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Incorporating data analytics into design science to predict user intentions to adopt smart TV with consideration of product features

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ABSTRACT

Adoption intention for a new product is significantly affected by demographics (age, gender, occupation), individual characteristics (innovativeness, product involvement, information searching), and perceived benefits (usefulness, ease of use, complexity, compatibility). Most users initially have very limited product knowledge, so functional characteristics or selling prices may dominate purchase intention. Therefore, this research presents a data-analytics oriented framework to predict user intentions to adopt smart TV. In particular, perceived usefulness (PU) and perceived ease of use (PEOU) are respectively defined by technical engineering features (EFs) and ergonomic gesture features (GFs). Multivariate adaptive regression splines (MARS) and support vector machine (SVM) are used to justify the validity of the presented framework. Furthermore, behavior science is used to test the effectiveness of design science. Experimental results show that gender and prior experience in motion-sensing products are significant moderators for the causality between PU/PEOU and user intention. In summary, this study cannot only help smart-TV brand companies identify key product features that influence user intentions but also provide a basis of market segmentation for targeting the *ad-hoc* user groups.

1. Introduction

Smart TV, also called social TV or internet TV, is technological convergence between computers, television sets, and set-top boxes integrated with online connectivity. In addition to traditional one-way broadcasting, smart TV can provide internet service, online interactive media and on-demand streaming media [14,26,32]. Today, it becomes a powerful platform to enable the following tasks: (1) internet connection and online entertainment, (2) program searching and recommendation, (3) gesture recognition and control and (4) on-demand video rental services. Similar to smartphones or tablets with the preloaded operating system and installed user interface, smart TV users download, install, and update various APPs via APP stores or marketplaces. In this range of applications, prior knowledge in human-machine interaction, such as gesture control or motion-sensing technologies, is a good basis to design user interface of smart TV [23,27,30].

In reality, smart TV can also incorporate various types of external devices, such as blue-ray players, game consoles, set-top boxes and digital media players. Functional design allows TV viewers to search, find and play videos, movies, photos and other contents from the Web. Based on Gartner's marketing survey, Fig. 1 shows that smart TV is now located in the deception zone of the technological hype cycle. Smart TV is likely to become a mature and less expensive product within five years. Fig. 2 indicates the growth of worldwide shipments of smart TV is expected to rise from 50 million in 2011 to 250 million in 2017, along with a rapid decline in average selling price (ASP). This is partly due to new product diffusion and new technology penetration that increases consumers' willingness to purchase a smart TV [3,28].

The Bass model and its extensions provide systematic ways to explain the diffusion process of a new product (e.g. internet protocol TV), service, or a technology (e.g. wireless communication or broadband service) [15,38]. The Bass model distinguishes adopters into innovators (early adopters) and imitators (late followers). Because Fig. 1 indicates that smart TV is now in the deception zone, potential buyers will gradually shift from "innovators" to "imitators". Hence, monetary factors, such as personal income or affordable price, may have more effect on purchase decision [12]. In addition, perceived benefits of product design or user experience are expected to have more influence. Both technical engineering features (EFs) and ergonomic gesture features (GFs) will concurrently influence user experiences of smart TV, as they do for mobile phones and cameras [17,43].

Without considering users' innate characteristics (product involvement, knowledge or variety seeking) and monetary factors (personal income or affordable price), this study considers the impacts of perceived benefits on user intentions [2,24,35]. To do so, this paper presents a novel framework that incorporates data analytics into design

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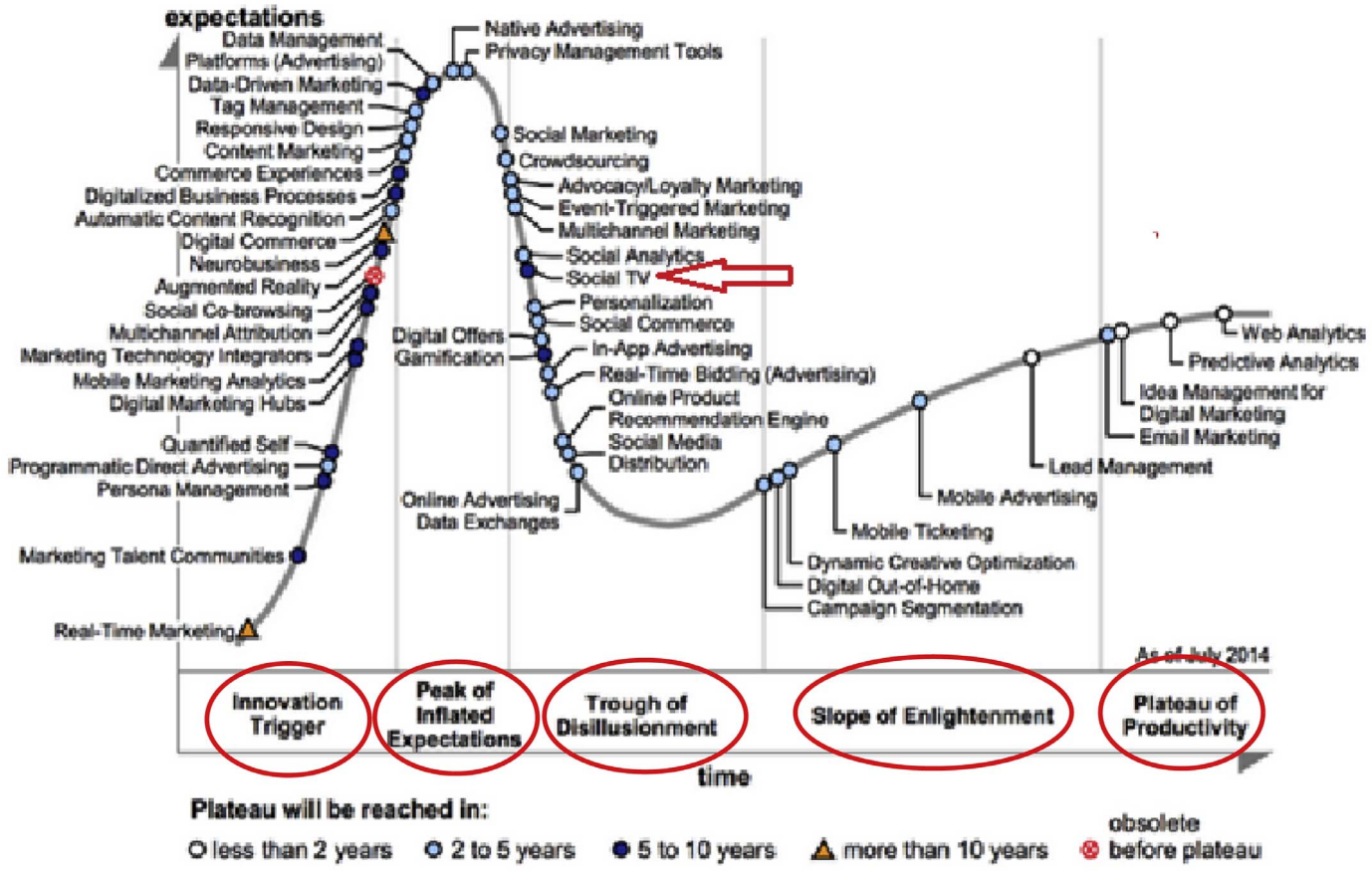

Fig. 1. Smart (social) TV in the deception zone of Gartner's Hype Cycle.

Fig. 2. Smart TV- worldwide shipments (in milions) and average selling price (in $USD) (http://www.statista.com/statistics/).

science and demonstrates the following merits [17,40]:

- Technical EFs and ergonomic GFs are defined to characterize two constructs of smart TV: perceived usefulness (PU) and perceived ease of use (PEOU),
- Significant moderators that influence the causalities between product features and user intentions help firms form a basis of market partitioning,
- Significant EFs and GFs are identified to help firms forecast user intentions to adopt smart TV and develop next-generation products.

The rest of this paper is structured as follows. Section 2 overviews the concept of TAM and user intentions to purchase or adopt a new product. Section 3 presents proposed methodologies. An empirical example is illustrated in Section 4. The results are discussed in Section 5. Conclusion and future work are presented in Section 6.

2. Overview

Consumer behavior is a highly complex decision-making process because it requires information searching, acquisition, retrieval, processing and evaluation [8–10]. It can refer to a series of assessment regarding hidden requirements, prior experience, brand image, word of mouth, user satisfaction, and affordable price [5,7,8]. One of the most classical theories to address this issue is TRA (the theory of reasoned action) [9]. In simple words, the TRA specifically defines behavioral intention as a function of both user attitude and subjective norms toward that behavior. Several studies indicate that prior experience may result in an increased weight on the attitude component of the behavioral intention [31,39]. Thus, in predicting human behavior, the attitudes are usually weighted more heavily than subjective norms. According to TRA, an individual forms an intention to behave on the basis of which he/she forms an attitude toward an object [18,33]. User intention is theoretically considered as a driver of actual behavior [1,12].

Similar to Fishbein and Ajzen's TRA [9], Davis et al. [6,7] proposed technology acceptance model (TAM) to explain why users accept or reject an information technology. The original TAM is an adaption of the TRA but neglects the effect of subjective norms. Due to the popularity in information technology and new product adoption, TAM is selected as a conceptual framework in this study. Following the three research questions in Turner et al. [39], prior experience is treated as a moderator to evaluate the significance of product features in forecasting user intentions. Most past studies to implement the concept of TAM are based on behavior science and thus hypothesis test, factor