

Love is in the air! – What creates strong bonds between voice assistants and their users.

Nataliia Lukacs

Technische Hochschule Mittelhessen

Martin Haupt

Justus-Liebig-Universität Giessen

Stefanie Wannow

Technische Hochschule Mittelhessen

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Love is in the air! – What creates strong bonds between voice assistants and their users.

Over the past decade, voice assistants have been making their way into people’s lives. Anecdotal evidence suggests that users can form strong – and even loving - relationships with their voice assistants (VAs). However, research on antecedents of close and long-lasting relationships is scarce. With our study, we link different VA attributes and benefits to cognitive, emotional and behavioral user responses, i.e. satisfaction, love and future usage intention. We find that the creation of a stable, affective relationship is mainly related to emotional benefits, which can be established by a superior response quality.

Keywords: voice assistants, human-computer interaction, love

1. Introduction

Once the product of fiction, having your own intelligent digital assistant at your service is not only a possibility but a common occurrence. Now, after almost half a century of technological development, more than 1,6 billion people worldwide communicate with their voice assistants (e.g. Alexa, Google Assistant, Siri, Cortana etc.), completing a variety of daily tasks, such as making or receiving phone calls, creating shopping lists, searching for specific information, or controlling other devices (Statista, 2020). The market of voice assistants (VAs) is growing rapidly – it is expected to account around 8,4 billion devices supporting VAs by 2024 overtaking the world's population (Juniper Research, 2020), which makes VAs one of the fastest-adopted digital technologies in history (Newman, 2018).

Recent improvements in conversational technologies powered by artificial intelligence (AI) have resulted in a profound understanding of the structure of human language (Hirschberg & Manning, 2015). This has allowed VAs not to rely on a limited set of build-in commands, but to understand the contexts of user requests and instantly provide meaningful responses with synthesized human-like voice (Hoy, 2018). Furthermore, users can interact with their VAs in a similar way to how they communicate with their friends, asking for current news, engaging in small talk or asking for a joke. In such cases, people may develop social interactions with their VAs treating them like actual human assistants or conversation companions and slowly developing feelings of social presence, closeness (Han & Yang, 2018), or even a sense of social relationship with them (Schweitzer et al., 2019). In fact, Amazon reported that in the first year after Alexa was launched, half a million home users had told 'her' that they loved her (Risley, 2015; Turk, 2016).

So far, related VA literature has focused mainly on engagement and usage patterns (e.g., Bentley et al., 2018; Hoy, 2018; Sciuto et al., 2018), drivers of VA adoption (e.g., Cowan et al., 2017; Han & Yang, 2018; Moriuchi, 2019), and on social roles of VAs (e.g., Lopatovska & Williams, 2018; Purington et al., 2017; Schweitzer et al., 2019). However, it is not fully understood, yet, how specific attributes of VAs contribute to consumer perceptions and evaluations of VAs. Moreover, it has not been explored in detail how consumer satisfaction, feelings of love and, finally, future usage can be reinforced by these attributes. Therefore, our study aims to assess how voice-/speech-related characteristics of VAs drive perceived benefits and user responses on a cognitive, emotional and conative level. More specifically, the following research questions are addressed:

RQ1: How do VA characteristics influence perceived functional and emotional benefits from a user perspective?

RQ2: How are these benefits linked to cognitive and emotional consumer responses, i.e. user satisfaction and love?

RQ3: Are functional/cognitive or hedonic/emotional aspects of the user experience more crucial in fostering future usage intention?

With this study, we contribute to a better understanding of user perceptions and attitudes towards their VAs, as well as forms of user-VA relationships. Drawing on existing models (e.g., the TAM model) and research findings, the final structure of our research model was developed and empirically tested based on a survey among frequent users of VAs in Germany and Ukraine. Our research results offer several contributions both to literature on human-computer interactions and to management perspectives on smart digital assistants, revealing that speech recognition and response quality are crucial VA-characteristics to positively impact perceived benefits of voice technologies and driving consumer response. We conclude with suggestions for future improvement for VAs.

2. Conceptual framework

2.1 Attributes and benefits of VAs

Although the concept of voice-controlled smart assistants is not new, a common definition is still lacking. According to Hoy (2018), the term “voice assistant” (VA) refers to software agents that can interpret human speech and respond via synthesized voices, that can be controlled by voice commands and are either integrated into smartphones or built into stand-alone speaker devices. The definition of VAs by Fivesight Research LLC (2017) underlines their technical qualities as AI-powered, general-purpose software applications that simulate intelligence through conversational (vocal) interactions, factual knowledge, predictive abilities and personalization. Juniper Research Ltd (2020) describes a VA as a software program designed with the intent of filling some or all of the role of a personal assistant, which is given its instructions by the user through the medium of voice interaction.

Three *main attributes* of VAs, namely the quality of their speech recognition and their responses, as well as their synthesized voices, differ them from earlier conversational agents (e.g., chatbots). First, speech recognition is possible due to a combination of cognitive AI techniques (e.g., machine learning), which allow VAs to receive user commands, transcribe them into text, analyze and provide with an appropriate response (Han & Yang, 2018). Therefore, VAs can recognize and understand human language as it is spoken with up to 95% accuracy rate (Glaser, 2017). Second attribute is the ability to provide relevant qualitative responses instantly. VAs are initially programmed to have basic world knowledge and be informed about a certain variety of topics. In order to broaden the spectrum of VA’s knowledge and therefore increase the quality of responses, consumers can activate additional applications (e.g., *Skills* for Amazon devices; *Actions* for Google devices). Additionally, after some time VAs may provide personalized answers as they gather and remember some user data (e.g., location of the device, time, log history, activated applications, etc.) and transform this data into informed contextual “guesses” (Mari et al., 2020). In certain contexts, they even use informal language or provide humorous responses and jokes, which make them potentially pleasant conversation partners (Han & Yang, 2018). Finally, as interactions with VAs are (usually) screenless and done via voice-user interface (VUI), the third outstanding attribute of VAs is their synthesized human-like voices. Continuously developing voice technologies allow to implement auditory social cues and appropriate emotional expressivity into rendered voices through a system of vocal parameters (Izdebski & Cahn, 2008). As of modern VAs, many consumers agree that they still sound somewhat robotic, but that their vocal qualities are rapidly improving (Hoy, 2018). A combination of the three above-mentioned attributes of VAs result in their ability to hold conversations with humans in a way that sounds very close to being natural.

VAs offer their users both utilitarian/functional and emotional *benefits*. Firstly, interaction via VUI allows the user to complete several daily tasks in a convenient way with little effort: there is no need to type, read, hold or touch a device (Hoy, 2018). Connectivity to other smart devices makes it possible to control them with voice commands from distance. On the other hand, individuals often interact with technologies for hedonistic purposes (Wu, 2017). Especially in the voice technologies domain, consumers often show high interest in trying out the new technology (Schweitzer et al., 2019). Consumer’s enjoyment, interest and pleasure obtained from use and interactions with voice technologies relate to emotional benefits (McLean & Osei-Frimpong, 2019).

2.2 Personification, satisfaction and love

For many users, having their VAs around as daily helpers and the ability to interact with them naturally via voice, co-occurs with the tendency to assign human features to them. Due to the highly technological design and the use of cognitive AI techniques, some functions of VAs are similar to human abilities. Furthermore, they are activated when their name is called (e.g. “Hey Siri”, “Hey Google”), and assume a persona (“I”) to refer to themselves (Mari et al., 2020). This makes VAs inherently socially interactive devices and, as a result, strongly promotes anthropomorphic perceptions among their frequent users.

Several studies (e.g., Lopatovska & Williams, 2018; Purington et al., 2017) have already proven the personification tendencies towards VAs. In particular, a half of frequent Alexa users reported saying “please” and “thank you”, refer to Alexa by name, use the gendered pronoun “she” and say “good afternoon” when greeting the VA. Personification co-occurs with high levels of satisfaction, improvements in user experience, attribution of more favorable evaluations (Aggarwal & McGill, 2007) and in increased consumption (Hur et al., 2015).

Consumer satisfaction is defined as “the consumer’s fulfillment response” (Oliver, 2014) and individual evaluative judgement of the product, which can occur immediately even after the first product trial (Thomson et al., 2005). It is highly intercorrelated with perceived quality of a device and, thus, reflects the impact of cognitive perception of performance on consumer’s state (Olsen, 2002). Recent international reports on frequent VA users show high levels of satisfaction with VAs (80%) (Olson & Kemery, 2019). Moreover, consumers with personification tendencies towards their VAs are still satisfied with them even in cases of technical issues with speech recognition or when they provide irrelevant responses (Purington et al., 2017).

Research on social roles of VAs indicates that they have already become a fixture in the social life of many users as a friend, family member or a partner (Purington et al., 2017). Furthermore, some users have even confessed their love to Alexa (Turk, 2016). Brand love refers to a high degree of passionate emotional attachment a satisfied consumer has for a particular trade name (Carroll & Ahuvia, 2006). It implies a spectrum of positive emotions that occur and can develop over time to a form of a long-term relationship (Langner et al., 2016). Whether consumers form actual relationships with their VAs is currently open to speculation and discussion among both marketers and researchers. This paper explores, in particular, the occurrence of love feelings towards VAs and their effect on future usage intention.

3. Hypotheses

According to Hoy (2018), VAs offer individuals ease, usefulness and convenience in completing several daily tasks. The relevance of these functional benefits for the adoption of technologies has been introduced in the Technology Acceptance model (Davis, 1989), which has already been applied and confirmed in the context of voice technologies (McLean & Osei-Frimpong, 2019; Moriuchi, 2019). Given the aforementioned ability to use VAs hands-free using only VUI, we hypothesize that high-quality speech recognition and relevant responses via synthesized human-like voices create functional benefits for a user, including perceived usefulness and ease of use:

H1a-c: Speech recognition (a), response quality (b) and the voice of a VA (c) have a positive effect on perceived usefulness of VAs.

H2a-c: Speech recognition (a), response quality (b) and the voice of a VA (c) have a positive effect on perceived ease of use of VAs.

The human-like design of VAs can also lead to increased pleasure and fun in VA-user interactions (Diederich et al., 2020). However, emotional benefits occur mainly when VAs are functioning in a frictionless way. Thus, we theorize that the attributes of VAs should facilitate

the experience of these benefits, e.g. by a pleasant voice that provides an enjoyable interaction without any misunderstandings:

H3a-c: Speech recognition (a), response quality (b) and the voice of a VA (c) have a positive effect on emotional benefits from VAs.

Satisfaction and pleasure from regular use of a product is closely related to user perceptions of practical and hedonic benefits from the product. Previous studies show, that effortless completion of tasks with help of VAs positively contributes to user satisfaction (Kiseleva et al., 2016). Similarly, emotional benefits in a form of interest and enjoyment co-occur with high levels of user satisfaction with VAs (Schweitzer et al., 2019). We propose:

H4a-b: Functional benefits, i.e. perceived usefulness (a) and ease of use (b), have a positive effect on user satisfaction with VAs.

H5: Emotional benefits have a positive effect on user satisfaction with VAs.

Hedonic product benefits (Carroll & Ahuvia, 2006) and satisfaction (Park & Lee, 2005) have been established as antecedents of brand love. In the context of voice technologies, pleasure and enjoyment from using voice-controlled smart assistants lead to social attraction and emotional attachment to them (Han & Yang, 2018). Furthermore, satisfied consumers tend to develop trust and loyalty towards their VAs (Luger & Sellen, 2016). Despite feelings of love have not been detected and studied in the scientific research of VAs yet, this paper aims to discover this relational construct based on previous love confessions from thousands of users in the US (Risley, 2015; Turk, 2016). We suggest that emotional excitement and satisfaction with VAs may eventually lead to love feelings towards them:

H6: Emotional benefits of a VA have a positive effect on the occurrence of love feelings towards this VA.

H7: Satisfaction with a VA has a positive effect on the occurrence of love feelings towards this VA.

Various studies have shown that the major determinant of the continuance intention was user satisfaction. This was also proven in the context of voice technologies (Han & Yang, 2018). Additionally, recent research of social roles of VAs revealed a strong link between consumer-VA relationships and future usage behaviors (Schweitzer et al., 2019). Thus, we conclude:

H8: Satisfaction with a VA has a positive effect on future usage intentions.

H9: Feelings of love towards a VA has a positive impact on future usage intentions.

Based on the conceptual framework and above-mentioned hypotheses, we built our research model (Figure 1):

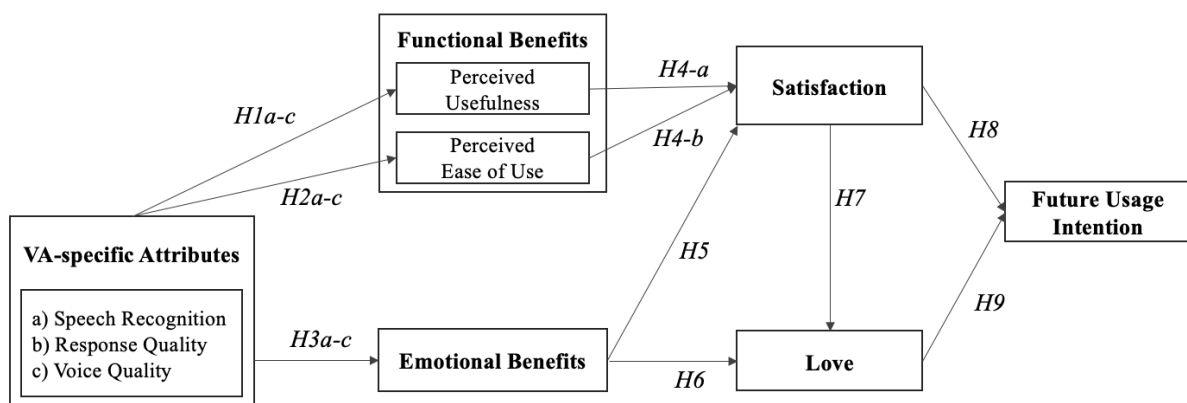


Figure 1: Research Model

4. Method

As a qualitative pre-study, we conducted seven in-depth interviews with regular VA-users. The findings were used to finalize the research model. Further, to test the hypothesized model we conducted an online survey among frequent users of VAs. The survey was conducted over the course of two weeks in November 2020. Data were gathered from 120 respondents in Germany and Ukraine (results across the countries were not different), both male and female in the age bracket between 18 and 44 years old (96%). The study focused on frequent consumers that used their VAs at least once a week in order to get valuable insights about possible emotional connections to their VAs. Following data cleansing and removing responses with missing values, the final sample consisted of 75 usable answers for further analysis.

The scales used in the research were mostly drawn from existing literature and adapted to the study context. We used scales for Functional Benefits including Perceived Usefulness and Ease of Use (Davis, 1989; Venkatesh et al., 2012), Emotional/Hedonic Benefits (Sweeney & Soutar, 2001), Satisfaction (Hunter & Garnefeld, 2008), Love (Carroll & Ahuvia, 2006) and Future Usage Intent (Venkatesh et al., 2012). To evaluate user perceptions of the quality of VA's responses we applied items from Accenture Interactive and Fjord's Love Index (Nayak, 2016). Since there is no established scale for speech recognition, three items were developed by the authors using the information from the qualitative pre-study. To measure the items of the abovementioned dimensions, a seven-point Likert scale (Strongly Disagree – Strongly Agree) was utilized. To evaluate users' perceptions of VA's voice, a matrix was applied where different voice characteristics were assessed: friendly/unfriendly, pleasant/unpleasant, competent/incompetent, easy/difficult to understand.

The confirmatory factor analysis results provided strong evidence of the reliability and validity of the used measures. Psychometric properties were all well above the recommended levels, indicating construct-level and convergent validity. In particular, Cronbach's α and composite reliability were above .7, and the average variance extracted (AVE) for each construct exceeded .5.

5. Results

Using IBM SPSS 25 software, we assessed the gathered data and evaluated relationships proposed in the research model. The most-used VA was Alexa (38.7%), followed by Siri (32.0%) and Google Assistant (26.7%). The respondents mostly used their VAs on a daily basis (68.0%) for a period from several months to a few years, on their smartphones (66.7%), smart speakers (41.3%) or other smart devices.

The study participants mostly acknowledged good level of speech recognition of their VAs (66.7%)¹, however only a half found their VA's voice friendly and pleasant. Users agreed to derive functional and emotional benefits from their VAs: many found them easy to use (80%), useful and convenient (70.7%), enjoyable (56.0%) and interesting (69.3%). Over 73% of the respondents agreed that they were satisfied with their voice-controlled smart assistants, furthermore 17% agreed that they love their VAs. More than a half of the research sample intended to use their VAs more in the future.

In order to test the hypothesized model in Fig. 1, multivariate linear regressions (*H1-H6*) and mediation analysis using PROCESS (Model 4) (*H7-H9*) were applied (Hayes, 2017). As summarized in Table 1, speech recognition and response quality have a positive effect on perceived ease of use of VAs (*H1a*, $\beta = .55$, $p < .01$; *H1b*, $\beta = .23$, $p < .05$). Similarly, response quality of VAs has a positive effect on perceived usefulness (*H2b*, $\beta = .45$, $p < .01$). With regards to emotional benefits, only response quality showed significant positive impact (*H3b*, $\beta = .44$, $p < .01$). Vocal characteristics of VAs were not a significant factor to influence either

¹ Results based on Top-3-Box method for 7-point Likert scales

functional or emotional benefits of VAs, thus rejecting *H1c*, *H2c*, *H3c*. Therefore, answering RQ1, voice-/speech-related characteristics of VAs partially have a positive effect on functional and emotional benefits of VAs, where response quality has the strongest impact on perceived usefulness and enjoyment, and speech recognition is crucial for perceived ease of use.

Both functional benefits have a positive impact on user satisfaction with VAs (*H4a*, $\beta = .50$, $p < .01$; *H4b*, $\beta = .35$, $p < .01$); furthermore emotional benefits have a positive impact on satisfaction (*H5*, $\beta = .25$, $p < .01$) and a strong positive effect on love (*H6*, $\beta = .58$, $p < .01$). Addressing RQ2, functional benefits to a higher degree determine the level of user satisfaction forming cognitive consumer response, while emotional benefits result in building emotional connection to VAs leading in some cases to occurrence of love feelings towards VAs.

Hypotheses		Results of Multivariate Regressions (<i>H1-H6</i>) and Mediation Analysis (<i>H7-H9</i>)		
		Stand. β	Significance ²	Conclusion
1a	Speech recognition \rightarrow Ease of use	.55	***	supported
1b	Response quality \rightarrow Ease of use	.23	**	supported
1c	Voice quality \rightarrow Ease of use	.01	n.s.	rejected
2a	Speech recognition \rightarrow Usefulness	-.07	n.s.	rejected
2b	Response quality \rightarrow Usefulness	.45	***	supported
2c	Voice quality \rightarrow Usefulness	.08	n.s.	rejected
3a	Speech recognition \rightarrow Emotional benefits	.13	n.s.	rejected
3b	Response quality \rightarrow Emotional benefits	.44	***	supported
3c	Voice quality \rightarrow Emotional benefits	-.08	n.s.	rejected
4a	Ease of use \rightarrow Satisfaction	.50	***	supported
4b	Usefulness \rightarrow Satisfaction	.35	***	supported
5	Emotional benefits \rightarrow Satisfaction	.25	***	supported
6	Emotional benefits \rightarrow Love	.58	***	supported
7	Satisfaction \rightarrow Love	.19	n.s.	rejected
8	Satisfaction \rightarrow Future usage intention	-.01	n.s.	rejected
9	Love \rightarrow Future usage intention	.51	***	supported

Table 1: Results of Multivariate Regressions (*H1-H6*) and Mediation Analysis (*H7-H9*)

Finally, we conducted mediation analysis to confirm the intermediating role of the Love variable between Satisfaction and Future usage intention (*H7-H9*). The mediating role of love was not significant, as well as the effects of satisfaction on love and user intention to use VAs, leading to rejection of *H7* and *H8*. Unlike satisfaction, love showed a strong positive effect on future usage intentions (*H9*, $\beta = .51$, $p < .01$). Addressing RQ3, we may conclude that solely hedonic/emotional aspects of the user experience were key in determining intentions to use VAs more. Still, it is noteworthy, that the effect of satisfaction on love was close to be marginally significant (*H8*, $\beta = .19$, $p = .103$).

6. Discussion

The findings of this study contribute to a better understanding of consumer perceptions and interactions with VAs. The applied empirical approach allowed to capture and evaluate the impact of VA-related characteristics on cognitive and emotional user response and further analyze its effect on the intent to use this technology in the future.

Theoretically, the study results enrich the literature on human-computer interaction, in particular in discovering the development of love feelings towards the AI-powered voice

² Significance levels: *** = $p < .01$; ** = $p < .05$; * = $p < 0.1$; n.s. = non-significant

technology, which has been under-researched yet. This study sheds light on the communication attributes of VAs, showing that consumers derive functional benefits mainly from speech recognition (input), and emotional benefits from qualitative responses (output) instantly synthesized by VAs. Put differently, whereas perceived ease of use and usefulness is primarily connected to our input (e.g., voice command) into the system and the level of the VA's understanding, emotional benefits are created by the corresponding answer or voice output. Furthermore, while functional benefits positively affect consumer satisfaction, emotional benefits are crucial for occurrence of strong emotional connection between a user and a voice-controlled smart assistant. Finally, consumers' love towards VAs was the only significant factor to positively influence future usage intention, which has to be considered by VA-developers.

Managerially, the findings of this study offer multiple insights for further development of voice technologies. First, the quality of speech recognition is a strong predictor of the consumer's perceived ease of use, while response quality of VAs drives not only cognitive, but also emotional user response. Second, we proved that managerial focus in long-term should not only lie on user satisfaction, but even more so on developing a strong emotional connection between a consumer and a VA, since love feelings trigger future user intention. Therefore, the question how emotional benefits can be increased – besides by enhanced response quality – should be explored in more detail in future studies. The role of the usage of specific skills could present an especially valuable field of investigation.

Lastly, we believe there is a big potential for businesses in incorporating AI-powered voice technologies into their products and services, ensuring their presence in voice search and creating voice touchpoints with their potential users. By doing so brands could possibly reach a stronger emotional consumer response and in turn a higher future usage intent. This could create a plethora of unexplored marketing possibilities, including opportunities and challenges, which could be further explored in future research.

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