Stanislav Ivanov / Craig Webster / Peyman Seyyedi

Consumers' attitudes towards the introduction of robots in accommodation establishments

Abstract

Robots are increasingly discussed in academic literature as well as public discourse because of their introduction into consumers' lives. The increased usage of robots in industry will meet with resistance from customers in the service industry as well as employees in industry, as their capabilities increase and they are used to augment or replace human labour. This article explores data gathered from a 2017 survey of 393 Iranian consumers to determine how Iranians perceive the use of robots in hotels, indicating which tasks Iranian consumers find robots can do for them and those that they want humans to continue doing. The findings reveal that Iranian consumers' attitudes towards having services performed for them by robots is largely driven by general attitudes towards robots, a recognition of the advantages of robots compared to humans, experience with robots, and the social skills of robots. It is noteworthy that no demographic variables explored seem to play a role in shaping attitudes towards service in hotels by robots.

Key words: robots; artificial intelligence; hotels; hospitality; attitudes; Iran

Introduction

The age of robots has arrived. Robots are increasingly becoming apparent in our economic landscapes and daily lives. Karel Čapek introduced the concept of the robot in his 1920 play, R.U.R. (Rossum's Universal Robots) (NPR, 2011). While the robots that Čapek imagined were imaginative, how quickly their capabilities have grown in less than a century is quite impressive. While the use of the word "robot" has been around for nearly a century to refer to the concept that many of us understand as a computer driven mechanical device, robots have become smarter and more pervasive in recent years, threatening a great deal of economic and social disruption in the not-so-distant future.

From its inception, the robot has played a disruptive and interesting incorporation into the economic landscape and will continue to do so. We are in a time in which self-driving cars are in an advanced stage of development before they become mainstream fixtures on our roads and many jobs done by humans are replaced by robots. Alone, the introduction of the self-driving truck will make an enormous impact upon humans in industry. For example, 2014 data from the USA indicate that "truck driver" is the most common job in 29 of the USA's 50 states (NPR, 2015) and the robot that is the self-driving truck will almost immediately make these workers redundant/unemployed (Solon, 2016). There should be concern that one of the few job categories that enables people with only a high school education to have a middle class existence will become replaced in one fell swoop with a computer-controlled self-driving truck.

However, technologies such as self-driving vehicles and voice recognition technologies have the potential for great disruption and much innovation in business (Brynjolfsson, McAfee & Cummings,

Prof. **Stanislav Ivanov**, PhD, Varna University of Management, Varna, Bulgaria; E-mail: stanislav.ivanov@vumk.eu
Assistant Prof. **Craig Webster**, PhD, Department of Management, Ball State University, Muncie, USA; E-mail: cwebster3@bsu.edu
Peyman Seyyedi, Allameh Tabataba'i University, Dehkade-ye Olampik, Tehran, Iran; E-mail: seyyedi.p@atu.ac.ir

2014; Ivanov, 2017; LaGrandeur & Hughes, 2017). While there is a history of machines replacing human labour (coin-operated vending machines that are found in public locations are doing the work of a hospitality worker and ATM machines have largely replaced the human labour of the bank teller), these minor mechanical improvements will pale in comparison to what will come around the corner. The next generation of technologies that are just around the corner should offer fantastic leaps in terms of technical progress and economic efficiency, although it is unclear what the economic externalities will be and what the social and market consequences of the incorporation of such technologies into the economy will be.

This paper contributes to the body of knowledge by focusing on consumers' attitudes towards the potential application of robots in hotels. The literature on robots in tourism (outside the engineering domain) is a scarce but expanding field of research. Ivanov, Webster and Berezina (2017) and Collins, Cobanoglu, Bilgihan and Berezina (2017) review the current robotic technologies used by tourism and hospitality companies and discuss the potential application of these technologies in a tourism setting. Murphy, Gretzel and Hofacker (2017) investigate conceptually the anthropomorphism of service robots in tourism and hospitality. A paper by the same authors (Murphy, Hofacker & Gretzel, 2017) provides a review the current research on robots in tourism and sets agenda for further research while Tung and Law (2017) identify the research opportunities in human-robot interactions in tourism and hospitality. Kuo, Chen and Tseng (2017) interviewed academics and practitioners in order to develop SWOT analysis of the adoption of robots by hospitality companies in Taiwan. Tussyadiah and Park (2018) focus on customers' evaluations of hotel service robots, while Tussyadiah, Zach and Wang (2017) assess people's attitudes towards self-driving taxis. In a recent paper, Ivanov, Webster and Garenko (2018) investigated young Russian adults' attitudes towards the introduction of robots in hotels. Additionally, Ivanov and Webster (2017a) focus on the design of robot-friendly hospitality facilities and Ivanov and Webster (2018) develop a cost-benefit analysis of the adoption of robots for travel, tourism and hospitality companies. Finally, Ivanov (2018) and Ivanov and Webster (2017b) emphasise that tourist companies should adopt a broader perspective of who their customer is and the possibility that in the future, they would need to treat robots as consumers. Most of these papers are either conceptual or exploratory in nature, and the empirical research in the field of robots in tourism is very limited. Hence, this paper aims to partially fill in this gap by looking at the attitudes consumers have towards the potential introduction of robots in accommodation establishments. The supply side perspective, the cost-efficiency of adoption of robots, the uncanny valley problem, and other robot-related research issues go beyond the scope of this paper.

In this article, we look into the perceptions of the public upon the introduction of robots and artificial intelligence into the hospitality and tourism industries. Since we know that a deluge of advanced technologies are coming to the industry, we should know something about the resistance that they will be met with by consumers who may be resistant to the incorporation of advanced technologies that replace a great deal of human labour. However, they may also be receptive to some technologies. In this article, we investigate how Iranians feel about the use of service robots in the hospitality industry, using a survey of 393 respondents. While research on service robots usually focuses on developed economies (e.g. USA, Western Europe, Japan, South Korea), other geographic regions like Eastern Europe, Latin America, Africa, and the Middle East are neglected in research. This paper tries to partially fill in this gap by looking at the perceptions of service robots in Iran.

In the next section, we review the literature on the use of robots and human perceptions of the desirability of robots in service industries. Then, we turn to the methods and analysis of the data resulting from the survey of Iranian consumers. Finally, we conclude, showing what the data and analysis have

shown us with regards to the Iranian population's perceptions of the introduction of robotic and artificial intelligence into the environment of the hospitality industry.

Literature review

There are several different considerations in terms of understanding and interpreting the issue of the imposition of advanced technologies such as robotics and artificial intelligence into the hospitality industry. We begin by reviewing some of the relevant literature on the psychology of tourists, to look into how the academic literature has dealt with the tourist and the thinking of the tourist in the hospitality establishment. Then, we turn towards the general academic literature linked with how consumers perceive interacting with robots and artificial intelligence. The academic literature suggests considerations for independent variables used in the research of Iranians and their perceptions of the use of robots and artificial technologies in the hospitality and tourism fields.

One of the important issues in social psychology and tourism is the attitude of the tourist. Attitudes can be defined as feelings of favourability or favourability towards a particular attitude, object, or behaviour (Ajzen & Fishbein, 2005). Some define the attitude as a set of individual thoughts on a subject that is based on an individual's assessment of that subject and its mental data; individuals are exposed to an issue over time, or by getting indirect information by others (Ajzen, 2001). Researchers have repeatedly examined attitudes and presented several definitions of such attitudes. In one of the first definitions of attitude, the psychological dimension of the human being is more importantly appreciated in the process of forming an individual's attitude of assessment (Eagly & Chaiken, 1993). In other definitions, an attitude of action towards a human being or an object or concept is considered to be a learned state (Chakraborty, Srivastava & Marshall, 2007). At any rate, there are very different ways in which consumer attitudes can be molded or influenced in the mind of the tourist and there is a great deal of literature that investigates those different influences upon consumer attitudes (see, for example, Fulk, 1993; Glasman & Albarracín, 2006; Kabadayi & Gupta, 2011; Kraus 1995; Lorenzo-Romero, Constantinides & Alarcon-del-Amo, 2011). It seems that in most definitions of attitude, evaluation is considered as an important element. In fact, what is created before the attitude is evaluation; the evaluation and the attitude that follows thereafter can form different modes. It seems that if one's assessment and attitude are closely related, then a great deal of time is not needed for the formation of attitudes, although attitudes do take time for form in the event that evaluation and attitudes are not closely related (Wittenbrink & Schwarz, 2007).

In the field of tourism studies, there is substantial literature linking behaviour and attitudes (see, for example, Bamberg, 2006; Bamberg, Ajzen & Schmidt, 2003; Kroesen & Chorus, 2018; Kroesen, Handy & Chorus, 2017). The general findings of the literature is that the identification of attitudes and their link to specific behaviours is not only difficult to measure, but that behaviours may have very little link with attitudes. What is especially interesting is that there is empirical evidence of a greater link between tourist behaviour to attitudes than from attitudes to behaviour (Kroesen et al., 2017), suggesting that behaviour has a greater impact upon attitudes than attitudes have upon behaviour. What this implies is that attitudes follow behaviours, suggesting that exposure to a hospitality concept will influence attitudes more than attitudes can be used as a predictor of behaviours or choices.

There is voluminous literature linking attitudes of consumers and managers and the adoption of new technologies (see, for example, Burner & Kumar, 2005; Cui, Bao & Chan, 2009; Denis-Rémis, 2011; Kim & Qu, 2014; Lin & Hsieh, 2006; Morosan & DeFranco, 2014; Porter & Donthu, 2006; Reisch,

Scholl & Bietz, 2011). One subset of this literature links tourism and hospitality industries with the adoption of new technologies (see, for example, Compeau, Higgins & Huff, 1999; Wang & Qualls, 2007). In both the general literature, as well as the more specific hospitality-relevant literature, the lack of previous experience with technology and the novelty of the new technologies are leitmotivs that are present in the literature. There are two different reasons that people feel an attraction to new technologies: they may feel that the new technology will increase their satisfaction, or they may feel that the novelty of a new technology, itself, is attractive. (Lin & Hsieh, 2006).

Although technology entry has been able to make people's lives easier, people are not embracing technology and do not have the same attitude toward technology that changes the way people work (Singh, 2014). Whatever the change, either negative or positive, organisations are required to be more creative and productive in order not to lose their share (Singh, 2014). It is important to address people's attitudes toward technology and study it in the hospitality and tourism industries, because the growth rate of technology used in the tourism industry is increasing and, at many destinations, widely used technology is going to be normal (Bilgihan, Cobanoglu & Miller, 2010). In recent years, there have been many reasons for using technology: the optimal use of time, cost reduction, the new flow of income (Bilgihan, Smith, Ricci & Bujisic, 2016) and hence better supply chain management (Puschmann & Alt, 2005). When looking from the consumers' side, the created attractiveness after using technology will also affect their satisfaction and may also affect their behaviour in the future (Cobanoglu, Berezina, Kasavana & Erdem, 2011). These cases point to the complexity of technology in the tourism industry, which is complicated for both the provider and the consumer (Wang & Qualls, 2007).

There is significant literature that deals specifically with the way that humans will interact with more advanced technologies, such as robots and artificial intelligence, in businesses (see, for example, De Graaf, Allouch & Klamer, 2015; Dinet & Vivian, 2014; Frennert & Östlund, 2014; Hudson, Orviska & Hunady, 2017; Katz & Halpern, 2014; Malchus, Jaecks, Wrede & Stenneken, 2013; Piçarra, 2016; Pino, Boulay, Jouen & Rigaud. 2015; Pochwatko et al., 2015; Reich-Stieber & Eyssel, 2015; Yan, Ang Jr. & Poo, 2014). This literature is vast and uses many different methods, including public opinion surveys (Hudson et al., 2017), analysis of secondary data (Yan et al., 2014), face-to-face interviews (De Graaf et al., 2015), surveys (including psychometric tests) (Pochwatko et al., 2015; Katz & Halpern, 2014), and mixed methods (Pino et al., 2015). The general consensus of the findings is that there seem to be some elements that influence perceptions of the adoption of robots and artificial intelligence technologies in service industries.

The most common element of such research is that gender seems to play a role in shaping a person's perceptions of the desirability of using robots, although there is one noteworthy article that finds that gender does not play a role in shaping perceptions of robots (Dinet & Vivian, 2014). The findings generally indicate that females are more sceptical of robots and generally resist wanting to use them in service industries. From the work of the large-scale study by Hudson et al. (2017), a study based upon Eurobarometer data, there is evidence that people in urban settings have a more favourable approach to the use of robots. From this, we can draw a hypothesis that there is something qualitatively different about the approaches that urban populations have towards robots than rural ones. Another key indicator suggested by the previous research findings is that general attitudes towards robots are a strong indicator of willingness to use robots for specific purposes (Malchus et al., 2013).

Thus, while there is much literature looking into the attitudes and the formation of attitudes in tourism and hospitality, and while there is significant literature dealing with desirability of adopting new technologies, there is precious little with regards to how consumers will be willing to interact and

use the services of robots and artificial intelligence in a hospitality/tourism environment with a few notable exceptions (e.g. Ivanov et al., 2018; Tussyadiah & Park, 2018; Tussyadiah, Zach & Wang, 2017). However, related literature suggests that there will be segments of the population that are more willing than others to have robots serve them in a hospitality/tourism environment. The most relevant literature (Ivanov et al., 2018) suggests that those with more positive predispositions towards the use of robots in the hospitality and related industries are those in big cities, males, and those with attitudes that are generally favourable towards robots. Here, we look into the impact of what is suggested from the literature—that general attitudes towards robots will positively impact upon a person's willingness to use a robot in a hotel or other tourism-related facility, that females will be somewhat less willing to use robots and AI in such establishments, and that more urban populations will be more willing to embrace robotic technologies than rural populations. We now turn to data collection and analysis to determine if there is any evidence that the hypotheses have an empirical basis in Iran.

Methodology

Data were collected during the period of January-May 2017 by contacting potential respondents face-to-face at 5 hotels in Tehran. The questionnaire was completed by the respondents on a tablet provided by the third author or the link to the online questionnaire was emailed to them if they preferred to complete the questionnaire later. The total number of submitted questionnaires was 450, of which 393 were complete and used for this research. Sample's characteristics are presented in Table 1.

Table 1
Sample characteristics

Characteristic		Number of respondents	Percent
Gender	Male	206	52.4
	Female	187	47.6
Place of living	Tehran	94	23.9
	Mashhad	17	4.3
	Isfahan	30	7.6
	Tabriz	11	2.8
	Shiraz	24	6.1
	Ahvaz	28	7.1
	Qom	6	1.5
	Other	183	46.6
Education	Diploma	158	40.2
	Associate degree	43	10.9
	Bachelor	141	35.9
	Master	12	3.1
	PhD	39	9.9
Age	18-30	272	69.2
	Over 30	121	30.8
Tourism experience (number of nights spent in hotels last 12 months)	0	30	7.6
	1-5	242	61.6
	6-10	95	24.2
	11-15	12	3.1
	16-20	3	0.8
	21+	11	2.8
Total		393	100.0

The questionnaire was initially developed in the English language and then translated into Farsi by the third author, who is a native speaker. It included several blocks of questions. The first block included questions about the respondents' attitudes towards the (potential) use of robots in general and in hotels, in particular. The second block evaluated respondents' opinions about the acceptability of various activities that robots could perform in a hotel. The third block was focused on respondents' preferences towards the appearance of the robot (machine-like vs. human-like). The fourth block evaluated the attitudes towards robots through the level of agreement (5-point Likert scale) with various statements related to robots' advantages and disadvantages compared to human service employees, and the user experience robots create in the human-robot interaction. The last block collected data about respondents' demographic characteristics.

Exploratory factor analysis, cluster analysis, and hypothesis tests were used in data analysis. The Kolmogorov-Smirnov z-test revealed that the distribution of respondents' answers were statistically different from normal. That is why the non-parametric Mann-Whitney U-test and Kruskal-Wallis χ2-test were used in the hypothesis testing (Baggio & Klobas, 2011; Gau, Gursoy & Sirakaya-Turk, 2017).

Findings

Tables 2 - 6 present the research findings.

Table 2
Attitudes towards the (potential) use of robots in hotels

Attitudes towards the (potential) use of robots in hotels	Mean	Standard deviation	Mann-Whitney U-test			Kruskal-Wallis χ2-test		
			Gender	Age	Cluster	Tourism experience	Attitudes towards service robots	Education
Personal attitude towards service robots in general [a)]	3.52	1.072	16,592**	14,221.5**	8,428***	4.773	x	9.001
Personal attitude towards being served by robots in a hotel [a)]	3.50	1.195	18,426.5	14,802.5	9,127.5***	5.232	137.408***	5.228
Robots will be faster than human employees [d)]	3.42	1.188	17,937	15,806	6,135***	7.793	62.391***	1.449
Robots will deal with calculations better than human employees [d)]	3.73	1.145	17,309	15,766.5	6,748***	6.449	70.969***	4.791
Robots will provide more accurate information than human employees [d)]	3.54	1.210	17,150.5	14,476**	6,199***	3.946	47.215***	2.118
Robots will be able to provide information in more languages than human employees [d)]	3.82	1.192	15,811***	15,359	6,439***	16.604***	60.101***	7.641
Robots will be friendlier than human employees [d)]	2.45	1.334	18,623	15,924	13,826***	13.814**	12.249**	13.312***
Robots will be more polite than human employees [d)]	3.22	1.317	19,020	16,337.5	7,461***	3.252	40.534***	2.819
Robots will be able to understand a guest's level of satisfaction [d)]	2.82	1.202	18,815.5	14,727	13,693***	15.721***	11.617**	9.519**
Robots consume too much electricity [e)]	2.67	0.988	18,312.5	16,112	13,492.5***	4.528	22.239***	3.111
Robots can malfunction during service [e)]	2.34	1.018	17,094.5**	15,562	12,914.5***	7.948	16.008***	2.740
Robots can misunderstand a question/order [e)]	2.30	0.978	17,414.5	16,158	11,707.5***	6.213	20.091***	6.980
Robots can't do special requests/ they work only in a programmed frame [e)]	1.96	1.052	17,457	14,866.5	10,335***	8.572	44.711***	17.483***

Table 2 **Continued**

Attitudes towards the (potential) use of robots in hotels	Mean	Standard deviation	Mann-Whitney U-test			Kruskal-Wallis χ2-test		
			Gender	Age	Cluster	Tourism experience	Attitudes towards service robots	Education
Being served by robots will be a memorable experience [d]	3.59	1.170	17,800	14,078**	3,549***	23.913***	65.562***	2.715
Being served by robots will be a pleasurable experience [d]	3.45	1.180	17,824.5	13,928**	3,971.5***	14.305**	67.566***	0.611
Being served by robots will be an exciting experience [d]	3.51	1.206	17,194.5	13,558.5***	3,491***	18.809***	69.962***	2.464
Preferences towards the appearance of the robots [b]	2.81	1.259	18,849.5	16,119.5	16,467**	6.834	3.866	6.458
Preferences towards the human employees-robots ratio in a hotel [c]	3.76	1.026	16,545**	15,340	16,024.5**	8.451	7.363	14.951***

Notes: 1. Coding: a) 1-completely negative, 5-completely positive; b) 1-Strongly prefer machine-like appearance of the robots, 5-Strongly prefer human-like appearance of the robots; c) 1-I prefer to be served only by robots, 5-I prefer to be served only by human employees; d) 1-completely disagree, 5-completely agree; e) reverse coding: 1-completely agree, 5-completely disagree; 2. Levels of significance: *** p<0.01, ** p<0.05.

Table 3
Clusters characteristics

Characteristic		Cluster 1 (The high-techies)		Cluster 2 (The high-touchies)		Pearson χ2-test
		Number of respondents	Percent	Number of respondents	Percent	
Gender	Male	115	49.8%	91	56.2%	1.559
	Female	116	50.2%	71	43.8%	
Place of living	Tehran	65	28.1%	29	17.9%	9.787
	Mashhad	12	5.2%	5	3.1%	
	Isfahan	20	8.7%	10	6.2%	
	Tabriz	6	2.6%	5	3.1%	
	Shiraz	14	6.1%	10	6.2%	
	Ahvaz	16	6.9%	12	7.4%	
	Qom	3	1.3%	3	1.9%	
	Other	95	41.1%	88	54.3%	
Education	Diploma	83	35.9%	75	46.3%	10.177**
	Associate degree	21	9.1%	22	13.6%	
	Bachelor	92	39.8%	49	30.2%	
	Master	10	4.3%	2	1.2%	
	PhD	25	10.8%	14	8.6%	
Age	18-30	150	64.9%	122	75.3%	4.809**
	Over 30	81	35.1%	40	24.7%	
Tourism experience (number of nights spent in hotels last 12 months)	0	22	9.5%	8	4.9%	13.772**
	1-5	128	55.4%	114	70.4%	
	6-10	68	29.4%	27	16.7%	
	11-15	6	2.6%	6	3.7%	
	16-20	2	0.9%	1	0.6%	
	21+	5	2.2%	6	3.7%	
Total		231		162		

Note: Levels of significance: ** p<0.05

The results in Table 2 reveal that respondents are receptive towards service robots (m=3.52) and their introduction in hotels (m=3.50). They also agree that robots will be able to provide information in more languages than human employees (m=3.82), will deal with calculations better than human employees

(m=3.73), and provide more accurate information than human employees (m=3.54). However, robots can work only in a programmed frame (m=1.96), can misunderstand a question/order (m=2.30) and can malfunction during service (m=2.34). As a whole, respondents are confident that being served by a robot would be a memorable (m=3.59), exciting (m=3.51) and pleasurable (m=3.45) experience for them. Nevertheless, respondents had clear preferences toward more human employees in the hotel than robots (m=3.76). In terms of appearance, respondents clearly prefer more machine-looking robots rather than humanoids (m=2.81).

Findings show that women are slightly more positive towards robots in general ($p<0.05$) and would accept a higher share of robots in the hotel than men ($p<0.05$). In terms of age, younger respondents (below 30) had less positive attitude towards robots ($p<0.05$) and were more sceptical towards the memorability ($p<0.05$), pleasure ($p<0.05$), and excitement ($p<0.01$) of their interaction with robots than older respondents. Respondents with lower education had higher expectations about the friendliness of robots ($p<0.01$), and were more optimistic in regard to robot's abilities to work outside the programmed frame ($p<0.01$). Respondents with more modest tourist experience had much higher expectations about the memorability ($p<0.01$), pleasure ($p<0.05$), and excitement ($p<0.01$) of their interaction with robots than tourists who had stayed in hotels more often. Findings also show that a strong halo effect exists: respondents who have more positive attitudes towards service robots in general are also more positive towards service robots in hotels in particular, have higher expectations about the human-robot interactions, and are more tolerant towards robots' technical disadvantages (all but one p-values are significant at 0.01).

The cluster analysis of the attitudinal statements identified two distinct clusters, the characteristics of which are depicted in Table 3. The first cluster (named the 'high-techies') includes 231 respondents. They have very high positive attitudes towards 'high-tech' service robots in general (m=3.94) and robots in hotels, in particular (m=3.94), hence the name of the group. The second cluster (named the 'high-touchies') is more sceptical toward service robots in general (m=2.93) and in hotels, in particular (m=2.87), and prefer the high-touch human-delivered service, hence the name of the group. The Mann-Whitney U-test values in Table 2 show that the differences in the attitudes of the two groups are significant at $p<0.01$.

Table 4
Factor analysis results

Factors	Factor loading	Cronbach's alpha	Eigenvalue	Variance explained
FACTOR 1: Robots' advantages		0.860	5.816	41.543%
Robots will provide more accurate information than human employees	0.808			
Robots will be able to provide information in more languages than human employees	0.771			
Robots will deal with calculations better than human employees	0.757			
Robots will be faster than human employees	0.681			
Robots will be more polite than human employees	0.680			
FACTOR 2: Experience		0.940	1.870	13.358%
Being served by robots will be an exciting experience	0.881			
Being served by robots will be a pleasurable experience	0.865			
Being served by robots will be a memorable experience	0.849			
FACTOR 3: Robots' disadvantages		0.798	1.247	8.909%
Robots can malfunction during service	0.844			
Robots can misunderstand a question/order	0.838			
Robots consume too much electricity	0.685			
Robots can't do special requests/they work only in a programmed frame	0.665			

Table 4 **Continued**

Factors	Factor loading	Cronbach's alpha	Eigenvalue	Variance explained
FACTOR 4: Social skills of robots		0.636	1.148	8.203%
Robots will be friendlier than human employees	0.820			
Robots will be able to understand a guest's degree of satisfaction	0.757			
Total variance explained				72.012%

Notes: a) Coding: 1-completely disagree, 5-completely agree; b) Extraction method: Principal Component Analysis; c) Rotation method: Varimax with Kaiser Normalization. Rotation converged in 6 iterations; d) KMO Measure of Sampling Adequacy=0.865; Bartlett's Test of Sphericity: $\chi 2$=3045.517, df=91, p=0.000.

Table 5
Regression analysis results
Dependent variable: Personal attitude towards being served by robots in a hotel

	Model 1						Model 2					
	Unstandardized coefficients		Standardized coefficients	t	Collinearity statistics		Unstandardized coefficients		Standardized coefficients	t	Collinearity statistics	
Independent variables	**B**	**Std. error**	**Beta**		**Tolerance**	**VIF**	**B**	**Std. error**	**Beta**		**Tolerance**	**VIF**
(Constant)	3.499	0.053		65.869***			1.479	0.234		6.324***		
FACTOR 1: Robots' advantages	0.392	0.053	0.328	7.378***	1.000	1.000	0.200	0.051	0.167	3.930***	0.860	1.162
FACTOR 2: Experience	0.373	0.053	0.312	7.021***	1.000	1.000	0.197	0.051	0.164	3.834***	0.844	1.185
FACTOR 3: Robots' disadvantages	-0.117	0.053	-0.098	-2.206**	1.000	1.000	-0.004	0.049	-0.003	-0.083	0.941	1.062
FACTOR 4: Social skills of robots	0.157	0.053	0.131	2.947***	1.000	1.000	0.144	0.049	0.121	2.968***	0.937	1.067
Personal attitude towards service robots in general							0.536	0.052	0.480	10.367***	0.724	1.380
Gender							0.102	0.096	0.043	1.063	0.966	1.035
Age							0.017	0.105	0.007	0.164	0.950	1.052
Education							0.018	0.039	0.019	0.464	0.887	1.127
Tourism experience							0.006	0.011	0.021	0.513	0.926	1.080
Model summary characteristics												
R	0.482						0.637					
R2	0.232						0.405					
Adjusted R2	0.224						0.391					
Standard error of the estimate	1.053						0.933					
df	4						9					
N	393						393					
F	29.319***						28.982***					

Notes: ***Significant at 1% level; ** Significant at 5% level.

The factor analysis of the attitudinal statements (Table 4) has identified four factors, namely: 'Robots' advantages', 'Experience', 'Robots' disadvantages', and 'Social skills of robots'. The four factors explain in total 72.012% of the observed variation in respondents' answers. The Cronbach's alpha is high for the first 3 factors (0.860, 0.940 and 0.798), while for the fourth it is 0.636, which is considered acceptable for exploratory studies like the current one (Uysal & Sirakaya-Turk, 2017, p. 338). The regression analysis (Table 5, Model 1) shows that 'Robots' advantages', 'Experience', and 'Social skills of robots' have a positive and statistically significant impact on respondents' attitudes towards being served by robots in hotels (all three p-values<0.01), while, expectedly, 'Robots' disadvantages' has

negative influence ($p<0.05$). However, when we control for respondents' demographic characteristics and their attitudes towards service robots in general (Table 5, Model 2), we see that attitude towards hotel robots is explained by four variables only: 'Robots' advantages', 'Experience', 'Social skills of robots' and personal attitude towards service robots in general; 'Robots' disadvantages' is not a significant factor. The two models explain 22.4% and 39.1% of the variation in the dependent variable. The tolerance and VIF indicate no issues in regard to multicollinearity.

Table 6
Directions of robot application in hotels

Directions of robot application in hotels	Mean	Standard deviation	Mann-Whitney U-test			Kruskal-Wallis χ2-test		
			Gender	Age	Cluster	Tourism experience	Attitudes towards service robots	Education
Reception								
Welcoming / greeting a guest	3.11	1.357	18,962.5	15,898.5	11,265***	18.304***	39.290***	2.197
Check-in	3.19	1.311	17,006**	16,179.5	99,84.5***	4.127	75.060***	4.002
Guiding to the room	3.29	1.355	16,345.5***	14,271.5**	9,297***	9.904	88.914***	1.508
Luggage carrying	3.93	1.181	16,698.5**	16,344	9,440***	13.913**	101.114***	9.626**
Providing information about hotel facilities	3.67	1.198	17,191.5	16,342	8,938***	7.000	73.881***	2.921
Providing information about the destination	3.62	1.198	16,308.5***	16,068.5	8,625.5***	11.596**	59.870***	7.185
Concierge services (ordering tickets, taxis)	3.48	1.208	16,229.5***	15,487.5	8,008***	6.396	71.581***	5.349
Processing cash payments	3.57	1.217	15,142.5***	15,054	9,087.5***	14.873**	62.878***	11.689**
Processing card payments	3.69	1.200	16,672.5**	14,201.5**	8,452.5***	12.943**	67.916***	13.367***
Check-out	3.34	1.247	15,879.5***	15,012.5	9,438.5***	12.959**	59.368***	3.632
Housekeeping								
Cleaning the common areas of the hotel	3.85	1.174	17,048.5**	14,080**	7,056***	11.732**	84.643***	9.977**
Cleaning the room	3.75	1.168	15,875***	15,446.5	8,823.5***	12.797**	72.870***	8.068
Taking customer orders for laundry	3.63	1.173	16,109***	14,901	7,916***	11.215**	76.348***	9.783**
Delivering ready laundry	3.68	1.180	17,079**	15,854	6,815***	6.103	67.465***	10.416**
Taking customer orders for new towels, linen, etc.	3.71	1.181	15,705.5***	14,808	7,443***	8.728	83.735***	10.371**
Delivering new towels, linen, etc.	3.70	1.175	16,738**	14,247**	6,454.5***	14.947**	95.467***	11.915**
Food and beverages								
Delivering food and drinks in room service	3.59	1.179	16,327.5***	14,900.5	7,468.5***	8.211	78.011***	8.889
Welcoming / greeting a guest in the restaurant	3.26	1.324	17,106**	16,022	9,262***	13.848**	45.051***	3.948
Guiding guests to the table in the restaurant	3.36	1.244	17,447.5	15,920	8,068.5***	7.952	54.452***	1.213
Taking orders in the restaurant	3.36	1.230	15,828***	15,065	7,566***	11.694**	69.770***	1.038
Serving food in the restaurant	3.28	1.239	16,748.5**	15,802	7,902***	7.962	57.346***	0.789
Serving drinks in the restaurant/bar	3.27	1.217	17,157	16,378	8,409***	10.170	61.666***	2.204
Making drinks (coffee, tea, cocktails) in the bar	3.31	1.234	17,268	15,609.5	7,994.5***	14.180**	59.996***	4.561
Cleaning the table	3.67	1.119	17,153	15,485.5	7,487.5***	10.672	76.762***	4.003

Table 6 **Continued**

Directions of robot application in hotels	Mean	Standard deviation	Mann-Whitney U-test			Kruskal-Wallis χ2-test		
			Gender	Age	Cluster	Tourism experience	Attitudes towards service robots	Education
Additional services								
Provide massages	3.14	1.356	19,101	15,775.5	11,363***	4.668	30.480***	7.193
Serve as guards / security	3.30	1.286	17,166	15,801.5	9,561***	6.353	62.994***	2.646
Provide gardening services	3.46	1.233	17,666.5	16,309	8,029***	9.331	58.205***	6.537

Notes: 1. Coding: 1-completely unacceptable, 5-completely acceptable; 2. Levels of significance: *** p<0.01, ** p<0.05.

The final point in our analysis relates to the directions of robot application in hotels, which respondents find acceptable (Table 6). Results clearly show that respondents would prefer robots to deal with activities that put the human in a dominant position in the human-robot interaction and do not involve the human body, such as: *a*) *cleaning* – cleaning the common areas (m=3.85), rooms (m=3.75), tables (m=3.67), *b) moving items* – luggage carrying (m=3.93), delivering new towels, linen, etc. (m=3.70), delivering food and drinks in room service (m=3.59), *c) provision of information* about hotel facilities (m=3.67) and the destination (m=3.62), *d) taking customer orders* for new towels, linen, etc. (m=3.71) and for laundry (m=3.63), and *e) processing payments* by card (m=3.69) and cash (m=3.57). On the other hand, less support receive activities that require the human to follow the orders of a robot guard (m=3.30), to temporarily subordinate his/her body to a robot to provide massages (m=3.14), or activities that create the first impression of a service like welcoming / greeting guests (m=3.11). Again, women, respondents above 30, people with more positive attitudes towards robots in general, and the high-techies are more supportive of the use of robots in the hotel in the majority of their application. Results for education and tourism experience are mixed and no tendency can be derived.

Discussion

Women have a slightly more positive attitude towards service robots, which is an unexpected result. While most prior studies have indicated that males are usually more receptive of technological advancements (Hudson et al., 2017; Ivanov et al., 2018; Katz & Halpern, 2014; Piçarra, 2016; Pochwatko et al., 2015), these findings generally support the findings of Dinet and Vivian (2014). Our data cannot confirm why it is that this Iranian sample seems to be an anomaly, with the exception of the findings of Dinet and Vivian (2014), we can conjecture that there is something about the social mores in Iran that plays a role. However, further studies of this sort using similar measures may find that the findings are reproduced elsewhere, as well. Indeed, as robots continue to penetrate our everyday lives, the female resistance to them may decrease over time, so this could also be suggestive of a secular trend of acceptance of robots by women.

Another unexpected result was that respondents below 30 were a bit more sceptical towards robots than respondents above 30. This also contradicts several prior studies which show that younger generations are tech-savvy and more receptive of innovations (Hudson et al. 2017; Reich-Stieber & Eyssel, 2015). However, it is consistent with the findings of Brandl, Mertens and Schlick (2016). The findings in Iran may be found to be true elsewhere, as future research may find.

Robots' advantages are a more important driver of respondents' attitudes than robots' disadvantages, according to the findings of this research. This is somewhat interesting, as it suggests that Iranian respondents saw the positive elements of robots while generally ignoring their weaknesses. Additionally, the findings were consistent with findings from previous studies that general attitudes towards robots

positively impact upon attitudes towards using robots for specific purposes (Malchus et al., 2013). It seems that a generally positive attitude towards robots and artificial intelligence gives a person a penchant for accepting robots to be used for particular/specific services. With regards to previous research that is most similar to this research (Ivanov et al., 2018), we see the similarity in the findings in that generalized attitudes towards robots seems to act as an attitude to enable people to accept the usage of robots in hospitality and tourism. So, it seems that in this sense the empirical data show that there is evidence among the Russians and Iranians surveyed that positive attitudes towards robots in general lead to positive attitudes towards robots in hospitality and tourism. While this may seem to be an intuitively obvious thing, the empirical data show, so far, that there is strong reason to believe that the general positively influences the specific, when it comes to attitudes towards using robots and artificial intelligence in a service environment.

Conclusion

Contribution

This paper contributes to the body of knowledge on the acceptance of robots by investigating the attitudes of Iranians towards the potential introduction of robots in accommodation establishments. The findings indicate that Iranians have mixed attitudes towards being served by robots in hotels, and these attitudes are driven mostly by their perceptions of robots' advantages, robots' social skills, expectations about human-robot interaction, and respondents' attitudes towards service robots in general. Gender, age, tourism experience, and education are not strong predictors to attitudes, although some statistically significant differences in respondents' answers have been identified. Results also identified the activities that Iranians mostly accept to be delivered by robots (those that put the human in a dominant position in the human-robot interaction and do not involve the human body, like cleaning, moving items, provision of information, taking customer orders, and processing payments), while activities that require the human to follow the orders of a robot, to subordinate his/her body to a robot, or activities that create the first impression of a service receive less support. Finally, findings revealed two groups of respondents, named the high-techies and the high-touchies, on the basis of their attitudes towards service robots.

Managerial implications

From a managerial perspective, results suggest that hotel robots would receive acceptance by Iranian tourists. Hotel managers that would like to introduce robot-delivered services would need to start with those services and activities which would face least resistance by the tourists, namely cleaning, provision of information, delivery of items / food / drinks to the room, and processing payments. The robots need to have a more machine-like than human-like appearance. On the other hand, results suggest that two distinct groups of Iranian tourists exist in regard to their attitudes towards robots—those that are quite receptive of this new technology ('high-techies') and those that prefer the human interaction ('high-touchies'). Therefore, it would be wise for hotel managers not to substitute human labour with robots (and lose the high-touchies customers), but to enhance the human employees by providing robots that can help them increase their work performance, rather than replace them. In this way, the introduction of robots would not face resistance by employees as well. A balance between human and robotic labour is necessary in order for the accommodation establishments to be able to serve both customer groups. Additionally, having a human employee at disposal, rather than relying on robots only, decreases the operational risk for the company because the human employee could step into the

service delivery process if the robot has malfunctioned, misunderstood the customer request, or the service process is too complicated for the robot. Furthermore, the results of the factor analysis indicate that, in their marketing communications, accommodation establishments that use robots would need to emphasise more on the robots' advantages, their social skills, and the experiences they create. However, the huge and statistically significant differences in the two clusters' attitudes and preferences towards robot-delivered services suggest that it would be difficult for accommodation establishments to serve both customer groups simultaneously for a long time, without hurting the level of satisfaction of either group. We can expect that in the future hotels would be divided into high-tech (mostly robot-delivered services) and high-touch (mostly human-delivered services) properties which would make their market positioning clearer for their target market segments.

Limitations and future research directions

The sample includes only Iranian respondents, hence, the results cannot be generalized beyond this specific cultural context. Further research can focus on the attitudes of people towards hotel robots in other countries in order to evaluate whether the attitudes are culturally specific. Another interesting research point would be to replicate the same study in the future, when accommodation establishments start using robots more often, in order to assess the change of the attitudes of Iranians before and after the introduction of robots. Finally, future research may focus on other tourism characteristics activities such as F&B outlets, guide services, travel agencies, museums and galleries, car rental, etc.

Acknowledgements:

This article is developed within the frame of Project BG05M2OP001-1.002-0008-C01 "Centre for Competence and Intelligent Solutions for the Creative and Recreational Industries (INCREA)". The project has been funded within Operational Programme "Science and Education for Smart Growth (2014-2020)" and with support from the European Commission. The publication reflects the views only of the authors and the Commission cannot be held responsible for any use which may be made of the information contained therein.

References:

Ajzen, I. (2001). Nature and operation of attitudes. *Annual Review of Psychology, 52*(1), 27–58.

Ajzen, I. & Fishbein, M. (2005). The influence of attitudes on behavior. In D. Albarracín, B. T. Johnson & M. P. Zanna (Eds.), *The handbook of attitudes* (pp. 173-221). Mahwah, NJ: Erlbaum.

Baggio, R. & Klobas, J. (2011). *Quantitative methods in tourism. A handbook*. Bristol: Channel View Publications.

Bamberg, S. (2006). Is a residential relocation a good opportunity to change people's travel behavior? Results from a theory-driven intervention study. *Environment and Behavior*, *38*(6), 820-840.

Bamberg, S., Ajzen, I. & Schmidt, P. (2003). Choice of travel mode in the theory of planned behavior: The roles of past behavior, habit, and reasoned action. *Basic and Applied Social Psychology*, *25*(3), 175-187.

Bilgihan, A., Cobanoglu, C. & Miller, B. L. (2010). Importance-performance analysis of guest entertainment technology amenities in the lodging industry. *FIU Hospitality Review*, *28*(3), 84-108.

Bilgihan, A., Smith, S., Ricci, P. & Bujisic, M. (2016). Hotel guest preferences of in-room technology amenities. *Journal of Hospitality and Tourism Technology*, *7*(2), 118-134.

Brandl, C., Mertens, A. & Schlick, C. M. (2016). Human-robot interaction in assisted personal services: factors influencing distances that humans will accept between themselves and an approaching service robot. *Human Factors and Ergonomics in Manufacturing & Service Industries*, *26*(6), 713-727.

Bruner, G. C. & Kumar, A. (2005). Explaining consumer acceptance of handheld internet devices. *Journal of Business Research*, *58*(5), 553-558.

Brynjolfsson, E., McAfee, A. & Cummings, J. (2014). *The Second Machine Age: Work, Progress, and Prosperity in a Time of Brilliant Technologies*. New York, NY: W. W. Norton & Company.

Chakraborty, G., Srivastava, P. & Marshall, F. R. (2007). Are drivers of customer satisfaction different for buyers/users from different functional areas? *Journal of Business & Industrial Marketing, 22*(1), 20-28.

Cobanoglu, C., Berezina, K., Kasavana, M. L. & Erdem, M. (2011). The impact of technology amenities on hotel guest overall satisfaction. *Journal of Quality Assurance in Hospitality & Tourism*, *12*(4), 272-288.

Collins, G. R., Cobanoglu, C., Bilgihan, A. & Berezina, K. (2017). *Hospitality information technology: Learning how to use it* (8th ed.). Dubuque, IA: Kendall/Hunt Publishing Co. Chapter 12: Automation and Robotics in the Hospitality Industry (pp. 413-449).

Compeau, D. R., Higgins, C. A. & Huff, S. (1999). Social cognitive theory and individual reactions to computing technology: a longitudinal study. *MIS Quarterly*, *23*(2), 145-158.

Cui, G., Bao, W. & Chan, T. S. (2009). Consumers' adoption of new technology products: the role of coping strategies. *Journal of Consumer Marketing*, *26*(2), 110-120.

De Graaf, M. M. A., Allouch, S. B. & Klamer, T. (2015). Sharing a life with Harvey: Exploring the acceptance of and relationship-building with a social robot. *Computers in Human Behavior*, *43*, 1-14.

Denis-Rémis, C. (2011). Relation of Green IT and affective attitude within the technology acceptance model: the cases of France and China. *Management & Avenir*, *9*, 371-385.

Dinet, J. & Vivian, R. (2014). Exploratory investigation of attitudes towards assistive robots for future users. *Le travail humain*, *77*(2), 105-125.

Eagly, A. H. & Chaiken, S. (1993). *The psychology of attitudes*. Belmont, CA: Wadsworth Cengage Learning.

Frennert, S. & Östlund, B. (2014). Review: Seven matters of concern of social robots and older people. *International Journal of Social Robotics*, *6*(2), 299-310.

Fulk, J. (1993). Social construction of communication technology. *Academy of Management Journal*, *36*(5), 921-950.

Gau, J. M., Gursoy, D. & Sirakaya-Turk, E. (2017). Relationship analysis: t-tests, analysis of variance, cross tabulations and non-parametric tests. In E. Sirakaya-Turk, M. Uysal, W. E. Hammitt & J. J. Vaske (Eds.), *Research methods for leisure, recreation and tourism* (2nd ed.) (pp. 284-303). Wallingford: CABI.

Glasman, L. R. & Albarracin, D. (2006). Forming attitudes that predict future behavior: A meta-analysis of the attitude-behavior relation. *Psychological bulletin*, *132*(5), 778-822.

Hudson, J., Orviska, M. & Hunady, J. (2017). People's attitudes to robots in caring for the elderly. *International Journal of Social Robotics*, *9*(2), 199-210.

Ivanov, S. (2018). *Tourism beyond humans – robots, pets and Teddy bears*. Paper presented at the International Scientific Conference "Tourism and Innovations", 14-15th September 2018, College of Tourism – Varna, Varna, Bulgaria. Retrieved from https://ssrn.com/abstract=3215437.

Ivanov, S. (2017). Robonomics – principles, benefits, challenges, solutions. *Yearbook of Varna University of Management*, *10*, 283-293.

Ivanov, S. & Webster, C. (2017a). Designing robot-friendly hospitality facilities. *Proceedings of the Scientific Conference "Tourism. Innovations. Strategies", 13-14 October 2017, Bourgas, Bulgaria (pp. 74-81).*

Ivanov, S. & Webster, C. (2017b). The robot as a consumer: a research agenda. *Proceedings of the "Marketing: experience and perspectives" Conference*, 29-30 June 2017, University of Economics-Varna, Bulgaria (pp. 71-79).

Ivanov, S. & Webster, C. (2018). Adoption of robots, artificial intelligence and service automation by travel, tourism and hospitality companies – a cost-benefit analysis. In V. Marinov, M. Vodenska, M. Assenova & E. Dogramadjieva (Eds), *Traditions and Innovations in Contemporary Tourism (pp. 190-203). Cambridge Scholars Publishing.*

Ivanov, S., Webster, C. & Berezina, K. (2017). Adoption of robots and service automation by tourism and hospitality companies. *Revista Turismo & Desenvolvimento*, *27/28*, 1501-1517.

Ivanov, S., Webster, C. & Garenko, A. (2018) Young Russian adults' attitudes towards the potential use of robots in hotels. *Technology in Society* (forthcoming). DOI: https://doi.org/10.1016/j.techsoc.2018.06.004

Kabadayi, S. & Gupta, R. (2011). Managing motives and design to influence web site revisits. *Journal of Research in Interactive Marketing*, *5*(2/3), 153-169.

Katz, J. E. & Halpern, D. (2014). Attitudes towards robots suitability for various jobs as affected robot appearance. *Behaviour and Information Technology*, *33*(9), 941-953.

Kim, M. & Qu, H. (2014). Travelers' behavioral intention toward hotel self-service kiosks usage. *International Journal of Contemporary Hospitality Management*, *26*(2), 225-245.

Kraus, S. J. (1995). Attitudes and the prediction of behavior: A meta-analysis of the empirical literature. *Personality and Social Psychology Bulletin*, *21*(1), 58-75.

Kroesen, M. & Chorus, C. (2018). The role of general and specific attitudes in predicting travel behavior–A fatal dilemma? *Travel Behaviour and Society*, *10*, 33-41.

Kroesen, M., Handy, S. & Chorus, C. (2017). Do attitudes cause behavior or vice versa? An alternative conceptualization of the attitude-behavior relationship in travel behavior modeling. *Transportation Research Part A: Policy and Practice*, *101*, 190-202.

Kuo, C.-M., Chen, L.-C. & Tseng, C.-Y. (2017). Investigating an innovative service with hospitality robots. *International Journal of Contemporary Hospitality Management*, *29*(5), 1305-1321.

LaGrandeur, K. & Hughes, J. J. (Eds.) (2017). *Surviving the Machine Age. Intelligent Technology and the Transformation of Human Work*. London: Palgrave Macmillan.

Lin, J.-S. C. & Hsieh, P. (2006). The role of technology readiness in customers' perception and adoption of self-service technologies. *International Journal of Service Industry Management*, *17*, 497–517.

Lorenzo-Romero, C., Constantinides, E. & Alarcon-del-Amo, M. (2011). Consumer adoption of social networking sites: implications for theory and practice. *Journal of Research in Interactive Marketing*, *5*(2/3), 170-188.

Malchus, K., Jaecks, P., Wrede, B. & Stenneken, P. (2013) Application of social robots in speech and language therapy?! An investigation into speech and language pathologists' attitudes towards embodied agents [Einsatz sozialer Roboter in der Sprachtherapie?! Erhebung eines Stimmungsbildes von SprachtherapeutInnen] *L.O.G.O.S. Interdisziplinair*, *21*(2), 106-116.

Morosan, C. & DeFranco, A. (2014). Understanding the actual use of mobile devices in private clubs in the US. *Journal of Hospitality and Tourism Technology*, *5*(3), 278-298.

Murphy, J., Gretzel, U. & Hofacker, C. (2017). *Service Robots in Hospitality and Tourism: Investigating Anthropomorphism*. Paper presented at the 15th APacCHRIE Conference, 31 May-2 June, Bali, Indonesia. Retrieved from http://heli.edu.au/wp-content/uploads/2017/06/APacCHRIE2017_Service-Robots_paper-200.pdf.

Murphy, J., Hofacker, C. & Gretzel, U. (2017). Dawning of the age of robots in hospitality and tourism: challenges for teaching and research. *European Journal of Tourism Research*, *15*, 104-111.

NPR. (2011) *Science Diction: The Origin of The Word 'Robot'*. Retrieved from https://www.npr.org/2011/04/22/135634400/science-diction-the-origin-of-the-word-robot.

NPR. (2015) Map*: The Most Common Job in Every State*. Retrieved from https://www.npr.org/sections/money/2015/02/05/382664837/map-the-most-common-job-in-every-state.

Piçarra, N., Giger, J.-C., Pochwatko, G. & Gonçalves, G. (2016) Making sense of social robots: A structural analysis of the layperson's social representation of robots [Donner un sens aux robots sociaux: une analyse structurelle de la représentation sociale des robots]. *Revue Europeenne de Psychologie Appliquee*, *66*(6), 277-289.

Pino, M., Boulay, M., Jouen, F. & Rigaud, A.-S. (2015). "Are we ready for robots that care for us?" Attitudes and opinions of older adults toward socially assistive robots. *Frontiers in Aging Neuroscience*, *7*, article 141.

Pochwatko, G., Giger, J.-C., Różańska-Walczuk, M., Świdrak, J., Kukiełka, K., Możaryn, J. & Piçarra, N. (2015). Polish version of the negative attitude toward robots scale (NARS-PL). *Journal of Automation, Mobile Robotics and Intelligent Systems*, *9*(3), 65-72.

Porter, C. E. & Donthu, N. (2006). Using the technology acceptance model to explain how attitudes determine Internet usage: the role of perceived access barriers and demographics. *Journal of Business Research*, *59*, 999-1007.

Puschmann, T. & Alt, R. (2005). Successful use of e-procurement in supply chains. *Supply Chain Management: an International Journal*, *10*(2), 122-133.

Reich-Stiebert, N. & Eyssel, F. (2015). Learning with educational companion robots? Toward attitudes on education robots, predictors of attitudes, and application potentials for education robots. *International Journal of Social Robotics*, *7*(5), 875-888.

Reisch, L. A., Scholl, G. & Bietz, S. (2011). 'Better safe than sorry': Consumer perceptions of and deliberations on nanotechnologies. *International Journal of Consumer Studies*, *35*(6), 644–654.

Singh, V. (2014). "We are not phobic but selective": the older generation's attitude towards using technology in workplace communications. *Development and Learning in Organizations: An International Journal*, *28*(4), 18-20.

Solon, O. (2016, 17 Jun). Self-driving trucks: what's the future for America's 3.5 million truckers? *The Guardian*. Retrieved from https://www.theguardian.com/technology/2016/jun/17/self-driving-trucks-impact-on-drivers-jobs-us.

Tung, V. W. S. & Law, R. (2017). The potential for tourism and hospitality experience research in human–robot interactions. *International Journal of Contemporary Hospitality Management*, *29*(10), 2498-2513.

Tussyadiah, I. P., Zach, F. K. & Wang, J. (2017). Attitudes toward autonomous on demand mobility system: the case of self-driving taxi. In R. Schegg & B. Strangl (Eds.), *Information and Communication Technologies in Tourism 2017*. Proceedings of the International Conference in Rome, Italy, January 24–26, 2017 (pp. 755-766).

Tussyadiah I. P. & Park S. (2018) Consumer evaluation of hotel service robots. In: B. Stangl & J. Pesonen (eds) *Information and Communication Technologies in Tourism 2018* (pp. 308-320). Cham: Springer.

Uysal, M. & Sirakaya-Turk, E. (2017). Factor analytical procedure and scale reliability. In E. Sirakaya-Turk, M. Uysal, W. E. Hammitt & J. J. Vaske (Eds.), *Research methods for leisure, recreation and tourism* (2nd ed.) (pp. 320-347). Wallingford: CABI.

Wang, Y. & Qualls, W. (2007). Towards a theoretical model of technology adoption in hospitality organizations. *International Journal of Hospitality Management*, *26*(3), 560-573.

Wittenbrink, B. & Schwarz, N. (2007). Introduction. In B. Wittenbrink & N. Schwarz (Eds.), *Implicit measures of attitudes* (pp. 1–13). New York: The Guilford Press.

Yan, H., Ang Jr., M. H. & Poo, A. N. (2014). A Survey on perception methods for human-robot interaction in social robots. *International Journal of Social Robotics*, *6*(1), 85-119.

Received: 3/5/2018
Accepted: 2/7/2018