Usefulness vs. Uncanniness: Exploring the perceived usefulness of virtual assistants in the customer journey

Author: Alexander Carl Alfred van Uelsen
University of Twente
P.O. Box 217, 7500AE Enschede
The Netherlands

ABSTRACT:
In recent times, many businesses increasingly rely on the use of virtual assistants for their customer management processes. However, whether these virtual assistants are perceived as useful remains at large. Specifically, the perceived usefulness of virtual assistants in the stages of the customer journey remains unexplored. Firstly, this paper will discuss relevant theoretical insights and theories about the perceived usefulness, AI technologies in general and the customer journey, which will result in the development of seven hypotheses, which are centered around the effect of external variables on the perceived usefulness and the consumer's perception of the usefulness of virtual assistants in the customer journey. Consecutively, this paper will include a description of the survey that was used to gather the necessary data to answer the proposed hypotheses. The findings of the survey demonstrate that the perceived ease of use, attitude towards the technology and the quality of the virtual assistant have a positive effect on the perceived usefulness of virtual assistants. Also, the findings show that there are significant differences in the perceived usefulness of virtual assistants in the three customer journey stages. In more detail, the analysis showed that virtual assistants are perceived as most useful in the Transaction stage.

Graduation Committee members:
1st Examiner: dr. C. Herrando
2nd Examiner: dr. E. Constantinides

Keywords
Artificial Intelligence, Perceived Usefulness, Customer Journey, Virtual Assistants

1. INTRODUCTION

As time progresses, the appearance of digital businesses and new technologies increases, many businesses increasingly incorporate new technologies in their business processes. While the digitalization process is continuously ongoing, those new technologies not only effect the operations of the businesses (especially Marketing), but also the customers in their online (shopping) experience (Libai et. al, 2020). One large field of advanced technologies belongs to Artificial Intelligence, which contains technologies like Augmented Reality, Virtual Reality, Mixed Reality, Internet of Things (IoT), Virtual assistants like chatbots, which generally have the capability to massively transform and change the customer experience combined with the prerequisite that companies adopt those technologies properly (Puntoni et. al, 2021).

Artificial Intelligence (from here on shortened to AI) is one of the fastest developing technologies, that gets more and more embedded into everyone's daily life. One prominent example is the Amazon Alexa, which relies on the idea of voice recognition and is able to take up different tasks like playing and stopping music or even dimming the light. In general, AI can be defined as a system's ability to correctly interpret external data, to learn from such data, and to use those learnings to achieve specific goals and tasks through flexible adaptation (Kaplan & Haenlein, 2019). Due to the increasing computer power, the amassing of huge amounts of data, the lower computing costs, and advances in machine learnings (Huang & Rust, 2021), those AI technologies do not only have the ability to largely influence customers in their customer journey and companies in the way they do business, but also possess the power to be more and more accurate in predicting behaviour (Afan et. al, 2016), with some companies even using AI mechanism as a tool to predict future customer purchases. For example, Amazon makes use of AI technologies by using a method called 'Anticipatory Shipping', where Amazon collects customer purchasing data and sends people products based on their behaviour without the customers ordering them (Hoyer et. al, 2020).

Considering the value that AI can have for companies, it is inevitable that AI technologies will play a big role in the future way of doing business.

Looking at the target group that AI technologies are supposed to address, namely the business customers, it is important to consider how those customers are affected by the usage of AI, especially in the customer journey, and what the value of AI is for customers.

Theoretically, AI has a lot of potential benefits. As described in Hoyer et. al (2020), the Internet of Things (from now on shortened to IoT) for example has the potential to create immense value as this technology will make ordinary consumer behaviour tasks much easier by collecting information, enabling automation of transactions, and helping in maintenance and service. Even though, theoretical benefits are established, the real perceived usefulness of those AI technologies for customers in their customer journey, especially for virtual assistants, still remains a mystery. Hence, this research tries to give an answer to this research gap. The underlying research question is the following:

RQ: Do consumers perceive virtual assistants as useful in their customer journey? And how do external factors influence the perceived usefulness?

This paper is structured as follows. The next section is about the theoretical framework of this study. In this framework, the variables that make up the term 'perceived usefulness' will be identified. After that, a literature review will be done, which defines the different types of AI technologies with a focus on virtual assistants, the customer journey, as well as some theoretical background on perceived usefulness and its variables and also their interferences.

In terms of methodology, this research will be designed around a survey, where the respondents are faced with a set of statements that relate to a specific variable. Based on the respondent's answers to those statements, the relationship between the different variables and the perceived usefulness of virtual assistants will be analyzed.

2. THEORETICAL FRAMEWORK

In this study, the term perceived usefulness will be considered in the context of the Technology Acceptance Model, which as the name might suggest, describes the variables and external factors that determine the acceptance of a specific technology. The TAM was originally developed as a result of Davis' study on perceived usefulness and perceived ease of use (1989). The main point of the TAM is that perceived usefulness and perceived ease of use are key determinants to explain the use of systems (Saade, 2007; Qi et. al, 2009). In this context, technology acceptance can be defined as 'an individual's psychological state with regard to his or her voluntary or intended use of a particular technology' and is described as by the perceived usefulness, perceived ease of use, attitude toward and the intention to use this particular technology and the relationships between them (Saade, 2007). This connection already shows the importance of perceived usefulness and perceived ease of use for the establishment of a new technology.

According to Davis, perceived usefulness and perceived ease of use of a technology are fundamental determinants of technology acceptance (Davis, 1989), as already described above. According to the same article, perceived usefulness can be defined as 'the degree to which a person believes using a particular system would enhance his or her job performance'. In this aspect, perceived usefulness is conceptually very similar to utilitarian value as it emphasizes task-oriented customer value (Yang & Lee, 2018). Over the years, many relationships concerning perceived usefulness and technology acceptance have been identified, with the general consensus being that perceived usefulness is a main contributor to the acceptance of a new technology (Davis, 1989).

Even though Davis' definition applies perceived usefulness only to a job performance level, the definition will be used nonetheless, but will be extended to compromise aspects such as the customer experience and customer value when faced with AI technologies. In line with the definition of perceived usefulness, taking into account the task-technology fit hypothesis might also be important. The task-technology hypothesis basically argues that for an information system (in this case AI technologies) to have a positive impact on performance, it must be designed and utilized in such a way that it fits with the task it supports (Lim, 2000).

2.1 LITERATURE REVIEW

2.1.1 Artificial Intelligence

As already described in the Introduction section, AI can be defined as a system's ability to correctly interpret external data, to learn from such data, and to use those learnings to achieve specific goals and tasks through flexible adaptation (Kaplan & Haenlein, 2019). Based on this definition, it is clear that the current level of AI still lies far below the level of humans. While humans are capable of observing the environment and deriving with underlying relationships (Corea, 2019), AI uses external information obtained through big data or IoT as a source for identifying patterns and underlying rules (Kaplan & Haenlein, 2019). Also, Kaplan and Haenlein (2019) categorize AI into three

distinct stages. The first one is called Artificial Narrow Intelligence (ANI) or 'Weak AI', which assesses AI as below-human level that is simply able to perform a specific task (Lu et. al, 2018). One prominent example of this is Amazon's Alexa, which is capable of recognizing voices but cannot perform any other tasks autonomously. The second stage of AI is Artificial General Intelligence (AGI). This type of AI categorizes AI technologies as human level. Such AI technologies are still in development and not in wide use currently. This type of AI has the potential to perform tasks autonomously, while even being able to reason. The most futuristic stage of AI is the Artificial Super Intelligence, which puts AI at an above-human level, making humans pretty much redundant. This type of AI technology would be able to solve most imaginable tasks quicker than a human can do. From a business perspective, AI has some crucial implications for the way businesses will perform and act. According to Kaplan and Haenlein (2018), AI will not only impact personal lives but also fundamentally transform how firms take decisions and interact with their external stakeholders (customers, employees), specifically in the field of Marketing, as AI might for instance be able to influence individual consumer preferences to create machine-driven marketing strategies, generate B2B pricing strategies and even product development and innovation (Martinez-Lopez & Casillas, 2013).

Generally, AI can be seen as an umbrella term, covering several advanced technologies. As this research relates to the perceived usefulness of AI technologies, three different technologies have been identified, which will now be reviewed in more detail. The identified technologies are: The Internet of Things (IoT), Virtual Reality (VR)/Mixed Reality (MR)/ Augmented Reality (AR), and virtual assistants (covering aspects such as chatbots). For the purpose of this research, only the last-mentioned AI technology will be considered in the methodology part.

Opposingly to all the advantages that AI might bring, there are also some significant downsides which might contribute to a potential lacking perception of AI usefulness, that this research is trying to shed light on. The main disadvantages of the current level of AI are centred around the fact that present AI technologies are limited to specific intellectual areas, such as image recognition, facial recognition, or voice recognition, while also lacking most abilities that human brains have, like self-consciousness or self-control (Lu et. al, 2018).

2.1.2 VR/AR/MR

Virtual reality, mixed reality and augmented reality generally have one thing in common: they add additional information and experiences to current real-life situations.

Augmented reality can be defined as a real-time direct or indirect of a physical real-world environment that has been extended/augmented by adding virtual computer-generated information to it (Carmigniani & Fuhrt, 2011). In this aspect, AR aims to simplify the user's life by not only adding additional information about the direct surroundings, but also to any indirect view of the real-world environment. Geas Energiewacht, a Dutch energy company, makes use of so-called AR glasses for training purposes of their employees. As their technicians are concerned with repairing and constructing energy boilers, those glasses display the steps that are required to repair and construct such boilers, so that the technicians are able to apply this in real-life scenarios. In the same way, many online retailers rely increasingly on a technology called Augmented-Reality Interactive technology (ARIT), which e.g., allows online customers to try on clothes online (Huang & Liao, 2014), as this technology can display the face, the body shape and other physical features. While AR blends the real and the augmented world (Huang & Liao, 2014), VR isolates the individual fully from the real-world, bringing the individual in a virtual reality world. Doing this happens mainly by the usage of VR glasses, that are supposed to guarantee a more in-depth, engaging and innovative environment by placing users in a virtual 3D world (Hoyer et. al, 2020; Lu et. al, 2018). According to Kurilovas (2016), one major limitation of VR usage in the current business context is that most applications are still limited to simple visualization of virtual objects that do not pass the simple stage demonstration prototypes. Differently, mixed reality basically combines real and virtual worlds with the purpose of creating a new virtual environment where physical and virtual elements co-exist and interact in real time (Milgram & Kishino, 1994). Similarly, Pan et. al (2006) define Mixed Reality as the incorporation of virtual computer graphics objects into a real three-dimensional scene, or alternatively the inclusion of real-world elements into a virtual environment.

Applying the three different concepts to a real business environment, where businesses interact with users/customers with the goal of selling their product and making profits, MR technology will most likely have the biggest impact, as about 82% of companies plan to make use of MR glasses in the future (Hoyer et. al, 2020). Similarly, AR will be commercialized quickly, which makes this technology available for pretty much everyone. Contrary, the future usage of VR is still unknown, as this technology is still held back as its limitations currently larger than its benefits (e.g. general lack of devices that guarantee a useful usage of VR).

2.1.3 Internet of Things

The Internet of Things (short: IoT) can most properly be defined as 'an open and comprehensive network of intelligent objects that have the capacity to auto-organize, share information, data and resources, reacting and acting in face of situations and changes in the environment' (Madakam et. al, 2015). Similarly, Ng and Wakenshaw (2017) describe the term 'IoT as a network of entities that are connected through any form of sensor, enabling these entities, (sic), to be located, identified, and even operated upon'. What these and most other definitions have in common is that the IoT takes the data creation away from people and places data creation onto physical objects and things, where physical objects and beings as well as virtual data and environments can interact with each other (Kosmatos et. al, 2011). The IoT as an umbrella term compasses a variety of technologies that have different implications for their usability in the business context. The most prominent one is probably Bluetooth, which allows for short-range wireless exchange of data between laptops/phones etc.

Referring back to the ARIT, which was mentioned in the paragraph about AR/VR/MR, that basically gives insights into how AI technologies can be incorporated into the online shopping experience, the IoT offers solutions on how advanced technologies can be incorporated into the physical world, influencing the consumer experience directly (Ng & Wakenshaw, 2017). Several researchers also identified that IoT technologies can transform the physical product experience into one of a service (Edvardsson et. al, 2005).

Possible applications may include smart consumer appliances and home equipment or medical devices/equipment. Nonetheless, the increasing amount of data that is consumed by IoT devices also raises numeral issues, mostly relating to data privacy and safety (Hoyer et. al, 2020).

2.1.4 Virtual Assistants

Generally, virtual assistants, like chatbots, enable companies to reach their target audience more easily without having to rely on physical manpower, with their main purpose being to stimulate a

human conversation (Shawar & Atwell, 2007). Chatbots are defined as computer programs that interact with users using natural language (Shawar & Atwell, 2007) and are not handled by human persons, but rather by a software that is leading the conversation (Zumstein & Hundertmark, 2018). According to Zumstein and Hundertmark (2018), the potential annual savings that are created by chatbots are as high as double-digit billions across a variety of industries, as chatbots have the ability to fully replace the human workforce in the aspect of customer communication. In reality, chatbots are widely used in the business context and companies like Facebook rely solely on the use of chatbots in their conversations with customers. The goal of chatbots is to achieve results by conversing with a machine in a dialog fashion, using natural language (Dale, 2016), which implies that chatbots intercorrelated with the topic of AI anthropomorphization, which generally describes the attribution of human-like characteristics to technology (Salles et. al, 2020).
From a business perspective, the most useful form of interacting is via such chatbots, which are powered by AI combined with deep learning that makes chatbots more precise and better with every interaction they have.
The usage of chatbots also brings some benefits. First and foremost, they allow one-on-one communication, while also being available 24 hours a day, 7 days a week. Zumstein and Hundertmark (2018) also say that chatbots allow companies to create customized offers that are targeted directly and personally to users.
Not only focusing on virtual assistants in the business context, but extending the term virtual assistants to a private, not commercialized use, some interesting implications arise as well. In this aspect, notable is for example Alexa, which can be connected to other smart devices, which in turn allows normal homes to be turned into smart homes (Yang & Lee, 2018), while even having the capability of allowing elderly people to live independently as they can solely rely on voice-command (Corbett et. al, 2021).
Virtual assistants are basically built on the premise that humans want to interact with chatbots using their natural language the same way they use for communication with other people (Shawar & Atwell, 2007), which stresses the importance of human-like interactions and conversations, indicating that a human-like interaction with a virtual assistants is perceived as better and more pleasant. More precisely, making virtual assistants more human-like is done by a so called text input and text output mask, which makes the end-user feel like communicating with a real person (Fei & Petrina, 2013). Zumstein and Hundertmark (2018) list several characteristics that virtual assistants need to possess. First, virtual assistants shall be perceived as a team member, rather than a technical device that humans can interact with. Additionally, virtual assistant's output quality should be designed in a way that the responses are human-like, meaning that answers e.g. should not be listed in bullet points. Also, virtual assistants should be adaptive to the user's personality, as people are more likely to interact with people that match their personality type. Credibility of virtual assistants is also increased when virtual assistants are able to express emotions, more precisely positive emotions like joy and happiness to improve the relationship with the user.
However, one major issue for virtual assistants, especially virtual personal assistants like Alexa or Amazon Echo is the low consumer retention, being as low as 3% in the second week of usage (Yang & Lee, 2018), which already gives an indication that Virtual assistant technologies might not be perceived as really useful, but rather as a playful tool or a funny gimmick. Also, issues around the topics of social isolation and ethical concerns, as well as lack of experience and difficulties in understanding are potential downsides of virtual assistants (Zumstein & Hundertmark, 2018).
Even though this only relates to private use assistants, the situation for chatbots and virtual assistants in a business consumer communication context is still unexplored, showing a gap between the actual usage of those assistants and their perceived usefulness, which this research is trying to close.

2.1.5 Customer Journey

As the above-mentioned AI technologies are all fed by customer data, it is also important to recognize what phases an individual goes through when interacting with a company, as the different AI technologies might be perceived differently based on the phase the individual is currently in when being confronted with the AI technology. Generally, the customer journey is referred to as a process or sequence that a customer goes through to access or use an offering of a company (Folstad & Kvale, 2018). From a marketing perspective, determining the customer journey is crucial for today's data-driven marketing (Micheaux & Bosio, 2019), as generating data allows companies to advertise to their customers at an individual level. According to Lemon and Verhoef (2016), the customer journey can be separated into three distinct phases, namely the pre-transaction phase, the transaction phase and the post-transaction phase, which do not follow a linear structure, which means that customers can go back and forth while touching with the different touchpoints across those stages (Wolny & Charoensuksai, 2014).
The pre-transaction phase is characterized by the need recognition for a specific product, and the followed direct search for a specific product. The purchase stage is characterized by the choice to buy the specific product, to order it and to pay for it. The post-transaction phase is characterized by the consumption and usage of the product but also by the post-transaction service of the company (Lemon & Verhoef, 2016).
As this research aims at assessing the usefulness of AI technologies in the eyes of the consumers, it is crucial to identify the different phases the consumers might find themselves in, as the perceived usefulness might be different across these phases and the touchpoints with the company. In this aspect, Hoyer et. al (2020) found that the influence of IoT might be the highest in the pre-transaction phase, as e.g. RFDI tags, embedded into clothing, might give the customer additional information about e.g. the manufacturing process. In terms of AR/MR/VR, the impact is most likely to be the highest in the pre-transaction phase as well, while having a low impact on the purchasing/transaction phase and the post-transaction phase. Virtual assistants most likely have the highest impact in the pre-transaction and the transaction phase, as they might have the ability to push consumers into purchasing a specific product, which is most likely linked to the fact that AI technologies may become more and more human-like, also being able to show emotions (Hoyer et. al, 2020).

2.1.6 Hypothesis Development

For the purpose of this research, some variables have been identified that are of importance when considering and analysing the perceived usefulness of AI technologies.

2.1.6.1 Perceived usefulness

As this research tries to determine the perceived usefulness of virtual assistants in the customer journey, the variable perceived usefulness needs to be assessed. As already described by Davis (1989) in the context of the development of the Technology Acceptance Model (TAM), perceived usefulness is one of the main influencing factors towards the acceptance of a new technology. As determined in the sections below, perceived

usefulness is also largely influenced by other variables such as the perceived ease of use or the quality of such technology. Nonetheless, to get a good picture of the consumer's perception of a technology's usefulness, the variable itself needs to be tested. Hence, the perceived usefulness will be seen as the dependent variable in the analysis.

2.1.6.2 Perceived ease of use

According to research, one of the main determinants of perceived usefulness is the perceived ease of use (Davis & Venkatesh, 2000), meaning how easy a technology is to use for an individual without having any experience with such technology. More precisely, Davis (1989) identifies Perceived ease of use as 'the degree to which a person believes using a particular system would be free of effort'. The TAM, which was already described in the section about the theoretical framework, proposes that the easier it is to use a system, the less effort it takes to fulfil tasks, hence directly influencing the intention to use the system, which in turn has direct implications on the perceived usefulness (Saade, 2007). In line with this, Alhashmi et. al (2019), in their study about AI implementation in Dubai's healthcare sector, mentioned that the TAM is a useful method to determine the usefulness of technologies, as successful AI implementation depends largely on adoption and acceptance, which is in turn influenced by the variables that make up the TAM in the specific context. Similarly, Alhashimi (2019) and Qi et. al (2009) state that the TAM has been effective in predicting the acceptance of a technology and user system implementation. Based on the already established correlation to the perceived ease of use, following hypothesis can be developed:

H1: The perceived ease of use of virtual assistants has a positive effect on the perceived usefulness.

2.1.6.3 Relevance for the task

Taking into account Lemon and Verhoef's (2016) description of the customer journey, which categorizes the customer journey into a pre-transaction, a transaction and a post-transaction phase, the perceived usefulness of virtual assistants might vary across those three distinct phases. Based on Hoyer et. al (2020), the above-described AI technologies have different impacts on the different phases in the customer journey. Hence, if a technology has different implications and impact on the different phases in the customer journey, the perceived usefulness of those technologies, applied in those different phases, might vary as well. For the hypothesis development, a high impact at a one of the three phases of the customer journey (Hoyer et. al, 2020) will be seen as correlated to a higher perception of its usefulness. In terms of Virtual assistants, Hoyer et. al (2020) established that the highest impact is in the pre-transaction phase and the transaction phase, while the impact in the post-transaction phase is seen as low. Based.on this, the following hypothesis can be developed:

H2: Virtual assistants are perceived as most useful in the pre-transaction phase and transaction phase.
H3: Virtual assistants are perceived as more useful in the pre-transaction phase than in the post-transaction phase.
H4: Virtual assistants are perceived as more useful in the transaction phase than in the post-transaction phase.
H5: There is significant difference in the perceived usefulness across the stages of the customer journey.

2.1.6.4 Attitude towards the technology

According to Saade (2007), one of the main contributing variables towards perceived usefulness is the overall attitude towards such technology, as such attitude influences the behavioural intention to use a technology. Additionally, Hubona and Geitz (1997) state that the TAM asserts that the influence of external variables upon user behaviour is influenced by the user's beliefs and attitudes. Hence, the following hypothesis can be developed:

H6: The attitude towards virtual assistants has a positive effect on the perceived usefulness.

2.1.6.5 Quality of the virtual assistant

According to Davis' and Venkatesh extension of the original TAM (2000), one important factor for perceived usefulness is the output quality of such technology. In their research, (output) quality relates to the user's perception of how well the technology performs the intended task. Applying this to the field of virtual assistants, following hypothesis can be developed:

H7: The perceived quality of virtual assistants has a positive effect on the perceived usefulness of virtual assistants.

3. METHODOLOGY

This quantitative research aims to answer the following research question: **Do consumers perceive virtual assistants as useful in their customer journey? And how do external factors influence the perceived usefulness?**
To be able to answer this question, the overall opinion of respondents on the general topic of AI and more specifically virtual assistants needs to be known, their opinion concerning the use of AI technologies in the customer journey and their opinion on the usefulness of such technologies as well as their perception on the ease of use of such technologies as a contributor to the perceived usefulness.
This research will be conducted in the form of a survey to assess the perceived usefulness of virtual assistants along the customer journey that is already described under 2.1.6. To do so, insights from Hoyer et. al (2020), will be used as they assessed the most likely impact of the mentioned AI technologies along the three steps of the customer journey.
The nature of this research is quantitative as this research will be conducted through a survey, which will be analysed statistically to get insights into the perceived usefulness.

3.1 Research Design and Data Collection

The survey is designed by using a total number of 28 statements, which represent the variables 'Perceived Usefulness', 'Perceived ease of Use', 'Relevance for the task', 'Attitude towards technology' and 'Quality of the virtual assistant'.
All the used statements will be formulated using a 7-point Likert scale, reaching from 1 – strongly disagree to 7 - strongly agree. To ensure the reliability of this study, all variables will be assessed by at least three different statements each (see Table with Items). If necessary, a statement that was formulated negatively will be reverse coded. In practice that means that if an applicant answers a statement with a 7, meaning strongly agreeing, in the context of a negative statement, this would mean that the respondent actually means that he/she strongly disagrees with the proposed statement, which would have implications for the assessment of the specific variable that is covered by the statement. To avoid any interference with the statistical data, such a statement would be flipped in the analysis.
For the purpose of this study, all respondents were exposed to the same set of statements.
The necessary data was collected by sending the questionnaire to friends and family and also publishing on various websites and online platforms.

From this survey, a better understanding of the consumer's perception on the usefulness of virtual assistants will be gained, especially in regards to their opinion of the usefulness during the stages of the customer journey.

3.2 The Survey

The survey was created with the intention to get insights into the consumer's perception of virtual assistants usefulness. To get an overview of the respondent's demographics, questions concerning the age, gender and highest school degree are implemented in the study. Even though this data is included for descriptive purposes only, it might show interesting findings, relating to the perceived usefulness of virtual assistants for different age groups, gender categories and school degrees, which could potentially result in interesting topics for future research.

Generally, there are no restrictions on the participation in the study, meaning that people from every age group, ethnicity, employment status and gender can participate in the study.

3.3 Reliability

To determine the internal consistency of the variables, Chronbach's Alpha will be determined by the usage of SPSS. Here, it can be assumed that a higher sample size also almost always results in a higher reliability of the survey variables. As the sample size is bigger than 100, reliability can be expected to be above 0.7 for all variables. If the reliability of a variable turns out to be lower than 0,7, item(s) will be deleted from this variable to increase reliability. The results of the variable's reliability can be found in Section 4 (Results).

3.4 Validity

The validity of this research relates to the degree to which the survey respondents gave truthful answers to the statements that they are confronted with. Here, a high level of validity means that the findings of this study truly represent the concept that is assessed by this survey. The validity will be determined by using Pearson's R with the help of SPSS. Also, validity will be determined for each variable of the study. The results of the validity analysis can be found in section 4.

4. RESULTS

This study has been analyzed by the usage of the statistics program SPSS. All graphs, data and figures that are presented in this study are created in SPSS. Most relevant data can be found in the text, while some tables and figures might be located in the appendix.

In total, 193 responses were collected for the study. After removing inconsistent responses, about 160 respondents were left for every variable. Here, it should be mentioned that incomplete responses were coded as missing data when the data did not show any other inconsistencies in the responses.

4.1 Chronbach's Alpha

To ensure the statistical validity of the survey, Chronbach's Alpha needs to be determined for each variable. In this aspect, it should be mentioned that even though Section 2 mentions five variables (Perceived Usefulness, Perceived ease of use, Relevance for the task, Attitude towards technology and Quality of the virtual assistants), the variable relevance for the task was split into three distinct variables in the actual study, namely relevance for the task for the pre-transaction phase, the transaction phase and the post-transaction phase, which brings the actual number of variables for the analysis from five to seven.

To ensure that the variables are internally consistent, Chronbach's Alpha should be no lower than 0.7.

All the used statements have been formulated using a 7-point likert scale, where a 1 indicates a negative attitude towards virtual assistants while 7 indicates the opposite. In the study, there is one exception to this connotation, which is why one item was reverse coded.

4.1.1 Perceived Usefulness

For this, the Chronbach's Alpha for the variable 'Perceived Usefulness' was determined. The analysis showed that the Chronbach's Alpha for this variable is 0.938, indicating that the inter-item reliability is adequate. For this variable, no item had to be deleted.

4.1.2 Perceived Ease of Use

In terms of the variable 'perceived ease of use', the determined Chronbach's Alpha is 0.683, which indicates that the inter-item reliability of this variable is slightly inadequate. Here, it should be mentioned that the item 'I perceive interacting with virtual assistants as frustrating' had to be reverse coded, meaning that the values were flipped. Deleting this item from the variable would bring up the inter-item reliability to 0.733, which represents an adequate inter-item reliability. Hence, mentioned item was deleted.

4.1.3 Relevance for the task (Pre-transaction Phase)

This variable is the first of the three variables stemming from the original variable 'Relevance for the Task' that was split up into three distinct variables for the study. The inter-item reliability for this variable is 0.897, which represents an adequate inter-item reliability. For this variable, no item(s) had to be deleted.

4.1.4 Relevance for the task (Transaction Phase)

For this variable, Chronbach's Alpha is 0.875, which represents an adequate inter-item reliability. For this variable, no item(s) had to be deleted.

4.1.5 Relevance for the task (Post-transaction Phase)

For this variable, Chronbach's Alpha is 0.945, which also indicates an adequate inter-item reliability. Also, no item(s) had to be deleted from this variable.

4.1.6 Attitude towards technology

The variable 'Attitude towards technology' shows an inter-item reliability of 0.890, which also indicates that the inter-item reliability is adequate. For this variable, no item(s) had to be deleted.

4.1.7 Quality of the virtual assistant

For the last variable of this study, Chronbach's Alpha is 0.873, which also represents an adequate inter-item reliability. Also, no items were deleted from this variable. For this variable, deleting any item(s) would result in a lower reliability of the variable.

4.1.8 Conclusion on reliability

From the analysis of Chronbach's Alpha for the 7 variables in the study, it can be determined that 6 out of 7 variables show a high and adequate reliability, while one variable was initially below the threshold of 0.7. Deleting one item of that variable increased the reliability to 0.733, which is above the threshold, bringing all

variables to an adequate and sufficient result in terms of reliability. To avoid deleting items, future research could increase the number of items for this variable, as this will most likely increase the reliability of the variable significantly.

4.2 Regression, Correlation & ANOVA

In order to test the correlation and the regression for the dependent and independent variables of this study, the independent variables will be tested upon the dependent variable. As this study is centred around the consumer's perception of the usefulness of virtual assistants, the variable 'Perceived usefulness' will be seen as the dependent variable, while the other variables are seen as the independent variables. For the variable 'Relevance for the Task', an ANOVA analysis was performed, while the variable 'Perceived Usefulness' was analyzed solely by the use of descriptive statistics.

4.2.1 Perceived Usefulness

To assess the perceived usefulness, descriptives are created to get a broad overview of the consumer's perception of the perceived usefulness. In table 4, it can be seen that the respondents find virtual assistants as slightly useful, as the mean is on the positive side of the Likert scale. As the standard deviation shows by how much the respondents of the sample tend to differ from the mean, a standard deviation of 1.18892 with a mean of 4.7775 indicates that the responses are quite diverse, reaching from the negative spectrum of the scale (<4) to the higher positive end of the spectrum (>4).

Construct	Mean	Std. Deviation	Variance
Perceived Usefuless	4.7775	1.18892	1.414

Table 1: Statistics for the variable 'Perceived Usefulness'

4.2.2 Perceived Ease of Use

For the perceived ease of use, this variable is being tested as the independent variable towards the dependent variable 'perceived usefulness'. The accompanied hypothesis for this variable is the following:

H0: The perceived ease of use does not have a significant effect on the perceived usefulness of virtual assistants.
H1: The perceived ease of use has a positive effect on the perceived usefulness of virtual assistants

As presented in table 2, the statistical significance of the variable 'perceived ease of use' is equal to 0.000, which implies that the null hypothesis can be rejected, as this research assumes $\alpha = 0.05$ for statistical significance. This means that the consumers perception does have a significant effect on the consumers perception on the usefulness of virtual assistants.
Computing the correlation between the two variables, Pearson's Correlation Coefficient R results in R = 0.707, which states that there is a moderate positive relationship between these two variables. The squared correlation coefficient $R^2 = 0.497$ means that 49.7% of the regression model explains the variability of the measured responses. The standard error of the estimate 0.84 indicates a 16% accuracy in terms of predictions made with the regression line. The regression for these two variables is very steep, which is indicated by B = 0.767, which means that for every one unit increase in the independent variable, the dependent variable increases by 0.767.
Here, it can be concluded that a respondents perception of the virtual assistants ease of use significantly explains his/her perception towards the usefulness of virtual assistants in general.

Construct	B	Std. Error	Sig.	R	R^2
Perceived ease of use on the perceived usefulness	0.767	0.844	0.000*	0.705	0.491

*Significant at $p < 0.05$
Table 2: Statistics for the variable 'Perceived Ease of Use'

4.2.3 Attitude towards technology

For the attitude towards technology, this variable was used as the independent variable, while the perceived usefulness was treated as the dependent variable. Based on this, null hypothesis is the following:

H0: The respondents attitude towards virtual assistants does not have a positive effect on the consumer's perception of the virtual assistant's usefulness.
H1: The respondents attitude towards virtual assistants does have a positive effect on the consumer's perception of the virtual assistant's usefulness.

As presented in table 3, the statistical significance of the variable 'attitude towards technology' is equal to 0.000, which implies that the null hypothesis can be rejected, as this study assumes $\alpha = 0.05$ for statistical significance. Hence, the attitude towards the technology has a positive effect on the perceived usefulness of virtual assistants. Pearson's Correlation Coefficient of R = 0.754 indicates a moderately strong positive relationship between the two variables, which means that the better the attitude towards virtual assistants, the higher is also the perceived usefulness. The squared correlation value of 0.568 means that 56.8% of the regression model explains the variability of measured responses. The regression line for this variable is fairly steep with a value of B = 0.67, meaning that for every one unit increase in the attitude towards the technology, the perceived usefulness increases by 0.67. For this variable, the standard error is fairly high with a value of 0.78642, which means that the accuracy in terms of predictions made for the regression line is only about 22%.
To conclude, it can be said that an individual's attitude towards virtual assistants can significantly explain his/her perception of the virtual assistant's usefulness.

Construct	B	Std. Error	Sig.	R	R^2
Att. towards technology on the perceived usefulness	0.67	0.78642	0.000*	0.754	0.568

*Significant at $p < 0.05$
Table 3: Statistics for the variable 'Attitude towards technology'

4.2.4 Quality of the virtual assistant

For the variable 'quality of the virtual assistant', the perceived usefulness was aswell seen as the dependent variable, while quality of the virtual assistant was treated as the independent variable. The null hypothesis for this is the following:

H0: The quality of the virtual assistant does not have a positive effect on the consumer's perception of the virtual assistant's usefulness.
H1: The quality of the virtual assistant has a positive effect on the consumer's perception of the virtual assistant's usefulness.

As presented in table 4, the statistical significance is equal to 0.000, which implies that the null hypothesis can be rejected, as this research assumes $\alpha = 0.05$ for statistical significance. Pearson's Correlation Coefficient of 0.723 indicates a moderate positive relationship between the two variables. The squared correlation coefficient of 0.522 means that 52.2% of the regression model explains the variability of measured responses. The regression line for this relationship is fairly steep with B = 0.684, which indicates that for every one unit increase in the perception of the quality of the virtual assistants, the perceived usefulness increases by 0.684. In terms of standard error, the results show a high value of 0.8266, which means that the accuracy of predictions made for the regression line was only about 17.4%.
To conclude, it can be said that the quality of the virtual assistant can significantly explain his/her perception of the usefulness of the virtual assistant.

Construct	B	Std. Error	Sig.	R	R^2
Qual. of virtual assistant on the perceived usefulness	0.684	0.8266	0.000*	0.723	0.522

*Significant at $p < 0.05$
Table 4: Statistics for the variable 'Quality of the virtual assistant'

4.2.5 Relevance for the Task

To assess the variable 'Relevance for the Task', a different test as opposed to the other variables had to be conducted, which is due to the nature of the hypothesis that were posed for this variable. Hence, instead of a linear regression analysis, an ANOVA test is being conducted, which allows for comparison between the groups in this variable (Pre-Transaction Stage, Transaction Stage, Post-Transaction Stage). Even though those three stages are treated as different variables in the section about the validity (4.1) and in the survey itself, those three variables are treated as one in this part of the analysis. The null hypothesis for the ANOVA test is the following:

H0: There is no difference in the perceived usefulness among the different stages.

H1: There is a significant difference in the perceived usefulness among the different stages.

In table 5, it can be seen that the statistical significance is equal to 0.000, which implies that the null hypothesis can be rejected, as this research assumes $\alpha = 0.05$ for statistical significance. Hence, it can be said that there are significant differences among the means for the different stages of the customer journey. As also demonstrated in the table, the mean for the transaction phase is the highest mean among the 3 categories that were tested in the ANOVA, which leads to the assumption that respondents find virtual assistants as most useful in the Transaction phase, followed by the Post-Transaction phase and the Pre-Transaction phase. This result contradicts with the assumptions made by Hoyer et al. (2020), stating that virtual assistants most likely have the highest impact in the pre-transaction and the transaction phase, while the impact in the post-transaction phase was seen as low.

Construct	F	Mean	Std. Deviation	Sig.
Relevance for the task	13.372	4.521	1.42670	0.000*
Pre-Transaction	/	4.2176	1.32115	/
Transaction	/	4.9771	1.26398	/
Post-Transaction	/	4.3771	1.57154	/

*Significant at $p < 0.05$

Table 5: Statistics for the variable 'Relevance for the task'

To see what stages are significantly different from each other, a post-hoc analysis (Scheffe test) is being performed. This test does not only allow to see whether there are significant differences between the groups, but also between which groups significant differences occur. The hypotheses were the following:

H2: Virtual assistants are perceived as most useful in the pre-transaction phase and transaction phase.
H3: Virtual assistants are perceived as more useful in the pre-transaction phase than in the post-transaction phase.
H4: Virtual assistants are perceived as more useful in the transaction phase than in the post-transaction phase.

In table 6, the results of the Scheffe test can be found. Looking at the results, it becomes clear that there are significant differences between the Pre-Transaction and the Transaction stage and the Transaction stage and the Post-Transaction stage as the corresponding significance levels are below 0.5, which represents statistical significance. No significant differences were found between the Pre- and Post-Transaction Stage, as the corresponding significance levels are higher than 0.5. Looking at the mean for each stage (table 5), the Transaction stage has the highest mean with a value of 4.9771, while the Pre-Transaction stage and the Post-Transaction stage have a mean of 4.2176 and 4.3771, respectively. Hence, it can be said that virtual assistants are perceived as significantly more useful in the Transaction stage than in the other stages, while there is no significant difference in the perceived usefulness of virtual assistants in the Pre- and Post-Transaction Stage.
Based on this result, the second hypothesis that virtual assistants are perceived as most useful in the Pre-Transaction Phase and Post-Transaction Phase is only partially supported, as the results showed that virtual assistants are perceived as significantly more useful in the Transaction Phase, but not in the Pre-Transaction Phase.
The third hypothesis turns out not to be supported, as there are no significant differences in the usefulness of virtual assistants in the Pre- and Post-Transaction Phase.
The last hypothesis turned out to be supported, as the Scheffe analysis showed that virtual assistants are perceived as significantly more useful in the Transaction Phase than in the Post-Transaction Phase.

Stage	Stage	Std. Error	Sig.
Pre-Transaction	Transaction	0.15507	0.000*
Pre-Transaction	Post-Transaction	0.15532	0.614*

Transaction	Post-Transaction	0.15580	0.001*

*Significant at $p < 0.05$

Table 6: Results of the Scheffe Test

5. DISCUSSION & CONCLUSION

The aim of this research was to assess the consumer's perception of the usefulness of virtual assistants, as well as determining the variables that significantly contribute to this perception, while also assessing the stage in the customer journey that consumers find as most useful for virtual assistants. To do so, the proposed relationships between the variables and in-between the stages of the customer journey were put into seven distinct hypotheses. Based on these hypotheses, a survey was created with a total of 28 items. In general, the following research question was supposed to be answered:

Do consumers perceive virtual assistants as useful in their customer journey? And how do external variables influence the perceived usefulness?

After conducting statistical tests, some interesting results were found.

In terms of reliability, all variables besides the variable 'Perceived Ease of Use' showed a very high inter-item reliability with the items of the initial survey. For the variable 'Perceived Ease of Use', one item was deleted from the dataset, which pushed the inter-item reliability for this variable above the minimum threshold of 0.7. This result is overall very satisfactory, as it ensures that the proposed items measure the construct that they are supposed to measure.

The analysis of the study showed that all proposed external variables do show a positive relationship with the perceived usefulness of virtual assistants. In more detail, the perceived ease of use does have a positive effect on the perceived usefulness of virtual assistants. Hence, it can be said that someone who perceives virtual assistants as easy to use also perceives the usefulness of virtual assistants as higher. Based on this, the hypothesis that the perceived ease of use does have a positive effect on the perceived usefulness turns out to be supported (H1). The next hypothesis (H6) which relates to the attitude towards virtual assistants and its effect on the perceived usefulness also turned out to be supported, as this study showed that the attitude towards the technology does indeed have a positive impact on the perceived usefulness. Also, the quality of the virtual assistant does have a significant positive impact on the respondent's perception of the usefulness of virtual assistants, which is why the proposed hypothesis for the relationship between these two variables also turned out to be supported (H7). To conclude, it can be said that a higher quality of virtual assistants, a higher perceived ease of use of virtual assistants and a better attitude towards virtual assistants increase the perceived usefulness of virtual assistants.

The hypothesis on the different perceived usefulness for the different stages of the customer journey turned out to be supported as well, as the ANOVA analysis showed that there are significant differences in the perceived usefulness of virtual assistants across the different stages of the customer journey (H5). Here, it was also found that virtual assistants are perceived as significantly more useful in the Transaction stage than in the two other stages, which results in the fact that H2 is only partially supported. H3 turned out not to be supported, as virtual assistants are not perceived as more useful in the Pre-Transaction Phase than in the Post-Transaction Phase. H4 turned out to be supported, as virtual assistants are perceived as significantly more useful in the Transaction Phase than in the Post-Transaction Phase. In terms of the descriptives of the variable 'Perceived Usefulness', the results indicated that virtual assistants are perceived as moderately useful, even though the standard deviation showed that the respondents are quite diverse, reaching to both sides of the spectrum.

From a business perspective, this research could have some interesting implications. The descriptives on the variable 'Perceived Usefulness' showed that the perceived usefulness of virtual assistants is in reality quite diverse. As the customer's perception of the usefulness of the virtual assistants hence also reaches into the spectrum of a perceived unusefulness of virtual assistants, those customers might show a higher reluctance to purchase or communicate if all customer communication takes place via virtual assistants. Also, the fact that the perceived ease of use and the quality of the virtual assistant have a positive effect on the perceived usefulness of virtual assistants stresses the fact that if a company uses virtual assistants for customer communication, those virtual assistants should be very easy to use and be of high quality in terms of the output that the virtual assistants generate, to ensure that customer satisfaction is high, and that the customers also get the same output they would get from an inter-human communication. Theoretically, as this research established, businesses should focus on implementing virtual assistants in the Transaction stage of the customer journey, as the perceived usefulness was found to be significantly higher than in the Pre- and Post-Transaction stage. Nonetheless, this does not imply that businesses should rely on the usage of virtual assistants in the Transaction Phase solely, as virtual assistants are also of value in the other two stages of the customer journey, for example in terms of customer consultation.

6. LIMITATIONS

As in every other research, this study also comes with limitations. One limitation is that a relatively large portion of responses were incomplete, meaning that only partial data was recorded. This resulted in some variables having a different number of responses. Another limitation of this study is that the study framework is mostly based on Davis' (1989) work on the Technology Acceptance Model, which sees the perceived usefulness as one of the main contributors to technology acceptance at the workplace. Also, the used variables consist mostly of the by Davis and Venkatesh (2001) determined main contributing factors to the TAM. In their model, they see the relevance, quality, and subjective norm (Attitude) as one of the main contributing factors to the perceived usefulness of a technology. Another limitation of this study is the limited number of variables that was used. In this aspect, including more variables to determine the perceived usefulness of virtual assistants might deliver a clearer picture and could potentially describe the perceived usefulness of virtual assistants more precisely.

7. FUTURE RESEARCH

For the future, research might be conducted in the field of perceived usefulness of other AI technologies. While this research only focused on the perceived usefulness of virtual assistants, interesting other topics might be centered around the perceived usefulness of RFID tags or even VR glasses in a commercialized setting. Also, in terms of virtual assistants, future research might take place on the topic of anthropomorphizing to determine the human-like attributes that virtual assistants should possess Additionally, future research could dive deeper into this topic by assessing the moderator effects of age, gender, and heritage.

8. ACKNOWLEDGEMENTS

First and foremost, I would like to thank my first supervisor, Dr. Carolina Herrando, for the support that she has given me throughout this whole thesis project. Her crucial feedback and help allowed me to conduct this research and to develop this thesis in the best way possible, even though all communication took place via email and Online Meetings. Similarly, I want to thank Dr. Efthymios Constantinides for n being the second supervisor in this thesis project. Also, I would like to thank my family and friends for the endless support throughout this project. Finally, I want to thank all the survey participants for taking part in this research. Your help is very much appreciated and contributed significantly to the creation and success of this research.

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10. APPENDIX

10.1 Questions on Demographics

What is your age?

- 18-24 (77.2%)
- 25-34 (16.6%)
- 35-44 (1.9%)
- 45 and above (4.4%)

What gender do you identify most with?

- Male (38.6%)
- Female (60.1%)
- Other (0.6%)
- Don't want to say (0.6%)

What is your highest qualification?

- Less than a high school diploma (3.2%)
- high school diploma or equivalent degree (48.1%)
- no degree (1.3%)
- Bachelor's degree (32.9%)
- Master's degree (13.9%)
- PhD (0.6%)

What is your current employment status?

- Full-time employment (11.4%)
- part-time employment (9.5%)
- Student (76.6%)
- Retired (0.6%)
- Unemployed (1.9%)

What would best describe you?

- European (80.4%)
- African (3.2%)
- Asian (11.4%)
- Native American (0.0%)
- Other (5.1%)

10.2 Survey Items

Perceived Usefulness	S1: I think that using virtual assistants saves me time. S2: I think that using virtual assistants improves the quality of the time I spent on the website. S3: I find virtual assistants useful. S4: Using virtual assistants would enhance my effectiveness on the website. S5: Using virtual assistants would allow me to accomplish the task (e.g. purchasing a product) on the website quicker. S6: Using virtual assistants makes accomplishing the task easier.
Perceived ease of use	S7: I think that using virtual assistants is very easy. S8: I perceive interacting with virtual assistants as frustrating. (DELETED) S9: I perceive virtual assistants as flexible. S10: I perceive the interaction with the virtual assistants as easy to understand.
Relevance for the task (Pre-Transaction)	S11: I think that using a virtual assistant is useful in helping me with my decision before I make a purchase. S12: I think that using a virtual assistant to make my decision is really helpful. S13: In the pre-purchase phase, I perceive virtual assistants as important.

	S14: In the pre-purchase phase, I perceive virtual assistants as relevant.
Relevance for the task (Transaction)	S15: In the purchasing stage, I perceive virtual assistants as important. S16: In the transaction phase, I perceive virtual assistants as relevant. S17: While purchasing a product, I perceive virtual assistants as useful.
Relevance for the task (Post-Transaction)	S18: I perceive virtual assistants as relevant in the post-transaction phase (e.g. after purchasing a product) S19: I perceive virtual assistants as important in the post-transaction phase. S20: I perceive virtual assistants as useful in the post-transaction phase.
Attitude towards technology	S21: If available, I tend to make use of virtual assistants. S22: If a virtual assistant appears (like a chatbot), I generally make use of it.
	S23: I make use of virtual assistants, when possible. S24: I think that virtual assistants can provide helpful guidance. S25: I make use of chatbots because I like to interact with them.
Quality of the virtual assistant	S26: I perceive the output of virtual assistants as useful and adequate. S27: I perceive the communication with a virtual assistant as one of high quality. S28: Generally, I think that virtual assistants give me the output that I need to accomplish a specific task.