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Investigating how systemic and heuristic factors affect consumers' acceptance towards the use of social robots during Covid-19. Evidence from the hospitality industry

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Framing of the research. *Artificial intelligence (AI), conceived as a series of technologies that enable a system to perceive, understand, react, and learn (Bowen and Morosan, 2018), is playing an increasingly important role in the tourism and hospitality industry (Nam et al., 2020). It not only allows automation but also empowers machines to demonstrate mechanical, analytical, intuitive, and empathetic intelligence (Huang and Rust, 2018).*

In a hedonic and high-human touch context, such as the hospitality industry, enhancing customers' service experiences will increasingly entail technology infusion, which is defined as the incorporation by service organizations of technological elements into the customer's frontline experience (van Doorn et al., 2017). In particular, customer service and, in general, the global experience, is a focal aspect in the hospitality industry, with hotels often living and dying according to their capacity of interacting with and satisfying their customers. With AI, there are different possibilities to improve this aspect, ranging from increased personalisation to tailored recommendations. In this optic, social robots, defined as systems that function as programmable tools that can sense, think and act can enhance human productivity and/or engage in social interactions (Bartneck and Forlizzi, 2004). To neutralize customers' need for high-human touch and the industry trend of being high-tech, AI social robots, capable to follow human's behavioral norms and directly interact with humans, have become the most competitive candidate to deliver high-human touch services in a rapidly changing service delivery environment (Chi et al., 2020). AI social robots, as service employees, can provide high-quality personalized and customized services by directly interacting with customers (West, 2018). For example, Connie, the robotic concierge adopted by Hilton Worldwide Hotel, can provide customers with personalized care and support, such as giving real-time recommendations and answering customer queries (Bellini and Convert, 2016); Pepper is a 1.2-m-tall wheeled humanoid robot capable of exhibiting body language, perceiving and interacting with its surroundings and moving around (Henkel et al., 2020).

Despite the advantages of AI social robot technology in service delivery, previous studies have suggested that not all customers are likely to interact with AI robots and accept the services provided by these devices (Chi et al., 2020; Gursoy et al., 2019). More precisely, some scholars have argued that the AI robotic technology used by hospitality firms can alter customers' evaluation and acceptance of hospitality services (Gursoy et al, 2019; Lu et al., 2019). Previous studies have suggested that AI devices' perceived intelligence may impact hospitality customers' intention to use these technologies (Tussyadiah and Park, 2018). Furthermore, Lu et al. (2019) argued that customers' willingness to use AI social robots depends on customers' perception of social robots' performance efficacy, customers' intrinsic motivations, anthropomorphism, social influences, customers' emotions and facilitating conditions. Specifically, if on the one hand, the adoption of AI social robots may improve customers' perception of service quality and performance (Zalama et al., 2014), resulting in higher willingness to use these technologies in hospitality services, on the other hand, the lack of social interaction caused by using AI social robots may lead customers to feel isolated, determining some difficulties in accepting the use of these AI technologies (Murphy et al., 2017).

Considering the co-existence of both acceptance and objection towards the use of AI social robots, Lin et al. (2019) suggested the framework of Artificially Intelligent Device Use Acceptance (AIDUA). They have proved that the customers' willingness to accept or reject the use of AI devices is determined by six factors that are: social influence, hedonic motivation, anthropomorphism, performance expectancy, effort expectancy, and emotion.

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The AIDUA model was tested in a general service setting and provided theoretical and conceptual implications. Then, it was also developed in the hospitality service setting, where customers seem to have higher hedonic benefit expectations (Lin et al., 2019).

Purpose of the paper. *Based on the framing of the research and considering that the growing implementation of social robots in the hospitality industry requires broader research into customers' experience with social robots, this study aims to validate and extend the applicability of AIDUA model in explaining customers' AI social robots acceptance in the hospitality industry. In such a context, the Covid-19 crisis offers a futuristic perspective on the changing role of service since it acts as a major disruptive factor for service consumers. While many services are provided remotely, some are suspended entirely (Hall et al., 2020). For those services that consumers and providers are can co-create physically (such as those ones related to the hospitality setting), social distance is the first priority (Bove & Benoit, 2020). Thus, a rapid adoption of AI social devices may be a direct consequence. Before the Coronavirus, hospitality companies were skeptical about the use of social robots since human touch is considered a core competency in the hotel industry (Choi et al., 2020). For example, interviews conducted by Ivanov et al. (2020) with Bulgarian hotel managers revealed their wariness of deterioration in service quality as a result of robot deployment. In their study, Choi et al. (2020) performed an experiment in a hotel context to compare guest perceptions of the service provided by human staff, service robots, and a combination of both. Their study revealed that human staff was preferred by the customers with respect to interaction quality and physical service environment. Due to the rapid development of AI technologies, these robots are expected to emulate humans with much greater fidelity and will be able to exhibit hospitality skills such as being courteous and helpful. During the pandemic, Kim et al. (2021) observed that customers were highly concerned about the risk of infection when staying in human-serviced hotels due to high levels of interpersonal contact. Therefore, many were willing to explore safer options, such as robot-staffed hotels.*

On this basis, some research questions have been formulated:

1. *What are the antecedents of customers' acceptance or rejection towards the use of social robots during service provision in the hospitality industry?*
2. *How do both heuristic and systemic factors affect the customers' willingness to use social robots in the hospitality industry?*
3. *What is the effect of Covid-19 on customers' attitudes towards social robots and have these attitudes reversed in the new "robotics society"?*

To address these research questions, this study develops a modified AIDUA model to explain and predict customers' intention to use AI social robots, also considering the effects generated by the pandemic on travel experience expectations (Gursoy and Chi, 2020).

The model first considers heuristic factors, such as social influence and hedonic motivation.

Adapted from the AIDUA model, social influence, hedonic motivation (Chi et al., 2022; Gursoy et al. 2019; Venkatesh et al., 2012) and trust in AI (Lippert and Davis, 2006) are proposed as important determinants of the outcome of the primary evaluation of the use of AI devices.

Social influence

According to Venkatesh et al. (2012), the social influence is the extent to which the social context can influence the consumer's perception of the value in use of a specific technology. As for AI social robots, social influence refers to the degree to which an individual's social groups (e.g., friends, co-workers, family, social networks, and opinionated leaders) believe that using AI social robots is relevant and congruent to their group norms. As a result, customers may create their attitudes toward the usage of AI social robots based on the attitudes of their social groups (Maruping et al., 2017). Social influence has an invaluable role in determining the level of trust towards a particular service (Baabdullah, 2018). When people find that their peers and the entire society prefer and have a positive attitude toward the use of technology such as AI social robots, they simultaneously tend to trust that the use of such technology might also yield them similar benefit and value like the others.

H1: Social influence significantly influences customers' trust in AI social robots.

Hedonic motivation

Based on the AIDUA model, hedonic motivation reflects customers' perception of fun, entertainment, and enjoyment they are likely to gain by using AI devices (Gursoy et al., 2019). As suggested by previous studies, if a customer perceives that using an AI social robot is likely to be entertaining, his/her level of trust to use this technology is likely to be positive.

H2: Hedonic motivation increases customers' trust in AI social robots.

Trust in AI

Trust has been identified as a catalyst that influences human-robot interaction (Xu and Howard 2018). It is intended as "the attitude that an agent will help achieve an individual's goals in a situation characterized by uncertainty and vulnerability" (Lee and See, 2004, p. 54). When it comes to a trust-oriented perspective for an emerging technology such as AI social robots, where uncertainty is present (Kim et al., 2020), the role of initial trust in AI social robots is an important component of primary assessment and a critical determinant of customers' intention or objection toward the use of AI social robots in the hospitality context. Thus, the level of trust is a critical predictor of performance expectancy and perceived risk (Ghazizadeh et al., 2011). Despite its critical importance, trust was not initially considered in the AIDUA model (Gursoy et al. 2019). However, some recent studies (Ghazizadeh et al., 2011; Hengstler et al., 2016) argue that incorporating trust as a critical determinant of performance expectancy within

technology acceptance models is of fundamental importance, particularly in examining technologies that might be viewed as high-risk.

Moreover, a high level of trust is positively related to the effort customers are likely to sustain to interact with AI social robots (Lee and Song, 2013).

H3: Trust has a direct positive impact on performance expectancy of AI social robots

H4: Trust has a direct positive effect on effort expectancy of AI social robots

Performance expectancy, effort expectancy and positive emotion

Performance expectancy refers to customers' evaluations of AI social robots' performance in terms of service accuracy and consistency; effort expectancy, conceptually similar to perceived ease of use, is consistent with the customers' perception of the amount of psychological and mental effort needed to interact with AI social robots. While a higher level of performance expectancy results in a higher level of overall positive emotions toward the usage of AI robotic devices, a higher level of effort expectancy negatively impacts customers' evaluation of these technologies.

H5: Performance expectancy increases positive emotions toward the use of AI social robots.

H6: Effort expectancy decreases positive emotions toward the use of AI social robots.

Based on the Cognitive Appraisal Theory (CAT), according to which elicitations of emotions are due to individuals' evaluations of a stimulus, which further determines behavioral responses (Lazarus, 1991), the AIDUA model considers the effect of the overall emotions toward the use of AI robotic devices on customers' behavioral intentions: willingness to accept and objection to the use of AI devices (Gursoy et al., 2019). Willingness to accept the use refers to customers' overall tendency to use AI social robots, while the objection to the use refers to the likelihood of rejection of using AI robots since these ones cannot provide social interactions with customers.

H7: Positive emotion increases the willingness to accept the use of AI social robots.

H8: Positive emotion decreases the objection to the use of AI social robots.

Mysophobia (Covid-19)

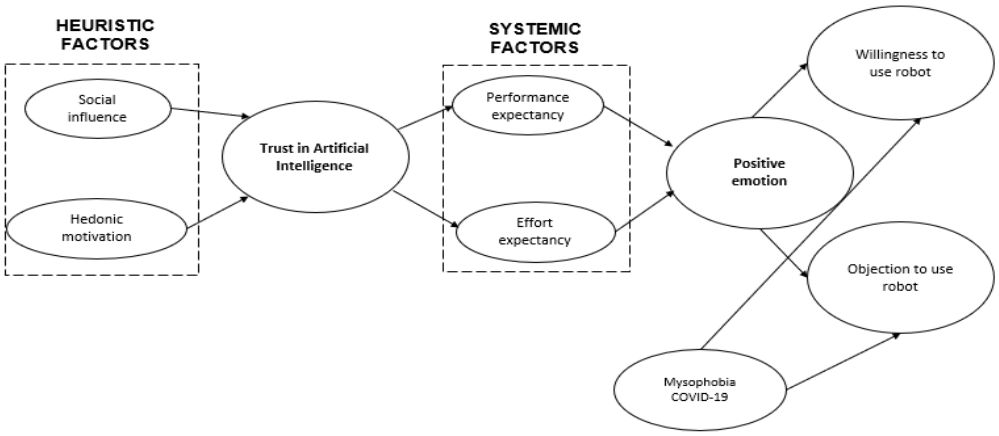
Since the beginning of the Covid-19 pandemic, individuals travel behaviors and how they view social interactions with others have been going through a significant transformation (Higgins-Desbiolles, 2020) because of social distancing rules and the fear of getting infected with the coronavirus (Gössling et al., 2020).

The Covid-19 pandemic may usher in a wave of mysophobia as people are constantly reminded to wash their hands frequently and to disinfect high-touch surfaces. Mysophobia, also known as germaphobia, is an irrational fear of contamination or germs (Chuah et al., 2022). By reducing human contact, many hospitality companies have elevated their safety and cleaning protocols also ensuring high levels of safety and hygiene, thus alleviating customers' fear of infection or contamination (Davis, 2020). In this circumstance, individuals that are particularly fearful of contamination are likely to use AI social robots:

H9: Mysophobia (Covid-19) has a positive effect on the willingness to accept the use of AI social robots.

H10: Mysophobia (Covid-19) has a negative effect on the willingness to accept the use of AI social robots.

The modified AIDUA model



Source: our elaboration

Methodology. *The data have been collected using a survey questionnaire designed from previously validated scales adopted in literature. We collected the data over a single two-week period during January, sharing the survey on social networks, such as Facebook, Instagram. In particular, for the AIDUA model, we have measured Social influence with 5 items and Hedonic motivation with 4 items adapted by Lin et al. (2020). Moreover we measure Performance expectancy with 3 items and Effort expectancy with 3 items adapted by Chi et al. (2020). Finally, we have measured Willingness to use with 3 items adapted by Shi et al. (2021) and Objection to use with 3 items adapted by Lin et al. (2020), Regarding the extension we measured Covid-19 with 3 items adapted by Chuah et al., (2022), Trust with six items adapted by Lippert & Davis (2006). Positive Emotion with 5 items adapted by Chi et al. (2020). The survey was administered in Italian using the translation and back-translations procedures (Saunders et al., 2009). All the items are measured using a seven-point Likert scale (1 = "strongly disagree" and 7 = "strongly agree"). Finally, we have asked for some*

demographic information about (Age, Gender, Income, Istruction, Occupation). In order to reduce retrieval bias (Kline et al., 2000; Podsakoff et al., 2003), we have intermixed the items from different constructs in the various scale grids, while to reduce social desirability bias, we have added guidelines to the survey to explain the scope of the survey, and to provide contacts for further information (Saunders et al., 2009). The data collected have been studied adopting the Partial Least Squares approach to Structural Equation Models (PLS-SEM) (Hair et al., 2011), using SmartPLS (Ringle et al., 2015) for model evaluation. This approach is used when the type of relationships is complex (direct, indirect, and moderation) containing first-order and second-order constructs, as in our case. PLS-SEM is appropriate for both small and large samples, as well as for non-normal data (Hair et al., 2019).

Preliminary results. *This is a working paper on a research that is going to be completed. Up to date, we have only had 250 respondents, which confirm our hypotheses, but it is our intention to enlarge our sample so to better generalize the results. Our goal is indeed to collect more observations and test the complete model. In general, we expect all hypotheses will be confirmed. In particular, we expect that both Social influence and Hedonic motivation significantly influences customers' trust in AI social robots. Then, we expect that Trust positively influences both Performance expectancy and effort expectancy and that these constructs positively affect positive emotions toward the use of AI social robots. Moreover, we expect that Positive emotion positively influences the willingness to accept the use of AI social robots and negatively affect the objection to the use of AI social robots. Finally, we expect that Mysophobia (Covid-19) has a positive effect on the willingness to accept the use of AI social robots and a negative effect on the willingness to accept the use of AI social robots.*

Research limitations. *First of all, we have focused only on one country in the context of analysis. Furthermore, we have considered only facilitators who may influence the willingness to use robots, not considering potential inhibitors that may influence the willingness to use robots in the hospitality industry. Finally, we adopted the scenario approach, because the use of social robots in the hospitality industry is still at stress, hence some answers could be influenced by the fact of not having well understood the characteristics of the social robots and its functionalities.*

Managerial implications. *The identification of the main managerial contribution is subjected to data collection and its analysis, only after testing the model is it possible to identify the significant variables and define more precisely the managerial implications. In general we can say that the research can reveal the propensity of consumers to use this service and therefore give hints and suggestions to hotel firms for its implementation. Moreover, understanding the determinants of consumers' acceptance of robots in the hospitality industry suggests managers at which levers to act to improve hospitality experience.*

Originality of the paper. *Most of the studies that can be found on robotics deal with engineering theory (robot design, navigation, face/object/speech recognition, autonomy) followed by field or laboratory experiments. Recent contributions call for a more significant effort to be made to explore customers' human-robot interaction experiences (Tung & Law, 2017). Furthermore, this study advances the AI social robots' adoption literature by extending the theoretical AIDUA framework (Gursoy et al. 2019) to predict customers' intentions to use AI social robots during their hospitality experiences by incorporating trust in AI and mysophobia (Covid-19).*

Keywords: *artificial intelligence; technology acceptance; hospitality; AI social robots; Covid-19*

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