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Technology acceptance modeling of augmented reality at the point of sale: Can surveys be replaced by an analysis of online reviews?

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ABSTRACT

Online reviews by users have become an increasingly important source of information. This is true not only for new users of goods or services, but also for their producers. They extend the insight into the acceptance of new goods and services, e.g. at the point of sale, from a mere sales and usage quantity oriented point of view to a cause and effect oriented one. Since online reviews by consumers of many goods and services are nowadays widespread and easily available on the internet, the question arises whether their analysis can replace the more traditional approaches to measure technology acceptance, e.g., using questionnaires with TAM (Technology Acceptance Model) items. This paper tries to answer this question using IKEA's mobile catalogue app as an example. For comparisons reasons, data on the acceptance of the current version of this catalogue is collected in four different ways, (1) as answers to batteries of TAM items, (2) as assignments to pre-defined adjective pairs, (3) as textual likes and dislikes of users (simulating online reviews), and (4) as publicly available (real) reviews by users. The source for (1)–(3) is a survey with a sample of respondents, the source for (4) an online forum. The data is analyzed using partial least squares (PLS) for TAM modeling and text mining for pre-processing the textual data. The results are promising: it seems that data collection via surveys can be replaced – with some reservations – by the analysis of publicly available (real) online reviews.

1. Introduction

With regard to the acceptance and adoption of a technological innovation, Robertson and Gatignon (1986, p. 3), emphasize the "unfamiliarity" of the potential user and the lack of a "knowledge structure" for product evaluation. Potential users therefore often rely on the experiences and opinions of other users. This information exchange is referred to as word-of-mouth (WOM) communication (Arndt, 1967; Duhan et al., 1997; Anderson, 1998). Several empirical studies have shown that WOM is the most important source with regard to becoming aware and deciding to buy an innovation (Sheth, 1971; Bickart and Schindler, 2001). This is due to personal sources being considered to have no commercial interest and therefore to be "more trustworthy and credible" (Lee and Youn, 2009, p. 473). Besides the adoption of a specific innovation, WOM can influence the adoption of "complementary products" as well as "next-generation products" (see Kawakami et al., 2013, p. 17).

Taking the communication channel into account consumers increasingly rely on online reviews or electronic word-of-mouth (eWOM) (Hennig-Thurau et al., 2004; Chevalier and Mayzlin, 2006). In addition, the term virtual word of mouth (vWOM) has been used (Parry et al., 2012). Online reviews (and online ratings) have become a trusted source when researching information about goods or services or making buying decisions (Zhu and Zhang, 2010). In current market research studies they were ranked third place (68%) after family and friends (84%) and websites (69%) (Nielsen, 2013) or even first place (52%) (Cisco, 2013). Kawakami and Parry (2013) found online reviews to be perceived as more credible as personal sources in turn positively influencing innovation usage. Research has shown that customers rely on reviewer text, particularly on negative (one star) reviews, but not on summary statistics (star ratings) (Chevalier and Mayzlin, 2006). Altogether, online reviews are described by Tang and Guo (2013, p. 2) as "a goldmine of voluminous, authentic customer evaluation". For evaluation online reviews have been rated by consumers for example with regard to different product aspects (Zhu and Zhang, 2010), by researchers with regard to different (emotional) word categories (Tang and Guo, 2013) or the total number and frequency of words has been investigated (Li and Du, 2011). Text mining methods to analyze the voluminous text data

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are seen as promising approach to make use of the potential of the data (Tang and Guo, 2013).

Online reviews have found to have a positive influence on the adopter's perception of the variety of innovation use (Kawakami et al., 2013) and other innovation attributes (Parry et al., 2012) in scale-based approaches. This paper aims to investigate relying on text mining and the critical incident technique whether online reviews are suitable for replacing surveys to measure the acceptance of a technological innovation. The analysis is based on Davis technology acceptance model (TAM) that has become increasingly popular for examining technology-based innovations (e.g. Hausman and Siepke, 2009, p. 6). With regard to technology-based innovations in retailing and specifically concerning stationary and online points of sale, the focus here is on interactive applications using augmented reality (AR) that provide access to additional useful information for customers (Pantano and Servidio, 2012). According to a study by McKinsey&Company (2012), younger American consumers spent more of their time on mobile devices than on PCs and are more interested in digital than in non-digital content. Several retail companies, for example Tesco and IKEA, have started to use AR. Nevertheless, the use of augmented reality is discussed controversially in the literature in terms of its benefits for consumers. In addition, the lack of research studies on users, small sample sizes and experimental settings are criticized (see e.g. Bulearca and Tamarjan, 2010; Olsson et al., 2013). The use of laboratory experiments relying on student samples and the employment of self-reported item scales are also points of criticism with regard to the TAM model (Legris et al., 2003). Therefore object of research of this paper is the acceptance of the mobile IKEA catalogue app with augmented reality features in particular by younger consumers for addressing these problems. A TAM analysis and a detailed likes/dislikes analysis (with closed and open-ended questioning) of this smartphone-catalogue was performed whilst relying on student participants in an experimental environment. In addition to the traditional TAM analysis, we analyzed the open-ended questions and the likes/dislikes using text mining. The results were compared to a text mining analysis of comments on the smartphone-catalogue in online reviews. In summary, we find that the TAM analysis can be replaced by automated data analysis using comments gathered in the shop or online blogs. In addition, the results point to an overestimate of the TAM constructs in the experimental setting. The results are predominantly useful to improve future versions of the app.

The paper is structured as follows: the next section describes technology acceptance with a special focus on word-of-mouth. Then a TAM model is introduced and hypotheses are developed; these take external variables and the evaluation of online reviews into account. Augmented reality at the point of sale, as well as studies investigating the acceptance by customers is introduced. The subsequent section discusses the data collection, the experiment and the development of the measures either based on item scales or calculated with the support of text mining methods. After presenting the results of data analysis followed by an extended discussion, the paper closes with theoretical implications, limitations and avenues for further research.

2. Theoretical background and research hypotheses

Technology acceptance has been investigated by innovation diffusion theory and models from social psychology (for an overview see Agarwal and Prasad, 1997; Bhattacherjee, 2000). The main focus of innovation diffusion theory is the communication and adoption of an innovation (e.g. Rogers, 2003). Often the spread of innovation within a population starting with a very small proportion is mathematically modeled (Bohlmann et al., 2010). The diffusion of an innovation as a "special type of communication" (Rogers, 2003, p. 5) depends on word-of-mouth and the influence of early adopters on potential adopters. Different communication channels can be used. Rogers (2003, p. 18) lists interpersonal channels, mass media channels (newspapers, radio, television) and the internet. With regard to electronic word-of-mouth (eWOM) (Hennig-Thurau et al., 2004; Chevalier and Mayzlin, 2006) the network structure in the electronic environment and the adoption behaviour have been investigated (Vilpponen et al., 2006; Bohlmann et al., 2010). However, innovation diffusion theory does not explain the innovation decision process within an often heterogeneous population. This relates to the development of an attitude toward the innovation as well as the influence of innovation characteristics or word-of-mouth (Karahanna et al., 1999; Bhattacherjee, 2000). Several theoretical models investigate individual attitudes about an innovation which are linked to behavioural intentions and finally to innovation usage.

2.1. Developing hypotheses with regard to the technology acceptance model

One of these models is the technology acceptance model which is described by Karahanna et al. (2006, p. 782) as "robust yet parsimonious". Originally developed for explaining the acceptance of computer technology within an organizational context, TAM has now been applied in various areas and several meta-analyses have been conducted (e.g. refer to the overview of recent meta-analysis studies in Wu et al., 2011). In the basic TAM model two specific beliefs with regard to a technological innovation – perceived ease of use (PEOU) and perceived usefulness (PU) – are linked to attitudes (AT) and behavioural intentions (BI) towards using the innovation. In addition, an indirect positive effect of PEOU on PU is proposed (Davis, 1989; Davis et al., 1989). The intention to use an innovation or an available system has been used as a proxy for user acceptance (Venkatesh et al., 2003). Meta-analyses have confirmed the proposed positive relationships between the five constructs and the usefulness of the TAM model overall to predict usage (e.g. Legris et al., 2003). We therefore propose that the basic TAM model is useful to predict usage intentions of the mobile IKEA catalogue app and hypothesize:

H1. The relationships of the TAM model are valid for the mobile IKEA catalogue app (PEOU-PU, PU-AT, PEOU-AT, PU-BI, AT-BI).

In addition, external variables are integrated in the TAM model with an effect on PEOU and PU (Legris et al., 2003). With regard to AR applications, Olsson et al. (2013) mention the usefulness of information (perceived informativeness) as well as their entertaining effect providing fun (perceived enjoyment) as two important factors. This is in line with research in the field of electronic and mobile commerce (Chen and Tan, 2004; Bruner and Kumar, 2005; Hausman and Siepke, 2009). Both factors have been linked in empirical studies to positively influencing the attitude towards a website or a mobile device (see e.g. Hausman and Siepke, 2009; Pantano and Naccarato, 2010; Pantano and Servidio, 2012). Nevertheless they have also been proposed as having a positive effect on the perceived usefulness of an innovation in satisfying different customer needs. The product information offered by an innovative system satisfies customers' informational needs and supports them in their purchase decision (Chen and Tan, 2004). An innovative system perceived as entertaining satisfies customers' need "for escapism, diversion, aesthetic enjoyment, or emotional release" (Ducoffe, 1996, p. 23). These considerations lead to the following research hypotheses: