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A conceptual comparative approach on personal AI assistants and external service robots

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Abstract. *In the past years artificial intelligence (AI) has become an important subject for both companies and consumer due to the growth of personal AI assistants and external service robots. It is clear that many aspects of our life are not like they used to be. The fact that every one of us is sooner or later going to incorporate various AI functions in daily routine activities becomes somehow certain. It is not only our home-life that is transforming, but also the way we, as consumers, are going to interact with different product and service providers. In this paper we provide a comparative literature review on the challenges and research topics regarding personal AI assistants and external service robots. While the personal AI assistants intervene more in the private sphere of the consumer, the relation to the external service robots is more distant. The results of our literature review show that the relation between consumer and external service robot is more characterized by interaction, enjoyment and engagement, it is expected to have a para-social friendship relation between consumer and personal AI assistants. Taking this difference of perspective the two types of AI will be differently involved in the future business and marketing activities of companies.*

Keywords: artificial intelligence, personal AI assistant, service robot, consumer, human-AI-interaction.

Introduction

In today's world, probably the most exciting technology from which most companies are expecting to gain competitive advantage when implementing it, is artificial intelligence (AI). This allows the automation of the processes, predictive maintenance, logistics optimization as well as it helps businesses and consumers in decision-making (Zimmermann et al., 2020). We use the artificial intelligence and intelligent virtual assistants on a daily basis, and we think we know and we perfectly understand what it is but actually, only few people know exactly what this stands for. According to a global survey done by Pegasystem, a leader in customer engagement software, 72% of the people surveyed said they know what artificial intelligence is but when they were asked to describe what artificial intelligence can do, almost half of them didn't understand that the solutions of artificial intelligence allow machines to learn new things and fewer don't know it can understand speech, solve problems or feel emotion (Pegasystem, 2022). Basically, artificial intelligence refers to solutions which are automatically generated from previous effective cases and solution elements coming from causal inference structures such as ontologies and rules, but also the learning solutions

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based on data analysis with machine learning and deep learning with neural networks (Zimmermann et al., 2020). The pioneer of AI research is Alan Turing (1950) who introduced for the first time in the ’50 the question of whether machines can think as human and for this, he proposed a scenario to test this question, which nowadays is known as the Turing test (Rzepka & Berger, 2018).

There is currently no uniform scientific or generally agreed definition of the term AI, although it is considered to be of significant importance (Haenlein & Kaplan, 2019). Several definitions have been proposed so far as for instance the science of making machines that do things that require human intelligence (Stonier, 1992) or the science and engineering of making intelligent machines (McCarthy, 2005). It is primarily about the ability of machines to show 'intelligent' behavior. To date, this has not been achieved to the full extent desired at the time (Huang et al., 2021; McLeay et al., 2021). In this regard, it is important for researchers to keep AI advancements under observation and thus constantly keep track of the fields and forms AI is emerging into.

Nowadays, the biggest challenge for companies is the strong consumer’s preference for human interaction. People still prefer calling a human service agent instead of talking online with a chatbot when they have to solve a problem because consumers are not comfortable with the idea of giving their personal data such as location, phone number or name to a machine just to get better customer service. They also consider chatbots doing a poor job and in these conditions, AI transparency is critical for companies to gain consumer trust (Pegasystem, 2020). In other words, the technologies success can be more easily predicted by developers and afterwards implemented by companies, if they understand and know what consumers want from AI and in the same time, if consumers understand the benefits of using AI in everyday life they will accept and embrace this new technology.

One big debate in this sense is the relationship between consumer and AI and the positioning of the AI within the private sphere of the consumer. At the time being consumers and AI interact in different situation and contexts. On one hand there are personal AI assistants (like Alexa from Amazon) which are accommodated at the consumers’ home having accesses to different private information or smart-phone intelligent assistants, which accompany the users all day long and have accessed to the private life of the consumer. On the other hand there are external service robots, which interact with the consumer at the point of sale of the service acquired. In this case the external robot has less access to the private information of the consumer and the relation is more formal as in the case of the service employee. In this paper, we give a conceptual overview on the two types of AI. Because of the different relational distances (informal and formal) between consumer and AI, it is expected to have different research questions for understanding the relation between human and AI.

Literature review

Research topics on personal AI assistants

There are numerous AI technologies available to consumers but some of the most popular ones are personal AI assistants. Personal AI assistants are defined in many ways depending on the adopted perspective. They are a sum of hardware and software subsystems that influence in a particular way the interaction between users and the AI and they are continuously evolving based on the exchanged information. According to Hoy (2018), personal AI (artificial intelligence) assistants are software agents that run on a purpose-built speaker or smartphone device. They use natural language and machine learning to understand and translate the user’s language. They are able to provide a response in real time, following a conversation and they help people accomplish tasks by

facilitating the interaction in a natural and intuitive way (Hoy, 2018). In addition to this, they assist consumer with the search of information and decisional process through natural language in written or spoken form (Ki et al., 2020).

Even researchers started paying more attention to this field in recent years, this subject has been studied since the '50 by Alan Turing (1950). The first virtual assistant, named Eliza, appeared in 1966 (Weizenbaum, 1966) and it was used in psychotherapy by interacting with people and by asking different questions (Chaix, 2018). Nowadays, personal AI assistants can provide more complex responses to users and they can do more complex tasks such as face, voice and biometric recognition, due to technology development. The most popular personal AI assistants nowadays are Apple's Siri, Amazon's Echo (Alexa), Microsoft's Cortana or Google's Google Assistant (McLean et al. 2021) and there is a real interest in exploiting these technologies to interest more and more people to access and use them (Chaix, 2018).

Consumers' interactions with personal AI assistants are an important field of research given the fact that for the moment the relation between consumer and AI is not fully explained and besides there is a rapid expansion of this technology with major implications for the business environment (McLean & Osei-Frimpong, 2019). Over the years, intelligent personal assistants have been studied from different perspectives, from virtual assistant characteristics that influence consumers' perception and attitude, to consumer preferences toward the personal AI assistant and its characteristics. With reference to personal AI assistants' characteristics, the usefulness, perceived ease of use, the help to complete tasks efficiently are one of the several characteristics that make individuals accept and use this technology (McLean & Osei-Frimpong, 2019). Consumers acknowledge AI assistants as a novelty and innovative thing in their lives and they use them in order to satisfy their curiosity and to enjoy the communication with them (Fryer et al., 2017) According to McLean and Osei-Frimpong (2019) personal AI assistants motivate users by its utilitarian, symbolic and social benefits. Anthropomorphism and affinity of personal virtual assistants represent another significant characteristic for AI consumers (Yuan et al., 2022).

Research reflects that the interaction process between humans and AI assistants is also defined by the developing process of virtual friendship. The way that AI offer human beings characteristics like enjoyability, understanding and involvement will lead to the perception of social support from the AI and establish a para-friendship relation (Ki et al., 2020; Huang & Rust 2020). Studies reveal that self-disclosure and social support represent two important characteristics in the relation between AI and humans. The stronger these aspects are defined in the relationship, the more people intend to continue to use their personal AI assistant (Ki et al., 2020). The more AI assistants are perceived as a real person, the more will the consumers be willing to provide their personal data, reveal and share their thoughts and feelings with them (Ki et al., 2020; Stanescu et al., 2021). Another aspect taken into consideration for the use of AI assistants, is determined by the user perceptions of its human like features. This perception is established by the AIs' characteristics as well as the data collected in the interaction with the human (Yuan et al., 2022). Research results show that the higher the level of social anxiety at human beings is, the stronger the positive influence of the anthropomorphic features of AI assistant are on the hedonic value and on the responsiveness and compatibility towards its utilitarian value (Yuan et al., 2022). A major impact on interaction between individuals and voice personal assistants is represented by the used voices. With the exception of Siri (voice assistant developed by Apple) which offers an alternative male voice, most of the other voice assistants are operated by a female voice. Reports reveals the fact that a female voice is preferred by both male and female (Loideain & Adams, 2020). Furthermore, this subject can lead to studies about voice evolution and the gendering of the AI

assistants. The adoption of female names (Siri, Alexa, Cortana) usually leads to connotations and female stereotyped characterization (Loideain & Adams, 2020).

Research topics on external service robots

Smart technologies accompanied by various AI technologies are transforming frontline employee-customer interactions at an unprecedented level (Grewal et al., 2020; Lariviere et al., 2017; van Doorn et al., 2017). Introducing the so-called service robots, service encounters are experiencing a radical change, whereas the trend set by AI starts to become more and more clear (Mende et al., 2019; van Pinxteren et al., 2019).

Just like the previously described personal assistants, service robots are also advanced technological innovations (McLeay et al., 2021). Service robots are also autonomous machines (physically present), or interfaces (virtual) (Wirtz et al., 2018) programmed to communicate and interact with people, but moreover, they also deliver certain services to consumers (Wirtz et al., 2018; Lu et al., 2020). With the help of embedded AI technologies, service robots possess decision making abilities and function with the help of self-learning and improving skills (Pagallo, 2013), similar to human behavior. This is especially important for service robots, as their role and scope vigorously involve deliberate engagement with consumers in various service-related sectors (Ivanov et al., 2019; Shin & Jeong, 2020). Apart from the simple delivery of automated tasks, service robots engage both socially and emotionally, as well as functionally in diverse relationships with consumers and are starting to become an important and trusted part of the consumers' journey and enhanced service experience (Wirtz et al., 2018; Pelau et al., 2021; Seo, 2022).

Service robots appear to become more and more active and thus partially (by accompanying employees' performance) or fully (by solitary performing certain complex tasks) pursue activities of human frontline employees in the service sector (Wirtz et al., 2018; Grewal et al., 2020; Chang & Kim, 2022). Depending on their level and manner of engagement with the consumers, service robots can be perceived as functional service robots – only performing cognitive or physical tasks in order to improve service efficiency or as social service robots – whereas they can to a limited extent engage socially and emotionally with consumers and play an active role in building a strong relationship (Wirtz et al., 2018; Grewal et al., 2020; Chang & Kim, 2022). With such human-like incorporated features today's description of service robots goes beyond traditional self-service applications and technologies, as service robots are able to engage in interactive and enjoyable frontline encounters with consumers (Gursoy et al., 2019; Fuentes-Moraleda et al., 2020; Shin and Jeong, 2020).

According to Liu et al. (2022), previous studies have researched the factors influencing service robot adoption from three main viewpoints: robot characteristics, customer characteristic and robot – customer interaction. These perspectives offer important insights into various situations, and it is therefore in scope of the present literature review to bring to discussion recent researched themes on this topic.

With regard to robot characteristics, general appearance is an obvious topic, as it can influence consumers' perception and evaluation of service robots (Liu et al., 2022). For example, humanoid attributes, such as a head with facial expressions or hands with thumbs are attributed to a more competent service robot, than mechanoid robots lacking human-like looks (Zhu & Chang, 2020). Moreover, service robots are often programmed with an own gender identity and appearance, which calls for association with well-known existing social stereotypes (Tay et al., 2014; Seo, 2022). Furthermore, friendly features attributed to the appearance of a service robot are

proven to milden the negative consumer reactions towards service robot lack of success in achieving the desired result (Lv et al., 2021).

As one may expect in the service sector, consumers preferences toward service robots are also context dependent, not only appearance related (Liu et al., 2022). In this regard, consumers demand a competent service robot in utilitarian service contexts, whereas they are open to using a warm, yet not so competent service robot in hedonic service encounters (Choi et al., 2021, Park et al., 2021; Liu et al., 2022). This, according to further research also depends on the type of relationship a service provider wishes to develop with its customers. Chang and Kim (2022) differentiate here between communal relationships that are nurtured by warm service robots and exchange relationships in which a functional service robot is desired to complete the task and achieve better customer satisfaction with the provided service.

There are countless aspects that can influence consumers' attitudes toward service robots and AI in general. Adoption and acceptance of service robots represent streams of research, still at infancy often remains at a conceptual level, while further exploring needs to be done in order to embrace service robots in service encounters and offer accurate guidance for practitioners (Fernandes und Oliveira, 2021; Chang & Kim 2022). There are only few extensively formulated tested acceptance models, most of them based on existing theories of technology acceptance. In this regard, Wirtz et al. (2018) extended the classic Technology Accepance Model (TAM) by Davis et al. (1989) with social-emotional and relational variables and developed the Service Robot Acceptance Model (sRAM) to explore consumers' perceptions, beliefs, and behavioral intentions towards robot-delivered services. Gursoy et al. (2019) proposed the Artificially Intelligent Device Use Acceptance (AIDUA) model, highlighting the fact that consumers go through a multi-stage decision-making process for accepting AI devices during service interactions, ideas inspired from the Cognitive Appraisal Theory (Lazarus, 1991) and Cognitive Dissonance Theory (Festinger, 1962). Thus, they highlight that many of the previously tested variables from the classical technology acceptance models do not apply in the AI environment and emphasize the need to introduce new latent variables (e.g. the often mentioned anthropomorphism). Furthermore, Lu et al. (2019) developed a measurement scale, the Service Robot Integration Willingness Scale, to assess consumer willingness regarding the use of AI robots in service transactions.

Much attention was paid to antecedents of consumer acceptance of service robots, in accordance to service robot's characteristics and the relationship evolving from such interactions (Qiu et al., 2020; Ho et al., 2020; Wirtz et al., 2018; Seo 2022). The main point we want to underline is that, although some theories have been adapted to explain the adoption and acceptance of service robots by consumers, this has not been fully or is only industry-limited researched, being mainly based on historical or existing (mechanical) applications of AI. However, little research has been conducted on the potential acceptance of intuitive or empathic service robots that are starting to be widely adopted in various industries.

Conclusion regarding the theoretical results and challenges for future research

The literature review presented above gives an overview on the main challenges and perspectives on personal AI assistants and external service robots. The acceptance of both types of AI are analyzed from the perspective of the characteristics of the AI, the characteristics of the consumer and the relation between the consumer and the AI. Several similarities can be observed regarding the analysis and impact of the characteristics of AI and consumer. However the big difference can be observed for the relation between the consumer and AI. For external service robots the main expectations regarding the relation between consumer and AI are characterized by interaction

enjoyment and engagement, while for the personal AI assistants the expectation is to have a para-social friendship between consumer and AI. This difference is somehow natural as the relation of the consumer to the AI assistant is more personal in comparison to an external service robot. The personal AI assistant accompanies the human consumer all day long, having a continuous, familiar relation, while the interaction with the external service robot is discontinuous and more formal, as it occurs only when the consumer needs the offered service. For future research it is interesting to analyze if this personal relation to AI assistants is perceived in a different way to a social relation to an external service robots and in how far it impacts the acceptance, trust and data sharing with the AI. While the external service robot replaces a human service employee but remains outside the private sphere of the consumer, the personal AI intervenes in the private area of the consumer impacting its decisions. The expectation of the consumer regarding its private sphere in the relation to the AI, will have major implications for business and marketing, as the two types of robots will have different roles in the relation to the consumer. Consequently it is important to determine how personal an AI assistant is and what the social rules are for the interaction with a service robot in order to optimize this relation.

The emerging transformation of service encounters with the help of AI and the implementation of personal AI assistants has clearly innovated the customer-service interactions (Wirtz et al., 2018; McLeay et al., 2021), while the Covid-19 pandemic has facilitated and increased implementation rate of service robots and AI assistants , as the demand for contactless interactions and online services has emerged in order to reduce the spread of the virus (Christou et al., 2020; Seyitoğlu & Ivanov, 2021; Kim et al., 2021; Liu et al., 2022). However, there is a clear difference between cultures, when assessing the adoption rate of service robots. While in Europe, for instance, one may not have yet interacted, seen or heard of the above described service robots, in Asian cultures, service robots are already predominant (Belanche et al., 2020) and have taken up serious tasks such as: serving coffee, preparing meals, greeting and assisting hotel guests, doing housekeeping (Fernandes & Oliveira, 2020; Lu et al., 2019). But it is only a matter of time until service robots mark their presence stronger world-wide.

At this point it is also worth mentioning that most of the research is still conceptual, using the method of hypothetical scenarios (Huang et al., 2021), with only few qualitative studies based on online reviews of real-life human-robot interactions (Tung & Au, 2018; Fuentes-Moraleda et al., 2020; McLeay et al., 2021). Moreover, when conducting research on the interaction between consumer and service robots, there seems to be a focus on the hospitality and tourism sector, as this industry holds huge application potential for service robot implementation as well as offers a variety of interaction contexts between consumers and service robots (Wirtz et al., 2018; Lin and Mattila, 2021; Liu et al., 2022).

A strong characteristic of human beings is represented by the ability to evolve and to adapt at new environmental requirements. This characteristic involves the fact that individuals' needs will be in a continuous process of changing and how personal virtual assistants will meet these needs will be a permanently subject of study. Moreover, these concepts are strengthened by the fact that machine learning andf neuro-linguistic programming (NLP) are also in a continuous growing process, fact that will lead to a continuously updating process of the technology which stands behind the interaction between human beings and personal virtual assistants. Future research could explore the unique way of evolution of voice assistants based on adoption and use of new future technology.

Given the evolving technological environment and the continuous changes, more and more economy sectors will be keen to adopt personal AI assistants and future research should focus on new business model development and analyzing consumer behaviors.

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