

Hey Siri: Exploring the Effect of Voice Humanity on Virtual Assistant Acceptance

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Abstract: This work in progress presents a proposed model to measure the acceptance of the use of voiced virtual assistants in commercial contexts. The use of these devices has increased after their implementation in smartphones and with the arrival of smart speakers in any household appliance. We propose the present model emphasizing the anthropomorphic aspect of the assistant to know if it has an emphasis on its acceptance. Unlike other models of acceptance, the contribution of the work is the inclusion of anthropomorphic variables such as human presence and human like voice. The work focuses on the virtual assistant Siri.

Keywords: anthropomorphism, technology acceptance, voice assistants, voice humanity

1. Introduction

David Hasselhoff, Harrison Ford and Joaquin Phoenix. All three of them have been the main characters of movies where a robot/virtual assistant was a helpful tool for the plot of the stories (Knight Rider, Star Wars and Her, respectively). Sci-fi movies have translated what the humans have been dreaming of since the industrial revolution. We don't use flying cars though, as it was broadcasted in the 60s on *The Jetsons*, but we all do surely have a smartphone with the ability of answer us back out loud if we ask them something. Fables and fairy tales made the current anthropomorphism popular back in the days, where animals and objects were treated as human beings (Alice's Adventures in Wonderland, 1865), but it was during the 1920s when this phenomena started to be translated into robots and assistants, specifically in 1992 Radio Rex was introduced as the first voice-activated toy, and ELIZA was the first NLP (Natural Language Processing) chatbot created by the MIT in the 1960s. It was created as a chatbot to prove that the communication between humans and machines was substantially depthless (Epstein & Klinkenberg, 2001). ELIZA was characterized by replicating users and simulating conversation, generating the feeling that the chatbot was able to understand what the interlocutor was saying. ELIZA was the origin of the expression "ELIZA effect", which in computer science is known as the tendency to unintentionally believe that computers behave the same way as humans do, also known as anthropomorphisation (Hofstadter, 1995).

The adoption of internet connection allowed chatting platforms to use the chatbot SmarterChild which was a chatbot that was able to display the weather, play games with the user and look for information on the internet. Siri made their debut on 2011 and it was created to vocally assist iPhone users to perform basic activities with their phone. From that moment in time the rest of the telecommunication companies debuted their own assistants. The late 2010s marked the born of the main virtual assistants (VA from now on) as we know them today. It is common to see a virtual assistant in a social commerce website, referred to those websites e-commerce based combined with the characteristics of the Web 2.0 and social media (Turban et al., 2018). Inside the context of a website, virtual assistants are prepared and programmed to help the users during their shopping experience, offering extra information and details about the products and guiding users through the process. VAs, the same market in 2020 was esteemed in more than 10,700 million dollars and it is expected to increase its value up to 27,160 million dollars during 2026. The number of virtual assistants is going to overtake the world population by 2024, reaching 8,400 million devices and led by smartphones (Juniper Research, 2020).

During the COVID-19 pandemic the world faced a new scenario that has previously never seen before. Workers who weren't able to leave their homes had to work remotely, which made the virtual assistants find a new definition and use: for online shopping and for people working from home. Telepresence was a common word during the pandemic years and innovations regarding speaking development and technology were common in order to facilitate teaching and learning (Nguyen et al., 2022), or to improve productivity (Marikeyan et al., 2022) and dictation (Stavarache & Dhopolsky, 2022). Worldwide electronic commerce sales increased by 19% only in 2020 (Statista Digital Market Outlook, 2021). The consequences of prolonged self-isolation placed many people into loneliness situations, where devices with integrated virtual assistants were useful to escape from that reality. Voice interactions offer easy communications, removing the need to acquire new skills to understand how they work (Sheerman et al., 2020), allowing users to learn quickly how to interact with them. It also allowed

people to shop using their voice. Voice commerce (VC) is at the intersection between online shopping and virtual assistants. It has been defined as a category of electronic commerce that provides customers with voice technologies used to place orders online (Mari et al., 2020). These voice technologies include natural language processing, speech synthesis and artificial intelligence technologies. VC is not limited exclusively to the transaction phase of the shopping process, it covers all the commerce steps: from users searching for products and services, listening to reviews, adding items to their shopping cart, tracking the order and so on. It counts with the potential to modify all the steps of the shopping journey (Mari et al., 2020). VC can be seen as another customer channel, but it does not cannibalize the rest of the purchasing channels, rather it has a positive effect on the smartphone channel (Sun et al., 2019). Compared to traditional electronic commerce, VC still has a long way to be fully developed.

Current virtual assistants can help during the decision process by giving information to the customers or reading reviews. The adoption of VA has increased the growth of the sales in the world's largest electronic commerce platforms (Sun et al., 2019), and contrary to other channels, voice commerce does not cannibalize other purchase channels (PC and mobile); rather, it has a positive spillover effect on the mobile channel. In fact, voice assistants have registered the fastest development rate for a new technological medium (Dellaert et al., 2020). Regarding new technologies, the research priorities of the Marketing Science Institute have highlighted academic interest in (1) voiced systems in new technologies: focusing on the creation of challenges and opportunities for marketing during post-pandemic years, emphasizing on the long-term effects on consumer behavior, the marketplace and communication strategies, and (2) the science of emotion, including the need to "understand the entire consumer journey and how to directly influence the emotions that affect future purchases".

The present work is based on the already established and accepted studies in relation to the models of technological acceptance. In order to advance the need for research around VA, the objective of this work is to present a model of technological acceptance of VA (specifically Siri) where the voice is the focus of the research. The main contribution is based on the inclusion of the anthropomorphic factor to measure the purchase intention. There is no specific definition of which variables should be included in the concept of anthropomorphism, since humanity in inert objects can be measured through a wide variety of factors that increase as technology progresses. This work aims to focus on the voice as an anthropomorphic factor and show that it is necessary to include this type of variables in the TAM models with virtual assistants because the voice can influence the purchase intention.

2. Technology background

The acceptance of technology is a subject that has been extensively researched for decades, so there are many models that try to explain this phenomenon. These attempt to explain the effect that external variables (and user perceptions and beliefs) have on models of attitude towards the adoption or use of a technology. The technology acceptance model (Davis, 1986) attempted to explain the acceptance and use of information systems by users based on the perception of the characteristics of the system itself. The objective of this theory tried to support the information systems to be able to evaluate them previously before their implementation. The conceptual framework behind this model is that the design features of an information system result in a user's cognitive response, which is divided into two individual perceptions: perceived usefulness and perceived ease of use. Perceived usefulness has been defined as the user's belief that the information system would improve their job performance, while perceived ease of use has been defined to explain a user's belief that the system they is using is free of physical and mental effort, to some extent. The perceived ease of use also influences the perceived usefulness of the system, since the user believes that an easy-to-use system ended their productivity.

Venkatesh et al., 2003 there was a unified theory of the use and acceptance of technology integrating several models, which he called UTAUT (Unified theory of acceptance and use of technology). The UTAUT model integrates the expectation of effort, performance, social influence and other types of facilitating conditions that lead to behavioral intention and usage behavior. Variables such as gender, age and experience moderate these relationships. The original model was proposed to understand the acceptance and use of technology in a managerial context. A similar model called UTAUT2 (Venkatesh et al., 2012) was created to explain the acceptance of technology outside of this realm. This model was created to explain the acceptance of technology in the context of the consumer, for which some variables were modified. A recent study by Murillo et al., (2021) shows a compilation of the most popular factors that have been included in the technology acceptance model

over the years. In addition to the three main factors of the model (Perceived Ease of Use, Perceived Usefulness, and Attitude Toward Use; (Davis, 1986), other popular factors such as Social norms, System Quality or User Interface Design, for example, are identified.

Anthropomorphism can be defined as “the universal human tendency to ascribe human physical and mental characteristics to nonhuman entities, objects and events” (Zawieska et al., 2012). Previous studies have shown that different types of anthropomorphic traits can be effective in creating clues that remind people. Human form (Aggarwal & McGill, 2007), liveliness (Morewedge et al., 2007) and most importantly voice (Lee & Nass, 2003). However, there are no works that definitively define the concept of anthropomorphism due to its changing nature with the state of technology.

Nass et al., 1994 discovered that humans treat computers like an extra person when they hear their voice and lately, Lee & Nass (2003) showed that study participants were forced to treat a computer like any other human being, even knowing that the computer's voice was synthetic and produced by voice creation software. The conclusion of these two studies is that interactions between users and VA where the voice is a main factor, can facilitate the effect of anthropomorphism. Thanks to artificial intelligence, voice assistants can process voice commands and issue responses like what a human being could say (Russell & Norvig, 2010). Current VA personalize their interactions with users, so they can hold robot-human conversations more naturally. Unlike other types of technologies, VA are progressing in anthropomorphism much faster. An VA communicates directly through voice with users, while other devices use text and images.

Nass & Yen (2010) showed that a VA's voice influences other human characteristics (such as personality) more powerfully than other forms of communication (such as written communication). Theories such as parasocial interaction (Horton & Richard Wohl, 1956) explain that people can develop a relationship through an imagined interaction with other people. The theory was originally used to describe the development of social relationships between the public and celebrities (Horton & Richard Wohl, 1956), then later used to describe social relationships between people and non-human concepts, such as chatbots and robots (Mou & Xu, 2017) and avatars (Fox et al., 2009). This theory assumes that the two participants are human, even though they do not interact with each other. However, it suggests that people can imagine relationships with non-human beings, like cartoons (Giles, 2002). When the other party to the relationship is not human, their perceived humanity is a fundamental condition that precedes parasocial interaction, since it allows people to see the other being as real (Banks & Bowman, 2016).

Regarding technology acceptance models and due to the literature on which we base this study, we understand anthropomorphism in the context of voiced virtual assistants through two factors: human presence and human-like voice. The first of them is defined by McLean & Osei-Frimpong, (2019) as a factor related to the perception of the VA as a human interlocutor. Some studies have begun to analyze the anthropomorphic perception of virtual assistants, referring to a human-like voice as the opposite of a robotic voice (Chérif & Lemoine, 2019). The existing literature on anthropomorphism in virtual assistants seems disjointed, since variables such as human-like voice appear very briefly in experimental studies as a stimulus, so there is no conceptualization of it.

3. Literature review and proposed model

As the theory focuses on the motivational process itself, it focuses not on measuring the qualities of the system, but on the user's own perceptions and beliefs, influenced by those qualities. However, we did not find any factor in technology acceptance models that include anthropomorphism or human likeness as a variable that would explain the intention to use the technology.

In this work, and due to the virtual assistant technology we use, we understand anthropomorphism as the mixture of human presence and human-like voice. Users tend to anthropomorphize VA because of voice-based interactions. Voice is thought to be an effective anthropomorphic cue because human-robot interaction literature confirmed that users anthropomorphize robots when these last ones have a voice (Nass et al., 1994).

Regarding the study of VA anthropomorphism as a whole and the perception of benefits, partial contributions have been proposed, specifically, benefits (utilitarian and hedonic), usefulness and social presence have been analyzed (McLean & Osei-Frimpong, 2019). Although there is a growing interest in relation to

anthropomorphism in virtual assistants, there is still not a strong enough literature, showing the need to integrate the previous variables in the study of the relationships between users and virtual assistants.

The VAs humanity finds its origins in social psychology, as applied to telecommunications, with scholars defining social presence as “*the degree of salience of the other person in a mediated communication and the consequent salience of their interpersonal interactions*” (Short et al., 1976). With the digital revolution, alongside interpersonal interaction mediated by a technological interface (“interactivity through the medium”), interaction between a subject and the medium itself (“interactivity with the medium”) has increasingly developed. In this context, the construct of social presence has been used in the human-computer interaction field to indicate the perception of the humanity of different technological communication interfaces, such as websites (Hassanein & Head, 2007), social media (Shen & Khalifa, 2008) and robots (Lee et al., 2006). Concerning individual-VA interaction, VA humanity has been measured with heterogeneous scales: social presence (defined as “*the subjective capacity of the medium to make people experience their interlocutor as psychologically present*”; Chérif & Lemoine, 2019) perceived humanness (summarizes those anthropomorphic characteristics, both in form and behavior, that the user finds in a robot; Fernandes & Oliveira, 2021) and human-likeness (is used as a single parameter to describe how humans perceive robots; von Zitzewitz et al., 2013)

VAs fulfill the precondition of the parasocial interaction theory due to the high level of human likeness by their voice. Voice assistants have many anthropomorphic features that automatically cause users to assign human characteristics to the device. The way voice assistants work provides anthropomorphic cues due to their resemblance to the way humans speak (for example, due to the ability to generate immediate and relevant responses to user questions). Therefore, users may perceive VA as human and interact with them as if they were interacting with another person.

H1. An increase in the perception of social presence will lead to an increase in the perception of human presence.

H2. An increase in the perception of perceived humanness will lead to an increase in the perception of human presence.

H3. An increase in the perception of human likeness will lead to an increase in the perception of human presence.

3.1 Anthropomorphism of voice assistants

Anthropomorphism has been identified as influencing different aspects in a commercial environment, benefiting relationships and trust between the consumer and the brand (Patrizi et al., 2021). The main hypothesis of this research is that anthropomorphism plays an important role in models of acceptance of VA technology. Therefore, it is hypothesized that anthropomorphism increases acceptance of VAs.

H4. An increase in the perception of human presence will lead to an increase in the intention to use VAs to purchase.

The human-like voice has been analyzed in the human-computer field through experiments that have placed this voice in opposition to a voice perceived as more synthetic/robotic. The literature shows that, compared to a synthetic voice, consumers are more likely to attribute anthropomorphic characteristics to a “robotic agent” when it has a human-like voice (Schroeder & Epley, 2016). The study published by Chérif & Lemoine, (2019) confirmed these results in the context of VA. The study highlights how the perception of humanity of the AV increases in the minds of users when they interact with an AV endowed with a human-like voice compared to a synthetic one. On the other hand, the literature on anthropomorphism has focused mainly and solely on physical attributes, without considering the role of voice characteristics (Golossenko et al., 2020). Studies related to political marketing have identified that some characteristics of the voice can be related to human characteristics, such as tone (Morales et al., 2012), accent (Zoghaib, 2019) and quality (Wiener & Chartrand, 2014).

H5. An increase in the perception of human-like voice will lead to an increase in the intention to use VAs to purchase

3.2 Acceptance of VA

Concepts like perceived usefulness and perceived ease of use are used from both technology acceptance model and the unified theory of acceptance and use of technology. With social influence, we will also consider the

effect of perceived popularity of the assistant, on the use intention and user satisfaction. Perceived usefulness is further examined by measuring the design features through perceived quality of the system, with the assumption that different platforms for voice assistants can lead to differences in their performance. Perceived usefulness was mentioned in the literature review to be used as a measurement in technology acceptance model (Davis, 1986), as well as UTAUT (Venkatesh et al., 2003) and UTAUT2 (Venkatesh et al., 2012) models, where it was named performance expectancy. This difference was reviewed to only be in name, as they measure the same aspect. This facet comprises of usefulness beyond system quality, for example how well the user finds the voice assistant to increase their productivity.

H6. *An increase in the perception of perceived usefulness will lead to an increase in the intention to use VAs to make a purchase*

Perceived ease of use was defined as a measurement, on how much effort and how easy to use a technology was perceived to be (Davis, 1986). Also called effort expectancy in UTAUT and UTAUT2 models (Venkatesh et al., 2003, 2012), ease of use describes how easy it is to use, or learn to use a technology, as well as how much mental or physical effort it is expected to cause. Based on the existing models this aspect is also hypothesized to influence the outcomes.

H7. *An increase in the perception of perceived ease of use will lead to an increase in the the intention to use VAs to make a purchase*

Previous literature states that anthropomorphism has an impact on user's behavior when triggered by cues. Technology acceptance has usually been measured using models such as TAM (Davis, 1986) and its multiple versions. None of them consider the influence, that perceived anthropomorphism in a non-human agent could have on user's behavioral intention. The next model is proposed based on a literature review, combining traditional TAM model factor (Davis, 1986) and accepted TAM models with anthropomorphic cues. Being a technological advance, we can rely on models of technological acceptance. However, since these are voice-based models, it is important to add different variables that measure the voice.

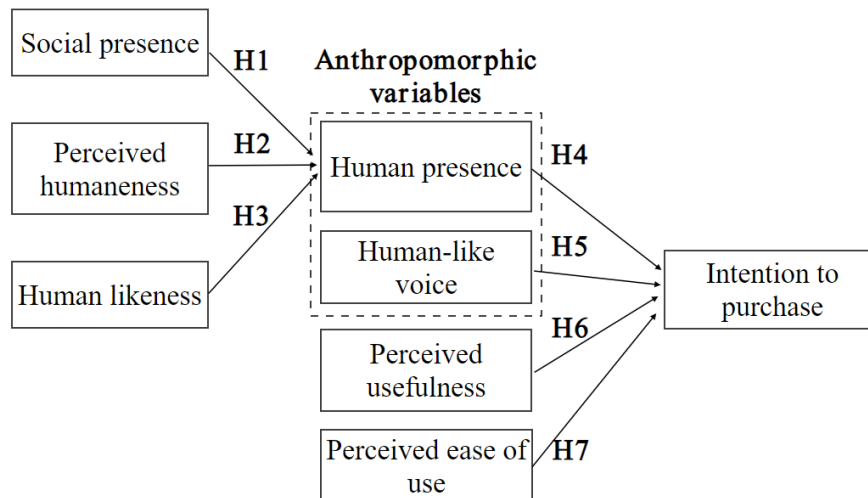


Figure 1: Proposed research model

4. Overview of the proposed research

4.1 Methodology

We will conduct a survey to test the hypotheses (may, 2022). To do this, we generated a battery of audios in which Siri read reviews posted by users of Amazon and Google Sites. Among all the AVs, we decided to choose only Siri because it has the necessary developer tools that allow Siri to read a text that has been previously written. The selected products on Amazon were running shoes, a book, a cleaning robot, and perfume. For Google Sites establishments and professionals, we selected a hotel room, a private teacher, a personal trainer, and a restaurant. We decided to choose those reviews that were written correctly so that Siri would have no trouble reading it. All the participants listened to the 8 contexts in a questionnaire that interspersed questions and scenarios. Social presence was measured on a scale by (Qiu & Benbasat, 2009); perceived humanness was measured on a scale by Whang (2018). Lastly, human likeness, human presence and human-like voice were

measured using scales by Patrizi et al., (2021) Both perceived usefulness and perceived ease of use were measured on a scale by Moriuchi (2019). Structural Equations Model will be examined to test the hypotheses. The results will contribute to explain the effect of the anthropomorphic variables of sound on the acceptance of AV to make online purchases.

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