Antecedents of the Intention to Use Voice-Activated Assistants in Electronic Commerce

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Abstract:

Voice-activated assistants (VAA) enable a natural, human-like and hands-free interaction with information systems that can transform e-commerce processes. Empirical research on consumers' intention to use such devices in e-commerce is still limited. This paper proposes and empirically tests a structural model on antecedents of attitude and behavioral intention of the usage of VAAs in e-commerce. It addresses specific attributes of voice-based interaction and integrates several seminal theories on technology adoption. Empirical testing with survey data shows that perceived usefulness, social influence, and trust are significant drivers of attitude which impacts usage intention. Perceived ease of use and security concerns turn out to be insignificant. The results show that relevant factors of adoption of VAAs in e-commerce differ from other technologies due to the enhanced human-likeness and convenience of voice-based interaction.

Keywords: Voice-Activated Assistants, Usage Intention, E-Commerce

Track: Digital Marketing & Social Media

1. Introduction

Among digital devices in consumer purchasing processes, voice-activated assistants (VAAs) have become an increasingly used interface between consumers and marketers. Prominent examples are Amazon's Alexa, Apple's Siri, or Microsoft's Cortana. VAAs allow an interaction with users that fundamentally differs from conventional information systems (IS) which are usually based on reading and typing of exchanged information. Typical processes in electronic commerce (e-commerce), such as product search and online purchasing transactions can thus be largely transformed. According to a recent survey, almost 50 percent of respondents have expressed their willingness to use VAAs to locate products, compare prices, get help, or use them for the self-checkout in physical retail stores (Kinsella and Mutchler, 2018). In another survey, approximately 35 percent of respondents stated that they have made purchases through VAAs in 2019 and another 27.4 percent intended to do so in the future (Olsen and Kemery, 2019).

Due to the novelty of VAAs especially in an e-commerce context, the drivers of consumers' adoption and usage intention are not yet fully understood. Several existing studies allow to conclude that findings from IS research on the adoption of technologies are also applicable to VAAs (Liao, Vitak, Kumar, Zimmer, & Kritikos, 2019; Simon & Paper, 2007). In this context, Authors blinded for review (2020) identified two key research gaps within the context of VAAs in an e-commerce context: First, research has addressed some specific consumer behaviors, such as loyalty (Moriuchi, 2019), but hardly the usage intention and its antecedents in general. Second, research on IS usage intention has shown that single theories do not fully account for the complexity of this behavior, hence several different theories need to be integrated for a full understanding (Venkatesh, Morris, Davis, & Davis, 2003).

The paper at hand is based on the conceptual framework developed by Authors blinded for review (2020) by addressing the following research question: *What factors drive consumers' attitudes and usage intention of VAAs in an e-commerce context?* It presents an empirical study that tests the above-mentioned conceptual framework with data collected in an online survey among 252 respondents. The findings show that consumers' perceptions of technological features are partly influential for a positive attitude formation. A significant impact is found for social influence and trust in VAAs whereas security concerns do not show a significant impact on attitude.

2. Human Interaction with Voice-Activated Assistants

VAAs are controlled by software agents that interpret human speech as an input and produce an output with a synthesized voice (Hoy, 2018). Tasks are carried by communication with users in a natural language (Jiang, et al., 2015) where users apply their voice as an input to control the action of an IS through the VAA (Moriuchi, 2019). The software agents usually apply natural language processing and other artificial intelligence technologies. The use of voice communication instead of written text results in a largely altered way of interaction between the user and the IS. They typically allow to execute tasks through mobile phones or smart speakers and support various types of information retrieval or information-driven actions such as weather forecasts, information search, or ordering products and services.

A distinctive feature of voice-based interaction is the naturality and human-likeness of communication and an increased convenience due to the hands-free interaction. The naturality of communication is driven by the similarity of voice-based interaction with regular verbal communication among humans (Han & Yang, 2018). Studies have shown that this characteristic increases VAAs' perception of human-likeness (Robert, 2017). The ability to conduct interactions in a hands-free way raises the convenience for users and offers many usage occasions, e.g. usage on the go, during work, or while exercising (Guy, 2018).

There are also perceived downsides for users. The missing of visual information requires a higher cognitive effort when information is provided in an audible way (Munz & Morwitz, October 15, 2019). The sensitivity of exchanged information and the possible dissemination of background conversations and noise can raise privacy and security concerns, especially in relation to sharing confidential information and its spread to unauthorized audiences (Feng, Fawaz, & Shin, 2017). Another concern addresses lacking trust in the VAA's or software's ability to interpret the user's speech correctly so that no unintended commands (e.g., unwanted purchase transactions) can occur (Jiang, Jeng, & He, 2013).

3. Research Model on Antecedents of Voice-Activated Assistants' Usage Intention

IS research has contributed several theories that explain drivers of users' adoption and usage of digital technologies. A seminal approach is the Technology Acceptance Model (TAM) by Davis (1989) that is based on Ajzen (1991)'s Theory of Planned Behavior (TPB). It considers a technology's perceived usefulness and perceived ease of use as beliefs that are antecedents of attitude which itself is a driver of behavioral intention. In the context of VAA, perceived usefulness and perceived ease of use need to be understood against the background

of VAAs' perceived human-likeness (Moriuchi, 2019; Simon & Paper, 2007). Since beliefs about both antecedents of human-like IS may follow different rules than IS that are not perceived human-like, these factors are revisited and we propose:

H1: Perceived usefulness (PU) positively impacts attitude towards using VAAs (ATT).

H2: Perceived ease of use (PEOU) positively impacts attitude towards using VAAs (ATT).

Despite large supporting evidence, the TAM has shown limitations in explaining the entire complexity of technology adoption by omitting factors outside technology perception, such as social impacts and situational conditions. Against this background, Venkatesh, et al. (2003) have integrated several theoretical concepts and developed the Unified Theory of Acceptance and Use of Technology (UTAUT) and its extension, UTAUT2, that addresses behavior of end-users. These theories extend the TAM by further constructs such as performance expectancy, effort expectancy, social influence, and facilitating conditions (Venkatesh, Thong, & Xu, 2012). The human-likeness of speech-based interaction with VAAs calls for the inclusion of theories that consider the interaction with IS in a social context. The UTAUT has demonstrated the relevant role of social influences in the use of IS (Venkatesh, et al., 2003). Social influence is the extent to which individuals' beliefs are influenced by other persons. Individuals are more likely to perform a certain behavior if important others think that they should do so (Hegner, Beldad, & Brunswick, 2019). Research within the VAA context identified social norms as a relevant impact factor of usage (Simon & Paper, 2007), hence we assert:

H3: Social influence (SI) positively impacts attitude towards using VAAs (ATT).

Social exchange theory has conceptualized trust as a key variable that influences technology adoption in various contexts. Trust is defined as a belief about the benevolence of an actor an individual is vulnerable to (Gefen, 2002). It has been found to be particularly crucial in electronic (Kim, Ferrin, & Rao, 2008) and mobile commerce applications (Lu, Yu, & Liu, 2005) where purchasing transactions are being carried out. Since VAAs show a very personal interaction pattern with users where the user's vulnerability vis-à-vis the VAA is high, we consider trust a relevant driver of attitude towards the usage of VAAs (Nasirian, Ahmadian, & Lee, 2017) and propose:

H4: Trust (T) positively impacts attitude towards using VAAs (ATT).

The high degree of personal and sensitive conversation as well as the private setting of VAA usage raises the issue of users' security concerns (Kumar, Kumar, & Bhasker, 2018). This became evident in a recent case of Amazon's Alexa that analyzed recorded data from conversations and obtained in-depth insights into details of users' personal behavior such as

daily schedules or locations (Chung & Lee, 2018). There is also the risk that conversations between individuals are unintentionally processed when the VAA is not turned off. Extant evidence on privacy and security concerns within the context of VAAs is mixed. The study by Pradhan, Mahta, and Findlater (2018) shows that users express a low level of concerns whereas Liao, et al. (2019) point at these concerns as significant VAA adoption barriers. Hence, we revisit the role of this factor and test the following hypothesis:

H5: Security concerns (SC) negatively impact attitude towards using VAAs (ATT).

Finally, in line with the TPB and a multitude of studies on behavioral intention in various consumer behavior contexts, we propose that attitude impacts the user's affection about a behavior which predicts behavioral intention:

H6: Attitude to use VAAs (ATT) positively impacts user's behavioral intention to use VAAs (BI).

4. Empirical Study

4.1 Research Methodology and Construct Measurement

The study is based on an online survey among U.S. and European Internet users who were recruited on the basis of quota sampling. The initial sample consisted of 275 respondents. After deletion of incomplete questionnaires, a final sample of 252 questionnaires has been used for analysis. 48.2% of the sample are males, 51.8% are females. The age of respondents ranges from 18 to 63 years with a mean of 28.03 years and a standard deviation of 9.21 years. 32.7% of the respondents are full-time employed, 20.3% are part-time employed, 43.4% are students, and the remainder is not employed, retired, or preferred not to disclose this information.

The construct measurement is based on the modification of established scales. Perceived usefulness and perceived ease of use have been adapted from the original TAM scale by Davis (1989). Social influence is based on the scale by Venkatesh, et al. (2003). The measurement of trust has been adapted from Gefen, Karahanna, and Straub (2003). For the measurement of security concerns, the confidentiality scale of Bansal (2017) has been adapted. Finally, intention to use VAAs has been measured by asking whether respondents would prefer to use VAAs rather than conventional store-based or online shopping for the purchase of products. The construct reliability as well as discriminant validity figures are displayed in Table 1. They show overall satisfactory scores with the only exception that Cronbach's Alpha of security concern scores slightly below the threshold value of .7. Furthermore, outer loadings were all above .7

except for one item of attitude (.597). VIF values range between 1.139 and 3.7, hence there is no occurrence of multicollinearity.

Table 1. Construct Reliability and Discriminant Validity

Con-struct	Cronbach's Alpha	Composite Reliability	AVE	Correlation matrix (numbers in italics are the square roots of the respective AVE)						
				PU	PEOU	SI	T	SC	ATT	BI
PU	.908	.942	.844	*.919*						
PEOU	.831	.922	.855	.293	*.925*					
SI	.776	.897	.813	.439	.002	*.902*				
T	.730	.881	.787	.566	.150	.396	*.887*			
SC	.694	.852	.745	-.150	.024	-.071	-.221	*.863*		
ATT	.702	.836	.635	.677	.231	.519	.580	-.147	*.797*	
BI	.853	.902	.698	.447	.088	.542	.337	-.159	.520	*.835*

4.2 Structural Model

The structural model has been tested by means of a Partial Least Squares (PLS) test using the software SmartPLS 3.0 (Ringle, Wende, & Becker, 2015). PLS was preferred over structural equation modeling due to the sample size, lack of normal distribution, and the early stage of development and scant previous evidence within the context of VAAs (Teo, Wei, & Benbasat, 2003). The results of the PLS analysis are shown in Table 2.

Table 2. PLS Analysis Results

Hypothesis		Path coefficient	T Statistics	P Value	Result
H1	PU -> ATT	.413	7.475	.000	Supported
H2	PEOU -> ATT	.075	1.525	.128	Rejected
H3	SI -> ATT	.244	5.161	.000	Supported
H4	T -> ATT	.234	3.827	.000	Supported
H5	SC -> ATT	-.017	0.321	.748	Rejected
H6	ATT -> BI	.520	11.145	.000	Supported

The R square values of the dependent variables are significant and amount to .562 for attitude and .271 for behavioral intention. The strongest path coefficient is found for the impact of attitude on behavioral intention (.520, $p < .001$), followed by the impact of perceived usefulness on attitude (.413, $p < .001$), supporting H6 and H1. The impacts of social influence on attitude (.244, $p < .001$) and trust on attitude (.234, $p < .001$) are of medium size, hence providing support for H3 and H4. An impact of perceived ease of use on attitude (.075, $p > .05$)

could not be shown by data, thus H2 is rejected. The data also shows no evidence of an impact of security concerns on attitude (-.017, p > .05) so that H5 is also rejected.

5. Discussion

The strong positive impact of attitude on behavioral intention in this study shows that research on attitude as a driver of usage intention holds true within the novel context of VAAs in e-commerce. Among the antecedents of attitude, the notion of the TAM is partly confirmed in the VAA context. The study shows the relevance of perceived usefulness for attitude, but does not support the impact of perceived ease of use. The importance of this variable may generally decrease with an increased technological experience of users. Especially digital natives who were a major part of the study participants are very familiar with digital devices, thus users are likely to perceive the usage of VAAs overall easy. On the other hand, the human-likeness of VAA interaction also enhances the perceived ease of use due to its larger naturality.

The role of social exchange theory turns out to be highly relevant in the VAA context. Both social influence and trust play a significant role for a positive attitude formation, hence social dimensions of beliefs regarding VAA usage are highly relevant. Also, this effect can be explained by the enhanced human-likeness of interaction with VAA. People's social activities are largely influenced by the extent to which relevant others think that they should be done (Hegner, et al., 2019), so it is obvious that this applies to the communication with VAAs, too. In addition, if others are present in a communication with a VAA, they can easily take part in this interaction which may further increase the social influence. Trust in an IS can be similar to trust in humans or dissimilar from it (Madhavan & Wiegmann, 2007). The human-likeness of VAAs suggests that users' formation of trust resembles trust in humans more than trust in technology (Seeger, Pfeiffer, & Heinzl, 2017). Hence, trust in the sense of social exchange theory among humans is applicable in a similar way within the context of VAA usage intention.

Finally, the study could not show any significant impact of security concerns on attitude which is in line with the controversial findings on the role of this variable. Despite VAAs' high potential of the dissemination of sensitive information, security concerns do not negatively impact attitude and therefore usage intention. One possible explanation is the privacy paradox (Gerber, Gerber, & Volkamer, 2018) which points at inconsistent behavior in respect of privacy protection triggered by the increased convenience of usage. The extraordinarily high convenience of the hands-free interaction with VAA may be an explanation of this issue.

6. Conclusion

The study at hand on antecedents of attitude towards usage of VAAs and usage intention in an e-commerce context shows that the role of drivers of technology adoption is changing across technologies and their characteristics. Although the study is limited in sample size and lack of representativeness, especially among older age groups, the findings show that traditional models on technology adoption need to be extended by the increasing human-likeness of interaction with innovative technologies. Such models need to be complemented with theories that address social contexts and interactions. Future research in this respect needs to revisit the role of human-likeness more strongly. It further needs to contribute to a better understanding of the paradox role of security and privacy concerns within human-like interactions in e-commerce.

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