



Attitudes of hotel customers towards the use of service robots in hospitality service encounters

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ABSTRACT

This study aims to identify whether hotel guests' attitudes towards robots serving at hotels show differences according to their gender, level of education, generation, and the continent they are from. The data for the study were collected from 1078 hotel guests who lived on four continents through an online survey. The analysis of the results shows that while the hotel guests are uncertain about their attitudes towards the presence of robots in daily life, in general, they tend to have more positive attitudes towards services delivered by service robots. The study shows that there is no significant difference in the attitudes of guests towards service robots in terms of the continent they are from. Generation X guests tended to be less interested in experiencing service encounters with service robots compared with Generation Y and Generation Z guests, as guests from Generation X believed that service robots offered more disadvantages. The study is original as previous research has not studied hotel guests' attitudes towards services delivered by service robots according to their gender, level of education, generation, and the continent they are from.

1. Introduction

Developments in the services have driven many businesses to adopt recently developed technologies due to the benefits of these technologies both for the customers and the business firms [1,84]. The fast adoption rate of technology in these sectors is due to the benefits of these technologies, from both demand and supply perspectives [34,79]. DeKeyser et al. [14] argue that the technological advancements in Artificial Intelligence through applications such as service robots will reshape the customer experience by influencing all overarching three customer experience building blocks. These building blocks are i) touchpoints (i.e., service encounters between the customer and service business), ii) context (i.e. available resources for the customer and service provider), and iii) qualities (i.e. attributes that show the nature of customer responses and reactions to interactions with service).

The main advantage of technologies for the customers is the opportunity to get the same service delivered to them more quickly, at much lower costs, with much less effort [40,50,78]. Due to their various cost, efficiency, and effectiveness advantages, recent technologies are increasingly becoming widespread in several service industries such as banking and finance [1,39], health [69], food and beverages [98], and

in tourism and hospitality industries [30,34].

As in the case of all services, tourism and hospitality services are heterogeneous and changes in who provides the service may influence customers' or guests' attitudes towards and evaluations of these services [45]. In addition to their various cost, efficiency, and effectiveness advantages, service robots, as a new technology application, may help reduce the heterogeneity of services [45]. The heterogeneity of service is largely due to the vagaries of human interaction in service encounters. One particular reason for the introduction of robots in delivering services has been to reduce the amount of heterogeneity and allow firms to offer a higher level of standardisation, or homogeneity, in the delivery of tourism and hospitality services [8,36,40,58]. However, it needs to be noted that, customers may still favour human staff services over services delivered by service robots, e.g. as in the case of tourism and hospitality [11]. Tung and Au [90] and Tuomi et al. [91] report that service robots do not currently operate well in uncertain or dynamic conditions and human service staff are needed on a wide variety of occasions.

As tourism and hospitality services involve intense and frequent contact with the customers they are usually referred to as *people businesses* [45]. Due to this intense and frequent contact and interaction between customers and service providers, various characteristics of

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customers and service providers, such as their cultural orientations can be significantly important [48]. Koc [48] argued that using service robots may minimise the intercultural differences between customers and service providers. Additionally, certain cultural characteristics may make customers more inclined towards the use of service robots than others. For instance, Lee et al.'s [12] study found that tourism and hospitality customers from high-power distance cultures such as Russia, Mexico, and China were more likely to view a service employee's attempts to initiate communication and interaction negatively, as they tend to view themselves as superior to the service employees. This may mean that as customers from high-power distance cultures may wish to avoid interaction with service providers, they may be more positive towards using service robots [46]. Hence, service robots may be extremely useful in reducing heterogeneity and increasing homogeneity, and standardisation of tourism and hospitality services, in addition to their various other benefits both for the customers and the service businesses.

Belanche et al. [5] emphasises the need for future studies to investigate the variables such as gender, age, and culture are important as they may significantly influence the use and adoption of service robots. Likewise, Flavián and Casaló [19] argued that the customers' characteristics such as age and gender may influence not only customers' attitudes towards service robots but also their eventual adoption of the service robots and the levels of satisfaction they get from service encounters. Moreover, as put forward below with the presentation of contradicting research findings, current research on how customers' characteristics such as age and gender influence their adoption of and satisfaction with service robots are inconclusive.

Additionally, as in the case of intercultural characteristics, heterogeneity of the services may occur due to various personal characteristics of customers such as their gender, level of education, the generation they belong to, and the continent they are from. As explained below in the review of literature, customers' gender, level of education, generation, and the continent they come from may play a significant role in determining their attitudes and behaviours towards services and their overall evaluations [13].

Although service robots offer a wide variety of benefits both for the customers and the service businesses, people's attitudes towards them and how people interact with them are still not clear [5,19,34,35]. It is believed that a study of service customers' characteristics such as gender, level of education, generation, and the continent they are from may shed light on the perception of and attitudes towards service robots. Based on the knowledge developed in this study, service businesses may be able to determine their various strategies regarding the use of service robots in various aspects of their service activities.

Moreover, although the number of studies regarding the service provided by robots at hotel businesses is on the rise, there are still important gaps in the literature due to the novelty of the field. An evaluation of the literature (e.g. Refs. [11,30,34,35,38,54,62,63,66,75,85,93] shows that no research has been carried out to explore the influence of hotel guests' gender, level of education, generation, and the continent they are from on their attitudes towards service robots. Based on this background, this study investigates the attitudes of hotel customers towards services delivered by service robots to determine whether the various demographic factors such as their gender, level of education, generation, and the continent they are from can make a difference.

2. Literature review

2.1. Service robots at hotels

Effectiveness, sustainability, and productivity are essential elements of the technological revolution. The service robots are system-based autonomous and adjustable interfaces that interact with customers in a business and serve the customers by communicating with them [65,

99].

Service robots learn through a programme or by interacting with their environments. The advanced humanoid robots can carry out various activities like human beings, e.g. service personnel do such as walking and talking [16]. Robots tend to be equipped with sensors such as sound, location, distance, pressure, temperature, power consumption, and face recognition. Also, robots tend to have actuators such as motors, robotic arms, screens, lights, loudspeakers, and transmitters that enable them to move or clutch an object, speak and transmit the signals to various devices [33]. The review of the literature shows that as service robots are a fairly recent phenomenon there are gaps in terms of understanding the implications of the use of service robots on the three overarching customer experience building blocks (touchpoints, context, and the qualities) put forward by DeKeyser et al. [14].

The hospitality industry has been quick in adopting various technological advancements since the early 1970s [104]. The technology used in hotel businesses is usually aimed at reducing the complexity within the facility, enhancing system practicality, and ensuring that the business is efficiently managed to achieve its goals [40,100]. The main motivation behind the use of service robots by businesses is to reduce costs, generate additional revenues, provide consistency in service quality, streamline operations, expand production/service capacity, and establish a competitive advantage for the hospitality business [8,24,32,61]. Also, as stated above, service robots may reduce heterogeneity, increase standardisation of the service and ensure reliability in service encounters [23].

Service robots may provide services directly at hotels on their own or may help service staff with the provision of various services. Service robots may carry out several tasks at hotels such as the tasks normally carried out by the front desk staff, bellboys, housekeeping staff, etc. Service robots may enable guests to check in and check out without encountering any human service staff [32]. However, the interaction between people and robots does not mainly depend on the perceived ease of use and the usefulness of the service robots. In addition to ease of use and usefulness customers tend to place great significance on the emotional and relational factors as well. Research shows that strengthening the quality of interaction between customers and the service robots plays an important role in creating satisfactory service encounters [21].

2.2. Hotel guests' attitudes towards robots

According to Davis' [12] technology acceptance model, people's attitudes towards technology influence the adoption and use of technology. In other words, people's beliefs regarding their abilities of technology use and their evaluations of the benefits of technology appear to be the main factors determining behavioural intention. In the technology acceptance model, the acceptance of technology, perceived usage easiness, perceived benefit, attitude, and intention are the four main criteria that determine technology acceptance.

According to Venkatesh et al. [95] in addition to performance expectation, effort expectation and social effect influence the behavioural intention for use of technology, behavioural intention, individual factors such as gender, age, and the level of education may play a determining role in the adoption and the use of technology. People's attitudes towards service robots may show variations according to their individual characteristics.

One of the individual characteristics that influence the attitudes of people towards service robots is gender [5]. Men's and women's behaviours and attitudes may vary according to the genetic structure and the gender roles in the society they have been brought up. While men may often be interested in brief technical knowledge, usually in the form of heuristics (Meyers-Levy and Loken [64]; women may prefer to collect more information and establish more personal relevance with the product [51,64]. Also, compared with men, women may be more critical towards the same information cues or stimuli [10]. Lin et al. [57]

showed that men as fathers were more interested in education robots for their children than women were. Meyers-Levy and Loken's [64] seminal study explains the main gender differences, and their implications on perceptions, attitudes, and behaviours of people based on the findings from a wide variety of disciplines. Regarding the adoption and use of technology, in general, it may be stated that men tend to be more interested in scientific discoveries and technological developments than women [17,77]. Also, while men tend to be more interested in technology in terms of its adoption and use, women tend to be more interested in the ease of use of technology [94]. Ivanov et al.'s [34] study showed that men were more interested in robots than women. However, there is very limited research regarding the attitudes of hotel customers towards service robots to make firm conclusions.

Gender has been studied extensively in tourism and hospitality studies from a wide variety of perspectives. For instance, Koc [43,47] shows how women are communal and men's agentic orientations influence their attitudes and behaviours towards tourism and hospitality activities both from the demand and supply sides. There are plenty of other studies in various fields investigating the role of gender on people's attitudes towards technology acceptance [37,60,72], and in tourism and hospitality (e.g. Refs. [2,103]). However, as service robots are fairly recent phenomena, the above studies did not investigate the influence of gender from the perspectives of attitudes towards service robots. Hence, a study on the influence of gender on attitudes towards service robots is worthy of investigation. Based on the above, the following hypothesis has been formulated:

H1. There is a statistically significant difference in the attitudes of customers towards service robots according to their level of education.

One of the factors that may influence the attitudes of customers towards service robots is their level of education. A Pew Research study [74] showed that the level of education had a significant relationship with Internet use and the number of hours spent on the Internet. This may show that there is a relationship between the level of education of an individual and the use of technology. Research in various fields and sectors/markets (e.g. Refs. [22,82]) shows that the level of education influences the technology acceptance of customers significantly. A review of the literature shows that there is very limited research that provides findings regarding technology acceptance and the level of education of customers. As one of the few studies in the area Anwar and Talib's [1] study in the health sector found that the level of education and the computer efficacy were among the factors that increased the technology adoption of users. The review of the literature also showed that the investigation of technology acceptance and the level of education in tourism and hospitality were even more limited. In one of those studies, Regev et al. [76] found that the level of education had no significant effect on technology adoption in terms of purchasing and searching for tourism services online. However, in a specific study, Ivanov et al. [35] investigated the attitudes of hotel guests towards service robots from the perspective of the level of education of hotel guests in Iran and found rather interesting results. This study found that hotel guests with lower levels of education were more optimistic about the friendliness and the expected level of performance of service robots than people with higher levels of education. Based on the above literature it may be argued that the level of education is one of the factors that may influence customers' attitudes towards service robots. Hence, the following hypothesis has been developed:

H2. There is a statistically significant difference in the attitudes of customers towards service robots according to their level of education.

Another factor that may influence people's attitudes towards the service robots could be their age and the generation they belong to. According to Strauss and Howe's [87] generational theory, people who were born at a certain period tend to have similar values, behaviours, and lifestyles [80]. As each generation gets influenced by the same specific events taking place in a period, it has been seen that the

individuals in the same generation tend to share economic, cultural, and political experiences, and have similar values [51]. In understanding generations, in addition to social, cultural, economic, and technological factors may need to be taken into account as well [9,86]. In general, relatively older people, e.g. people from generation X and Y, tend to have more negative attitudes towards service robots (Hudson et al., 2017; [71]). Especially, with the increasing use of internet technology, and mobile devices, members of Generation Z, in general, have been exposed to the recent technology applications relatively significantly [92]. Vitezić and Perić [96] found that factors such as anthropomorphism, effort expectancy, performance expectancy, and social influence played a significant role in the formation of positive emotions and the ensuing adoption of artificial technology applications by Generation Z members in tourism and hospitality. Vitezić and Perić [96] also showed that the use of smartphones had a moderating role in the relationship between the perceived effort of using artificial intelligence applications such as robots and the development of positive emotions. Vitezić and Perić's [96] research showed that the generation of the customers helped the formation of a set of drivers influencing the willingness to use the artificial intelligence applications in hospitality.

Hence, it may be possible that there may be differences between the attitudes of the Z generation towards service robots, and the attitudes of other generations. In this vein, researching young people, Lazanyi [54] found that people from generation Z were more eager to interact with robots than the members of generation Y.

The influence of generations of attitudes and behaviours has been extensively researched in tourism and hospitality, in areas as distinct as gamification in tourism [86], well-being in tourism [70], and customer participation in tourism [101]. Hence, carrying out further studies about the attitudes towards service robots by comparing users or customers from different cultures may make both theoretical and practical contributions. A further review of the literature has also shown that to date there has been no research to investigate the influence of one of the three generations on hotel guests' attitudes towards service robots. Based on this background, the following hypothesis has been developed:

H3. There is a statistically significant difference in the attitudes of customers towards service robots according to their generation

One other factor that may influence people's attitudes towards service robots is the geography they live in, e.g. the continent they are from, and their culture. According to Hofstede [29] depending on the scores of a particular cultural dimension, beliefs, attitudes, and behaviors of people in a country may be significantly influenced by their cultural characteristics. Geography influences culture [41,89], and, in turn, culture influences people's perceptions, values, attitudes, and behaviour [46]. According to Hall [25] cultures may be classified as high- and low-context cultures. In low-context cultures (e.g. in Europe, particularly in the Northern European countries) communications tend to be explicit and require little interpretation to understand the content [25, 46]. On the other hand, in high-context cultures (e.g. in Asia in general) the content of the message is less central to the communication, and the decoding of contextual cues is needed to fully understand the message [46]. Li et al. [56] showed that the above communicational expectations among people were valid for the service robots as well. In other words, customers expected the service robots to communicate with themselves according to their contextual orientation depending on whether they are from a low-context or a high-context culture. For instance, while people from low-context cultures (e.g. the Europeans) depended mainly on the utterances of the service robots, people from high-context cultures expected to see more contextual cues such as the body language of the service robot. In a similar vein, Wang et al. [97] found that service robots that communicated more implicitly were more positively perceived and trusted by people from high-context cultures (e.g. Asians). On the other hand, people from low-context cultures (e.g. the Europeans) preferred service robots that communicated in a more explicit manner and had more trust for service robots communicating in such a manner

[97]. Papadopoulos and Koulouglioti's [73] study is supportive of the above.

The above findings support the view that people's attitudes towards service robots may be shaped by their culture [4]. Also, MacDorman et al. [59] showed that businesses that develop service robots are mainly from Japan, and robots designed by these businesses, may reflect Asian characteristics. In general, the Japanese culture may be classified as a high-context, collectivistic, high uncertainty avoidance, masculine, high-power distance, long-term oriented, and high-uncertainty avoidance culture [49] and robots designed with these orientations may not match the expectations of people from other cultures. According to Obaid et al. [68]; service robots that may match the cultural characteristics of customers may enable the development of more positive attitudes towards service robots.

The Japanese tend to be more exposed to robots than the citizens of any other country [6]. Hence, the Japanese may be expected to have a higher level of awareness of the advantages and disadvantages of robots than people in other countries [3,6]. However, Haring et al. [28] showed that the Japanese did not appear to have significantly more positive attitudes and assumptions towards service robots than the Europeans did. This contradictory finding also supports the view argued in this study that as the service robots are rather recent the research findings are far from being conclusive. For instance, in contradiction with the above research findings, Nomura et al. [67] found that UK citizens (low-context, individualistic, relatively masculine, low uncertainty avoidance, indulgent, low power distance culture) [49] felt more negative towards humanoid robots than the Japanese (high-context, high power distance, high uncertainty avoidance, masculine, and restraint culture) [49]. Asians (e.g. Chinese, Koreans, and Japanese) tended to rate service robots higher in terms of factors such as animacy and anthropomorphism, likeability, trustworthiness, and safety than the people from the US, Germany, and Australia [7,28,56].

Also, as Bartneck et al. [3] put forward that the Japanese tended to worry more about robots in general due to their potential negative influences on society. While US citizens tend to be relatively accustomed to using technology and have more positive attitudes towards robots, Mexicans tend to be more negative towards robots than people in most countries [3]. On the other hand, Hair et al. [26] interestingly found that Australians had more positive attitudes towards robots than the Japanese. The review of the literature shows that there is no study on the geography the customers are from and their attitudes towards service robots at hotels. Merkle [63] put forward that Indians adopted service robots more easily than both Americans and Germans and were more able to associate empathy, expertise, reliability, and trust with the service robots.

Although the field of service robots is novel, several studies have been carried out recently investigating hotel guests' attitudes toward service robots [11,30,34,35,38,54,62,63,66]. However, it appears that no research has been carried out regarding the geography or region the hotel guests came from in relation to their attitudes towards service robots. Hence, carrying out more studies on the attitudes towards service robots by comparing users or customers from different cultures may have both theoretical and practical implications. Although the continent a hotel guest is from may not provide many specific cues, given the fact that it may be difficult to have a sufficient number of people from each country, the study was based on the continents the guests came from. Based on the above, the following hypothesis has been developed:

H4. There is a statistically significant difference in the attitudes of customers towards service robots according to the continent they come from.

3. Methodology

3.1. The instrument

Quantitative research methods were used in the study. The data were gathered through a questionnaire survey. The first part of the survey comprised hotel guests' demographic characteristics such as gender, generation, education level, and country of residence. The second part of the survey asked questions using the Scale of Attitudes Toward the (Potential) Use of Robots in Hotels, developed by Ivanov et al. [34]. The scale had a total of four sub-dimensions and 15 items. To identify hotel guests' levels of agreement with the scale items, a five-point Likert scale was used, from "(1) I strongly disagree" to "(5) I strongly agree".

3.2. Data collection

The universe of the study is people who previously stayed at hotels. As the Covid-19 pandemic was widespread when this study was carried out, in the months of February and March 2021, the survey technique was used rather than the experiments, focus group studies, and observations. Also, the convenience sampling method was used due to the Covid-19 pandemic as the occupancy rates were extremely low at hotels and it was difficult to reach larger groups of participants at the time by any other means. The study is limited to the continents of Asia, Europe, North America, and Australia. Apart from Asia which is broadly a high-context, the remaining continents can be broadly classified as low-context [46]. The survey form has been shared through various social media platforms and 1078 useable responses were collected.

3.3. Participants' characteristics

This section provides an overview of the demographic variables of the participants such as gender, generation, nationality, continent, and level of education.

According to the data presented in Table 1, the proportion of female respondents (74.7%) was higher than male respondents (25.3%). In terms of the generations of the respondents, it was seen that generation Y had the largest proportion (45.8%) of the participants in the study. Regarding the continents, the guests come from a large proportion of the respondents who lived in Asia (47.3%) and Europe (40.0%). In terms of the level of education, it was seen that most of the respondents held bachelor's degrees (55.1%), while the respondents who had primary/secondary school level of education constituted the smallest proportion of the respondents (3.1%) in the study.

3.4. Data analysis

The data obtained from the participants were analysed through SPSS 25.0 and AMOS 26.0. The skewness and kurtosis values for the scale were -0.298 and 0.471 . These values indicate that the skewness and kurtosis of the scale were within the range of -1.5 and $+1.5$, i.e. the distribution is normal [88]. As the data were normally distributed, parametric tests were used in the study. The Independent Samples T-Test and One-Way Analysis of Variance were used to identify the differences in the attitudes of hotel guests regarding the above variables. Harman's [27] one-factor test was used for common method bias. All items explain less than 50% of the total variance under a single factor. In this case, there is no common method bias (35.1%).

3.5. Reliability and validity

The Cronbach's alpha coefficient was calculated to measure the reliability of the scale. It was found that Cronbach's Alpha coefficient was 0.860 for the overall scale. This value shows that the scale has high internal consistency [26].

The Confirmatory Factor Analysis (CFA) was performed to find the

Table 1
Participants' demographic data.

		N	%			N	%
GENDER	Female	805	74.7	CONTINENT	Asia	510	47.3
	Male	273	25.3		Europe	431	40.0
GENERATION	Generation Z	122	11.3	EDUCATION LEVEL	North America	106	9.8
	Generation Y	494	45.8		Australia	31	2.9
	Generation X	385	35.7		Primary/Secondary School	33	3.1
	Baby Boomers	77	7.1		High School	53	4.9
					Associate Degree	99	9.2
					Bachelor's Degree	594	55.1
					Master's Degree	299	27.7

extent the which the theoretical model of the factor loadings on a construct that was identified or configured previously was consistent with the real data [26]. The first-order factorial construct of the scale that was comprised of a total of 15 items was tested by using AMOS 26.0. As the data were normally distributed, the maximum likelihood estimation method was employed. As per the first-order CFA, two items (R15 and R10) from the sub-scale of Robots' Advantages, one item (R5) from the sub-scale of Robots' Disadvantages, and one item (R14) from the sub-scale of Social Skills of Robots of the Scale of Attitudes Toward the (Potential) Use of Robots in Hotels were left out of the model due to the poor factor loading, and the analysis was repeated. The values of goodness of fit obtained alongside the first-order CFA ($\chi^2/37$, $N = 1078$ | $= 169.315$; $p < .01$; $\chi^2/sd = 4.576$; $RMSEA = 0.058$; $CFI = 0.980$; $GFI = 0.972$; $RMR = 0.039$) show that the proposed model was consistent with the data and acceptable [81]. These results demonstrate that the data obtained under the research were consistent with the estimated theoretical construct of the scale.

The convergent and discriminant validity were assessed to indicate whether the observed variables represent the latent constructs to which they are related [20]. The convergent validity shows the degree of relationship of the observed variables that measure the latent variable [26].

Table 2 displays factor loadings, average variance extracted (AVE), composite reliability (CR), and the Cronbach Alpha coefficient values. The factor loadings for the scale range between 0.611 and 0.950. Both the AVE and CR values for the sub-scales of Experience, Robots' Advantages, Robots' Disadvantages, and Social Skills of Robots are above the recommended threshold, respectively, 0.5 and 0.7 [26]. Also, the Cronbach's Alpha coefficient values indicate a satisfactory level of reliability [26] indicating that the scale has convergent validity.

Discriminant validity (see Table 3) is used to test whether the observed variables used in the model measure the latent variable or not. To establish the discriminant validity the square root of AVE for each sub-scale should be above the coefficient of the correlations between the sub-scales. Additionally, the discriminant validity of the Maximum Shared Variance (MSV) and the Average Shared Variance (ASV) should be below the value of AVE [20].

Table 2
Factor loadings, AVE, CR, and Cronbach's Alpha Coefficient values.

Sub-Scale	Item	Factor Loading	AVE	CR	Cronbach's Alpha
Experience	R1	.842	.807	.921	.945
	R2	.859			
	R3	.938			
	R4	.950			
Robots' Advantages	R11	.779	.539	.800	.773
	R12	.749			
	R13	.671			
Robots' Disadvantages	R7	.864	.559	.762	.679
	R6	.611			
Social Skills of Robots	R9	.738	.520	.736	.685
	R8	.705			

AVE: Average Variance Extracted, CR: Composite Reliability.

Based on the comparison of the coefficients of correlations between the sub-scales and the square root of AVE for each sub-scale, it is seen that the correlation coefficients were below the square roots of AVE. Likewise, it is established that the MSV and ASV values are below the AVE value, which suggests that the scale has discriminant validity.

In addition, the Heterotrait-Monotrait (HTMT) value, which is another criterion for discriminant validity, was examined (see Table 4). It is seen that HTMT values are lower than the threshold value of 0.85 [42], which suggests that the scale has discriminant validity.

4. Findings

The findings of the study

In terms of the level of education of hotel guests show that the averages of experience and the advantage of service robots for hotel guests differ. In addition, the averages of overall attitudes of hotel guests towards service robots differ according to the level of education. The level of education of the hotel guests influences experience ($\beta = 0.090$) and advantage ($\beta = 0.134$) dimensions, and the overall attitude ($\beta = 0.118$). The averages of hotel guests who would like to have service experiences with service robots and see them and those who view service robots as disadvantageous differ according to the generation they belong to. The generation influences experience ($\beta = -.0136$) and disadvantageousness ($\beta = 0.137$) dimensions. Also, according to the continents, the averages of hotel guests who view service robots as advantageous and have social skills tend to differ. The continent the hotel guests come from influences advantage ($\beta = 0.079$) and social skill ($\beta = 0.073$) dimensions. The above finding shows that research so far appears to be inconclusive regarding the advantages and disadvantages of service robots. While certain studies show that the service robots are viewed as advantageous by the customers (e.g. Ref. [83], in some others service robots are not viewed as advantageous by the customers (e.g. Ref. [58]. Liu and Hung [58] showed that customers and hotel managers found technology applications such as service robots more useful, advantageous, and easier to communicate.

An analysis of the findings shows that, in general, the attitude of hotel guests' towards the inclusion of service robots in human life is neither positive nor negative ($X^- = 3.18$). However, it can be seen that hotel guests' attitude toward service offered by robots at hotels is generally positive ($X^- = 3.47$). Also, hotel guests exhibit more positive attitudes towards the employment of human staff at hotels ($X^- = 2.20$). The study establishes those hotel guests who feel that the services delivered by robots at hotel businesses would be advantageous ($X^- = 3.60$). Moreover, hotel guests exhibit positive attitudes towards the view that the use of service robots would not disadvantageous ($X^- = 2.40$), and the service robots had social skills ($X^- = 1.94$). However, the study also showed that in terms of the willingness of hotel guests to have service experiences with service robots they appeared to be somewhat unsure ($X^- = 3.02$).

According to the results of the independent samples *t*-test analysis (Table 5), it can be seen that there was no statistically significant difference in the means of scores obtained from the participants from the overall scale ($p = .157$), and the sub-scales of Robots' Advantages ($p =$

Table 3

Discriminant validity.

Sub-Scale	X	SD	Number of Items	Experience	Robots' Advantages	Robots' Disadvantages	Social Skills of Robots	MSV	ASV
Experience	3.028	1.092	4	.898a				.293	.120
Robots' Advantages	3.605	.783	3	.483	.734a			.293	.123
Robots' Disadvantages	2.402	.804	2	.124	.163	.747a		.275	.122
Social Skills of Robots	1.942	.769	2	.157	.079	.390	.721a	.275	.109

a = Square Root of AVE, X: Mean, SD: Standard Deviation, MSV: Maximum Shared Variance, ASV: Average Shared Variance.

Table 4

Heterotrait-Monotrait (HTMT).

Sub-Scale	Experience	Robots' Advantages	Robots' Disadvantages	Social Skills of Robots
Experience	1			
Robots' Advantages	.561	1		
Robots' Disadvantages	.146	.197	1	
Social Skills of Robots	.194	.098	.563	1

Table 5

Gender - Hotel guests' attitudes toward the use of robots in hotels.

SUB-SCALE	Female		Male		t	p
	X ⁻	SD	X ⁻	SD		
Experience	3.076	1.042	2.887	1.217	2.299	.022
Robots' Advantages	3.608	.753	3.598	.868	.170	.865
Robots' Disadvantages	2.373	.780	2.487	.865	-1.925	.055
Social Skills of Robots	1.965	.791	1.875	.696	1.678	.094
Overall Scale	2.891	.593	2.824	.703	1.419	.157

X: Mean SD: Standard Deviation p < .05.

.865), Robots' Disadvantages (p = .055), and Social Skills of Robots (p = .094) in terms of the participants' gender. However, it was seen that regarding the gender of the participants there was a statistically significant difference in the means of scores obtained from participants from the sub-scale of Experience. Female hotel guests appeared to be more interested than male hotel guests in experiencing services delivered by service robots at hotels. Therefore, hypothesis H_1 is rejected.

According to the results of One-Way ANOVA in Table 6, it can be seen that there was no statistically significant difference in the means of scores obtained from the participants from the sub-scales of Robots' Disadvantages (p = .166) and Social Skills of Robots (p = .314) in terms of the level of education of the hotel guests. On the other hand, it was established that there were statistically significant differences in the means of scores obtained from the participants from the overall scale (p = .001) and the sub-scales of Experience (p = .033) and Robots' Advantages (p < .001) regarding the level of education of the participants. As the variances are homogeneously distributed, the Scheffe Test, a Post

Hoc Test, was used to identify whether there was a statistically significant difference between different groups of participants. According to the results of the Scheffe Test, the services offered by service robots at hotels tend to be viewed as more advantageous among the guests with higher levels of education (i.e. the participants with master's level of education) than the participants with relatively lower levels of education (i.e. the participants with high school education and those who have associate degrees). The findings show that hotel guests with master's degrees had more positive attitudes towards the service offered by robots than hotel guests with associate degrees. Hence, hypothesis H_2 is accepted.

Also, Table 6 shows that in terms of the generation the hotel guests belonged to there was no statistically significant difference in the means of scores obtained from the participants from the overall scale (p = .218), and the sub-scales of Robots' Advantages (p = .470) and Social Skills of Robots (p = .203). However, it is established that there were statistically significant differences in the means of scores obtained from the participants from the sub-scales of Experience (p < .001) and Robots' Disadvantages (p < .001). It was seen that the scores obtained from the participants (the overall scale and its sub-scale of Robots' Disadvantages) were homogeneously distributed, while the scores obtained from the other sub-scales were not homogeneously distributed. Therefore, the Games-Howell Test, a post hoc test, was used to find the source of statistically significant difference in the means of scores obtained from the participants from the sub-scale of Experience whilst the Scheffe Test, another post hoc test, was employed to find the source of statistically significant difference in the means of scores obtained from the participants from the sub-scale of Robots' Disadvantages. According to the results of the Scheffe and Games-Howell Tests, the hotel guests from

Table 6

As per education level, generation, and continent, ANOVA results in relation to attitudes toward the use of robots in hotels.

	Scale	F	p	Group	Difference in Mean Scores	p
Education Level	Experience	2.633	.033	Experience (Master)	Associate	.33299
	Robots' Advantages	5.548	.000			
	Robots' Disadvantages	1.622	.166	Robots' Advantages (Master)	High school	.39768
	Social Skills of Robots	1.188	.314		Associate	.31261
	Overall Scale	4.823	.001	Overall Scale (Master)	Associate	.25507
Generation	Experience	9.692	.000	Experience (Generation X)	Generation Y	-.36109
	Robots' Advantages	.844	.470		Generation Z	-.41287
	Robots' Disadvantages	7.824	.000	Robots' Disadvantages (Generation X)	Generation Y	.20786
	Social Skills of Robots	1.536	.203		Generation Z	.31655
	Overall Scale	1.483	.218			
Continent	Experience	.927	.427	Social Skills of Robots (Asia)	Europe	-.12745
	Robots' Advantages	2.397	.067			
	Robots' Disadvantages	.856	.464			
	Social Skills of Robots	3.010	.029			
	Overall Scale	1.206	.306			

p < .05.

generation X were less interested in experiencing the use of robots at hotels than participant hotel guests from generations Y and Z. Also, the service offered by service robots at hotels is viewed more negatively (disadvantageous) by the hotel guests from generation X than hotel guests from generations Y and Z. Hence, hypothesis H₃ is rejected.

Table 6 shows that, regarding the continent the hotel guests come from, there was no statistically significant difference in the means of scores obtained from the participants from the sub-scales of Experience ($p = .427$), Robots' Advantages ($p = .067$), and Robots' Disadvantages ($p = .464$), while there was a statistically significant difference in the means of scores obtained from participants from the sub-scale of Social Skills of Robots ($p = .029$). It is seen that regarding the continent the hotel guests resided, there was no statistically significant difference in the attitudes toward the service offered by robots ($p = .306$). As the scores obtained from the hotel guests from the sub-scale of Social Skills of Robots were homogeneously distributed, the Scheffe test was used. It was found that there was no statistically significant difference according to the continent the guest comes from in terms of their attitudes toward the service offered by robots at hotels. Hence, hypothesis H₄ is rejected.

5. Discussion and conclusions

Although the use of service robots at hotels and the research in this field are developing fast, current research appears to be insufficient and far from being conclusive. Hence, it is believed that the study fills an important gap in the literature, i.e. has both theoretical and practical implications. These implications and the contribution of the study are explained and discussed below. The study showed that the use of service robots at hotels would have implications for all the three overarching customer experience building blocks (touchpoints, context, and the qualities) put forward by DeKeyser et al. [14].

For instance, the study showed that hotel guests were unsure about the inclusion of robots in human life, though, to some extent, they were positive towards their use at hotels. Although an earlier study by Ivanov et al. [34] showed that young adults were quite in favour of the presence of service robots in hotel businesses, this study showed that not only young adults, all guests tend to have a relatively positive attitude towards the use of service robots at hotels. This finding is important not only for future research perspectives but also from the perspective of the practitioners working in the hospitality industry considering the launch of service robots in their establishments.

However, it should be borne in mind that this study showed that the hotel guests still preferred services delivered by the human staff more. It was established that the hotel guests thought that the services delivered by the service robots were advantageous, and the fact that robots had social skills, yet they were unsure about having a robot-delivered service. Customers' doubts may be due to the fact that in tourism and hospitality the intensity and the frequency of interaction and social exchange are high, and traditionally these guests have been used to human interaction, and the services delivered by human staff [44]. As Choi et al. [11] found, hotel customers viewed human staff services to be better than services delivered by service robots in terms of interaction quality and the physical environment. It is believed that the management of hotels may educate customers, and use certain incentives to encourage hotel guests to experience services delivered by service robots. Ivanov et al.'s [35] study with Iranian hotel guests found that the experience, the advantages, and the social skills influenced attitudes toward service robots. Hence, future research may be carried out to ascertain firmly whether human interaction and social exchange are the real causes behind customers' concerns regarding services delivered by the service robots. If that is the case, then the management of hospitality establishments may search for ways to add/increase interaction/social exchange elements in the services delivered by service robots. Additionally, the use of service robots at hotels may increase the reliability dimension of service quality, as customers switch to other service providers due to the service failures they experience during service

encounters [15]. Because service robots can provide a more homogeneous and standardised service with fewer service failures, hotels may benefit from using service robots in delivering various services [61].

This study found that female hotel guests tended to be more interested in having experience with service robots than male hotel guests. This finding contradicts the European Commission's [17] report on Public Attitudes towards Robots, Martins and Costa's [62]; and Reich and Eysel's [77] findings. Likewise, Ivanov et al.'s [34] study with young Russian adult hotel customers found that females were less positive towards service robots in general and their adoption at hotels. However, Ivanov et al.'s [35] study showed that females in Iran had a more positive view of service robots regarding the potential disadvantages and their social skills. The findings in the above studies, including this one, appear to be inconclusive due to the contradictions. As the differences found in the above studies may be culture-bound [41,89], future research may be carried out to investigate attitudes towards service robots by different genders in different cultures/countries. Because women, in general, tend to have more positive attitudes towards service robots than men, new incentives and marketing strategies can be developed to make female guests may be more positive towards service robots. It may also be suggested that service robots may be used at hotels for activities such as the hair and beauty salon and shopping which women may be more likely to be interested in.

As stated above in the literature, the level of education influences the technology acceptance of customers in various sectors (e.g. Refs. [22, 82]). The services offered by service robots at hotels tend to be viewed as more advantageous among participants with higher levels of education (i.e. participants with master's degrees) than participants with relatively lower levels of education (i.e. participants with high school education and associate degrees). Hence, hotel managers may be recommended to use people with higher levels of education as reference groups in promoting services delivered by service robots. In addition to the above, some opportunities can be planned for hotel guests who have lower education levels to have service robot experience together with the provision of information about service robots. Additionally, as the above discussion suggests, there may be differences in technology adoption based on the type of technology, i.e. whether the technology acceptance entails using online reservations or experiencing services delivered by robots. As in the case of using service robots, the users or customers may be more passive, requiring less effort and involvement, than making online reservations, there may be differences in attitudes towards each one. Hence, the technology adoption models may be reviewed in light of the developments in service robots.

Additionally, the findings of this study contradict the studies of Ivanov et al. [34] and Ivanov et al. [35] regarding the level of education of hotel guests. The former study found no statistically significant difference between the level of education of hotel guests and their attitudes towards service robots. The latter study found that hotel guests with lower levels of education were more optimistic about the friendliness of the expected level of performance of service robots. As suggested above the contradictions in research findings may be due to differences in culture, and further research may be carried out to identify cultural differences and patterns. As suggested by Koc [46] customers from high-power distance cultures may wish to avoid interaction with service providers as they tend to view themselves as superior to service providers. Hence, they may be more likely to prefer services delivered by service robots. However, it should be kept in mind that, although customers from high-power distance cultures may not wish the service providers to initiate communication and interaction with them, they may still wish to have human staff presence to feel/remind their superiority. As the technological applications may be complex and difficult to use their use may require a certain level of knowledge. Hence, hotel guests with higher levels of education may have a more positive attitude towards service robots. The hotels may provide more instructions and training for customers who have a lower level of education or people who lack knowledge about the use of service robots.

This current study found that attitudes of hotel guests towards service robots **did not show variations according to the continent they come from**. It may be stated that the findings of this study draw parallel with Zhang et al.'s [102] which did not find any significant difference between high-context (Asian) and low-context (western) countries in terms of their interaction with robots. However, as shown above, in the review of the literature [56,73,97] the attitudes of high-context Asian customers are different from low-context Europeans. Also, as described above, e.g. Refs. [3,6,26,63]; there may be marked differences among countries regarding the attitudes of their citizens towards service robots. As this study showed that the continent the hotel guests come from (e.g. Asians as high-context and the Europeans as low-context) may not be a good indicator of their attitudes towards service robots, future research may compare individual countries and cultures, rather than the continents, to ascertain the potential differences in attitudes towards service robots.

Additionally, attitudes towards service robots may be investigated **from a personality perspective as well**. For instance, as introverts tend to avoid social interaction [18,52], they may prefer services delivered by service robots rather than human staff. Additionally, as this study was **carried out during the Covid-19 pandemic, i.e. when people are scared of physical and social interaction**, their attitudes towards service robots may **be more positive than** had this research been carried out earlier. Hence, future research, depending on the developments Covid-19 pandemic, may regularly assess attitudes towards service robots to ascertain whether some proportion of positivity towards service robots is due to the Covid-19 pandemic scare [53].

Finally, this study found that guests from the **generation X tended to be less interested in** having service experiences with service robots and perceived the service robots as more disadvantageous than hotel guests **from the generation Y and generation Z**. This finding overlaps with the results of studies that demonstrate that the younger generations are more open to novelties in technology [9,31,92]. Based on the above, the hotels may provide different service combinations (e.g. with service robots or human staff) according to different age/generation segments. Having in mind that young people are more comfortable with technology, the extension of more services delivered by service robots to young guests may reduce customer dissatisfaction and negative online reviews. Also, as service robots may provide a more homogeneous and faster service they may be more efficient and effective to use from the perspective of customer satisfaction. As suggested above, research in the field of service robots appears to be inconclusive. Based on the above findings and research directions future research may be carried out to understand the use of service robots at hotels.

As stated above, future studies may compare countries rather than continents to understand the influence of various cultural paradigms and dimensions. This study investigated the contextual differences (high- or low-context). However, future studies may compare countries from the perspective of Hofstede's [29] cultural variables of power distance, individualism, uncertainty avoidance, time orientation, masculinity-femininity, and indulgence. Also, due to the time and cost savings and the lack of access to large group participants during the Covid-19 pandemic this study used the survey technique to collect data. Further studies may use **observations, focus group studies, and experiments** to shed light on customers' attitudes towards service robots.

Author statement

Ahu Yazici Ayyildiz: Conceptualization, Data curation, Methodology, Software. Muhammed Baykal: Visualization Data curation, Methodology. Erdogan Koc: Writing- Reviewing and Editing

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