devices and, as a result, users may face little difficulty in controlling new infotainment systems. Competing with Apple's CarPlay, Google unveiled in June 2014 its IVI system Android Auto, which extends the functionality of an Android device to the automobile environment. Many car manufacturers—including Audi, BMW, Chrysler, Ferrari, Fiat, Ford, Honda, Hyundai, Mercedes-Benz, Nissan, Toyota, and Volvo—have already exhibited an interest in implementing CarPlay and/or Android Auto in their automobiles.

The Apple and Google platforms have dominated in the global smartphone industry, establishing a *de facto* duopoly that accounted in 2014 for over 90% of smartphone sales worldwide (GSMA Intelligence, 2014). Now, with the aid of technological advances, the dynamics of mobile platforms competition have cascaded into other industries, including connected cars, and blurred traditional industry boundaries. This mobile platform-driven large-scale industry convergence has been pressing other industry players to position themselves in a complex, multi-layered technological space that features a variety of core competencies and platform strategies (Kenney & Pon, 2011).

* Corresponding author.
E-mail addresses: hugh1225@gmail.com (D.-h. Kim), heejinmelb@yonsei.ac.kr (H. Lee).
URL: http://null (H. Lee).

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Platforms, in general, comprise three constitutive elements—namely, a core technology, modular technologies that connect with the core, and the interfaces in-between (Baldwin & Woodard, 2009). Some platforms serve as multi-sided markets, where bringing multiple sides of the market on board (i.e. a large installed user base and a great number of complementary goods for network effects (Katz & Shapiro, 1985)) assumes crucial roles in platform competition (Eisenmann, Parker, & Alstyne, 2006; Evans, 2003; Rochet & Tirole, 2003). In this context, user interfaces and user experience have become of particular importance in attracting users and, in turn, increasing the value of platform networks. For instance, Apple's success with its iPhone can in part be attributed to its user interface—which features intuitive panning and zooming designed for a touchscreen—and to its tight control over an ecosystem of complementary firms (called a "walled garden" strategy); doing so created an effective and cohesive user experience, and "locked" users into Apple's iOS platform (Kenney & Pon, 2011; West & Mace, 2010). In 2011, when Apple integrated into its iOS "Siri" (the voice user interface-based app by which to improve information searches and the user experience while using Apple devices), Google considered this a competitive threat to its core search business[1] (Schmidt, 2011); it responded by rolling out Google Now, its enhanced voice search engine, in 2012.

Enhanced voice control in the user interface is one of the main differentiators between existing systems and Apple and Google's IVI systems. The installation of the voice recognition programs Apple Siri and Google Now into IVI systems enables the use of voice user interface-based applications, through which users can carry out eyes and hand-free operations in a manner similar to that seen with other iOS and Android devices. Switching to a voice user interface from a touch-based interface in an IVI system can offer users a number of potential benefits, such as quick access to services and less distraction from driving. It has been shown that auditory feedback may offload information from the visual modality and thereby reduce the user's cognitive workload (Burke et al., 2006). Despite the benefits stemming from the use of a voice interface, a majority of users mainly rely on a touch-based interface in an IVI system, given their dissatisfactory prior experiences with ill-functioning voice recognition programs (Kessler & Chen, 2015). This kind of user experience is likely to catalyze user resistance against the new voice-activated applications that Apple's CarPlay and Google's Android Auto will offer.

User resistance to change has been one of the important research topics in information systems (IS) studies. Kim and Kankanhalli (2009) and Kim (2011), for instance, each developed a research model while drawing on status quo bias theory (Samuelson & Zeckhauser, 1988); they each demonstrate that switching costs constitute the main determinant of user resistance to change. Nonetheless, these studies did not examine the effect of users' prior experience on user resistance to change—particularly, on the relationship between user resistance to change and its antecedents. Prior experience influences later behaviors, as it shapes realistic expectations. Some studies show that user experience moderates the impact of attitudinal beliefs (e.g. perceived ease of use and perceived usefulness) on behavioral intention (Castañeda, Muñoz-Leiva, & Luque, 2007; Gefen, Karahanna, & Straub, 2003). This also affects all the factors that determine the behavior in question, in an overall manner (Ajzen, 1991). From these prior studies, it is presumed that user resistance to change and its relationship with its antecedents (i.e. switching costs and perceived value) vary with user experience. Nonetheless, few researchers have paid attention to the effect of user experience on user resistance. To fill this research lacuna, we address a research question: how does user resistance to change vary with degree of user experience with the voice user interface?

In addition to addressing said research question, this study also attempts to apply the findings of previous research studies on user resistance to change (Kim, 2011; Kim & Kankanhalli, 2009)—most of which were derived primarily by examining the implementation of enterprise systems—to a different IS context (i.e. user interfaces of IVI systems). Such an attempt not only advances research on user resistance to change, but also sheds light on the ongoing phenomenon of platform and standards competition that revolves around a user interface. The growing importance of user interfaces in platform and standards competition gives this study a practical *raison d'être*.

In the subsequent section, we explain three main concepts (i.e. user resistance to change, switching costs, and user experience) and the conceptual framework used in this study. Section three describes our research model and hypotheses. We then present the research methodology in section four and report the results of hypotheses testing in section five. Thereafter, we discuss our results and their theoretical/practical implications, and reflect on those implications with respect to contemporary platform and standards competition.

2. User resistance to change, switching costs, and user experience

2.1. User resistance to change

Resistance to change has been extensively studied in a variety of academic fields—in IS, in particular. Many IS researchers who have delved into the failure of new IS implementation in an organization identify user resistance to change as a fundamental factor (Hirschheim & Newman, 1988; Lucas, 1975; Lyytinen & Hirschheim, 1987). In general, "resistance to change" refers to any conduct in line with attempting to maintain the status quo, and as persistence in avoiding change (Pardo del Val & Martínez Fuentes, 2003; Rumelt, 1995). Similarly, user resistance to change in IS research is conceptualized as user opposition (Markus, 1983) or adverse reaction (Hirschheim & Newman, 1988) to proposed changes in IS implementation. In this study, "user resistance to change" refers to the *opposition of a user to change associated with a new way of working with a user interface*.

As Lapointe and Rivard (2005) point out, while plenty of studies expressly address the concept of user resistance, only a few provide theoretical explanations of the mechanisms therein (Joshi, 1991; Marakas & Hornik, 1996; Markus, 1983; Martinko, Zmud, & Henry, 1996). Joshi (1991) relies on equity theory to elucidate user resistance: in essence, users resist if they perceive negative inequity (i.e. greater changes in input vis-à-vis output). Marakas and Hornik (1996) adopt the notion of passive aggressive (P–A) behavior to explicate user resistance as P–A responses to real or perceived threats or to stress associated with a new IS. They argue that the uncertainty that accompanies a new IS implementation may engender conditions under which resistance behavior can manifest among users. Markus (1983) categorizes three causes of user resistance—namely, (1) internal factors that mediate interactions among people and groups, such as cognitive orientations, (2) system factors, such as poor technical design and lack of user-friendliness, and (3) interaction between system and context of use. Resting on a political variant of interaction theory, she explains user resistance in the perspective of the distribution of intra-organizational power, and predicts that potential loss of power will beget resistance by a group of users to IS implementation. Martinko et al. (1996) propose an attribution model that posits that users'

[1] In 2012, 95% of Google's revenue was generated from advertising via its search engine (Pon, Seppälä, & Kenney, 2014).