İSTANBUL UNIVERSITY PRESS

Journal of Tourismology
JOT 2023, 9 (1), 1–11
DOI: 10.26650/jot.2023.9.1.1191050

RESEARCH ARTICLE

The Effect of Attitude and Acceptability of Robot Use in Restaurants on Behavioral Intention

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ABSTRACT

In recent years, it has been seen that technology-based tools have started to take place frequently in our daily lives. This situation is more prominent in organizations such as food and beverage producing human-oriented services. With the increase in technological awareness, it is observed that the tendency of individuals who are curious about creativity and innovation towards businesses that provide smart robotic services is increasing. The aim of this research is to determine the effect of attitude and acceptability of the use of robots in restaurants on behavioral intention. In line with the purpose of the research, relationships were determined with the help of data obtained from the scales developed on the subject. Based on the literature review, five hypotheses were developed. Relationships were tested with the path analysis created within the scope of structural equation modelling. The acceptability of robot use in restaurants by customers has a significant positive effect on behavioral intention, and this variable has the greatest effect on behavioral intention. In addition, "experience" and "advantage" dimensions of attitude towards robot use have significant positive effects, "disadvantage" dimension has a negative effect on behavioral intention. Lastly, according to R-square, 82.6% of behavioural intention is explained by attitudes and acceptability towards the use of robots in restaurants.

Keywords: Robots, Robot Use in Restaurants, Attitude, Acceptability and Behavioral Intention

Introduction

In the service sector, where technological developments are constantly increasing, personalized services for changing consumer demands related to technology are offered with innovative approaches (Sándor et al., 2017). Especially, food and beverage businesses that try to provide their consumers with satisfaction-oriented service are structuring their business processes in line with the latest technological developments. In this context, it is very important to closely follow robotic applications in order to increase the quality of service in the sector where there is an intense competition and not to fall behind. It can be stated that robotic technologies have started to be used in many areas where tourism activities take place (Bowen & Whalen, 2017). There are similar situations for food and beverage businesses, which are one of the most important elements of the tourism sector. For this reason, robotic service applications powered by artificial intelligence and autonomous applications are accepted as a compulsion beyond the necessity for these businesses (Li et al., 2017).

It is very important for the continuity of the enterprises that a product or service produced in the service sector is accepted and satisfied by the customers. For this purpose, businesses use technological tools that can provide customer satisfaction and positively affect their behavioral intentions (Sudari et al., 2019). Robotic vehicles, on the other hand, have recently come to the fore as the most frequently used technological devices in the services sector (Rüßmann et al., 2015; Zeng et al., 2020). The reason for this is both the customers' interest in technology and the quality perception of robotic services. Although there are scientific studies in the literature on the use of robotic vehicles (Yuh, 1990; Feddema et al., 2002; Duchoň et al., 2012), studies related to food and beverage businesses are limited (Bogue, 2009; Cheong et al., 2015; Iqbal et al., 2017). The studies on service robots are still in its infancy, and using user-generated content as a data source is innovative and worth exploring (Huang et al., 2021). Therefore, there is a lack of research on the robotic restaurant experience in the current literature (Seyitoğlu & Ivanov, 2020). It is thought that more research is needed to establish a comprehensive theory (Lu et al., 2020).

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Submitted: 18.10.2022 • **Revision Requested:** 28.12.2022 • **Last Revision Received:** 17.01.2023 • **Accepted:** 17.01.2023 • **Published Online:** 03.03.2023

Considering the gaps within the literature, the current study employs the technology acceptability model from a new perspective. Although it is stated that the use of robotics in food and beverage businesses brings satisfaction to customers in many different ways, it has not been concluded whether it fully affects their behavior or not (Kim, 2021). At this point, the research is evaluated with an innovative perspective by revealing original information about the issue. The outputs obtained from the study offer valuable empirical evidence about the technology acceptability model, and robot use in restaurants to both the tourism industry and tourism researchers.

Conceptual Framework

Robots are designed by human beings to perform the tasks they need to improve living conditions (Ficocelli et al., 2015). In addition to providing benefits to people in terms of physical strength and job stress, it also helps to set service quality at a certain level due to the absence of emotion (Scopelliti et al., 2005). Moreover, it is possible to say that a healthier environment is formed with regard to communication due to the fact that robots provide services to everyone on equal terms without prejudices. Nowadays tourism enterprises take these situations into account and follow innovative technology applications and robotic services more intensely (Blöcher & Alt, 2021).

In order to maintain quality standards in food and beverage businesses, many methods such as mobile infrastructures containing various smart applications, wireless calls, robot waiters, individual ordering systems and web-based menus are applied. For the purpose of providing robotic service in restaurants, the first application and action commands are uploaded to the robot. The robot tries to complete the task by following the procedures related to these directions. It is expected that the products loaded on the robot will be delivered to the right destination and served. In this process, the recognition of the space and the features of the area are recorded. Service activities are completed with the delivery process of the products that are successfully taken to the destination (Kamruzzaman & Tareq, 2017).

Robotic services are categorized as mobile robots and industrial robots on two main criteria. Service robots, on the other hand, are used as technological tools with an interface that can carry out industrial and mobile robot features (Hajduk et al., 2013). In this context, service robots that can provide services are demanded by organizations to be beneficial to people and to facilitate the business process of food and beverage businesses. Service robots are accepted as smart devices and act as auxiliary tools in food and beverage activities (Singh et al., 2020). In addition to their contributions to the business process, service robots come into play so as to cope with the challenging conditions that arise in human physiology and to help at the point of work efficiency. Robotic services used in food and beverage businesses offer the opportunity to reduce workload, save time for employees, standardize processes, minimize human-induced errors, reduce employee stress, and specialize in jobs that require skills (Fernando et al., 2016).

In line with service procedures and quality standards, some restaurants use robotic tools, which are technological tools, and classify them according to the type of tasks. In this regard, some of the various robotic tools are summarized as follows (Kılıçhan & Yılmaz, 2020).

The robot bartender can take beverage orders, prepare and serve them correctly. With its advanced coding, detection and preparation capacity, it can serve accurately. *The packaging robot* plays a role in transporting products or services needed in restaurants from one point to another. It fulfills the missions undertaken for desk service, room services and different areas. , this robotic service, which was used for the first time in Singapore, can cook the desired meals and prepare the most suitable product for the recipe. It provides an important service at the point of preparing the meals in a standard way. *The robot waiter* plays a serious role in food and beverage businesses where human physique is insufficient or the desired service quality is not achieved. Robot waiters, whose work process is defined correctly, can provide all the services required by waiter services in these businesses. In addition, they can set standards in service quality because they can perceive different languages and do not reflect their emotions. *Robot hostesses* are one of the technological tools that are frequently used in food and beverage businesses in recent years. They are used especially to guide and welcome guests, as well as to increase sales. According to another view, robotic services in food and beverage businesses are expressed in Figure 1.

With the adoption of robotic technology in restaurants, food and beverage activities have gained a different dimension. Orders from the restaurant have started to be taken by robots. In this context, a well-known pizza brand has accepted customer orders by including a robot with voice recognition and artificial intelligence features. Besides, payments through the robotic service have been begun to be received via credit cards. After this development, many food and beverage businesses have diversified their preparation, cooking and serving services by using robotic service tools. In addition, the Covid-19 pandemic that emerged in 2019 has also allowed an increase in robotic services due to its contagious nature (Singh et al., 2021). Due to infectious diseases and deadly viruses, people have been paying more attention to cleanliness and hygiene factors recently. For this reason, robotic vehicles that do not carry diseases and harmful substances in terms of health give confidence to people (Feng & Wang, 2020).

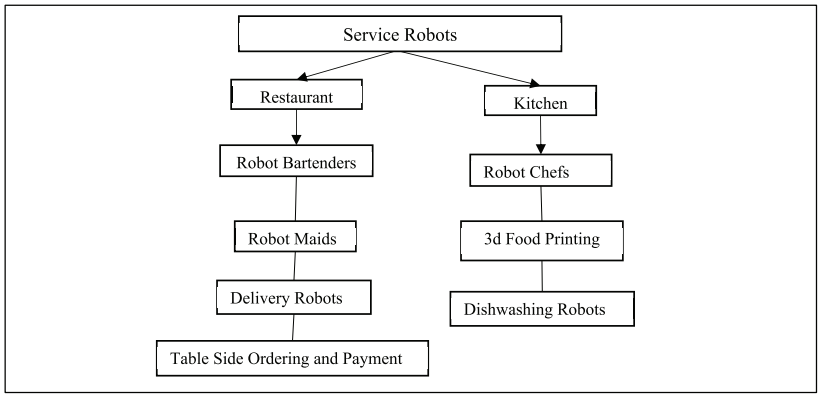

Figure 1. Service automation in food and beverage. **Source:**Ivanov, et al., 2017; Authors.

Robotic processes are used through the use of robotic mopping devices, contactless delivery of food and beverages, cleaning the physical space and vacuuming airborne viruses. Therefore, robotic devices play an important role in creating a contactless customer experience by providing navigation assistance and voice command support (Srivastava et al., 2021). Innovative robotic systems also come to the fore with hygiene practices in the preparation process of food and other products in food and beverage businesses (Gray & Pekkeriet, 2016).

With the transfer of the physical workforce to robotic vehicles thanks to technological developments, the experience of consumers in this regard has started to increase. In this way, consumers can transmit their requests and orders to robots using smart applications and autonomous systems. In addition, robotic services can reveal social behavior by interacting with humans. Thus, individuals who feel the need for socialization are satisfied with the systematic and strategically effective display of communication between service robots and consumers (Luo et al., 2021).

Literature Review and Hypotheses

Experience

Robotic service has reshaped the customer experience in the tourism (Borghi & Mariani, 2021). The use of robots in the service of food and beverage can enable strong service capacity, high efficiency and precise service delivery. In this way, by providing a good service experience to customers, it can lead to positive behavioral intentions (Guan et al., 2021). El-Said & Al Hajri (2022), in their study of customers with dining experience in restaurants where robots are used in the service department, noted that perceived benefit, service speed and experience innovation have a direct effect on satisfaction. The perceived value of experiencing robots in restaurants positively affects attitude. Moreover, the introduction of new technologies such as robot butlers to the service industry can has significant effects on guest behaviors and attitudes (Çakar & Aykol, 2020).

H_1: Perceived attitude towards the experience of using robots in restaurants has a positive and significant effect on behavioral intention.

Disadvantage

The perceptions of customers coming to food and beverage businesses towards robot service providers affect their intention to use them (Seyitoğlu et al., 2021). The possibility of robots providing inefficient or poor service and causing unnecessary problems may lead customers to avoid such technologies (Guan et al., 2021). Hwang, Kim, Kim & Kim (2021) state that risk factors perceived by customers in terms of privacy, financial, temporal, performance and psychological have negative effects on attitudes and behaviors.

H_2: Perceived attitude towards the disadvantages of using robots in restaurants has a negative and significant effect on behavioral intention.

Advantage

Robotic services enormously improve the quality of the service provided. This positively affects revisit intentions in the context of customer loyalty behaviors (Çakar & Aykol, 2020). It has been confirmed that the perceived value of customers' robotic

technology used in restaurants (such as animation, cuteness, intelligence, safety) has a positive effect on satisfaction and revisit intention (Jang & Lee, 2020). Besides, De Kervenoael et al., (2020) states that the perceived usefulness of robots increases their value and this, in turn, affects the behavioral intentions of visitors.

H_3: Perceived attitude towards the advantages of using robots in restaurants has a positive and significant effect on behavioral intention.

Social Skill

The use of artificial intelligence (AI) and robots in restaurants is not yet widely used. However, managers are looking for new ways to leverage these technologies to provide differentiation and excellence in service. In addition, in restaurant businesses, social and emotional skills are often given importance in order to achieve excellence in bilateral relations and interaction (between the service staff and the customer), hospitality, customer satisfaction and loyalty (Blöcher & Alt, 2021). Thus, managers prefer to use robots except for tasks that require social skills and emotional intelligence (Ivanov et al., 2020). The acceptance of the use of robots in service processes by customers depends on how well robots can meet social-emotional and relational needs (Wirtz et al., 2019). Lu, Zhang & Zhang, (2021) emphasize that the human characteristics of robotic service personnel are the main determinants of preference and that features such as human voice affect the evaluation of the service received and behavioral intentions.

H_4: The perceived social skill attitude towards the use of robots in restaurants has a positive and significant effect on behavioral intention.

Acceptability of Robot Use

Although the use of robots is seen as one of the most important trends for service marketers, customer acceptance for the application of robots in service scenarios is still an important issue to examine (Li and Wang, 2021). In the study conducted to identify the factors affecting the acceptance of robots used in businesses; attitude, usefulness and perceived values among all variables were determined as the factors that have the greatest impact on acceptance (Zhong et al., 2020). Furthermore, the perceived benefit and innovativeness of the technology used has positively influenced the acceptance intention (Sung & Jeon, 2020). Technology acceptance is recognized as a vital factor that determines consumers' intention to use a new technology introduced. Hence, it has been determined that consumers with high technology acceptance have higher purchase intentions than those with low technology acceptance (Zhong et al., 2020).

H_5: The acceptability of robot use in restaurants has a positive and significant effect on behavioral intention.

Methodology

Based on the theoretical background and literature, 5 hypotheses were established. Figure 2 shows the conceptual model developed for this research. For the purpose of empirically assessing the relations in the conceptual model, measurement items were adapted from the current literature and included in a survey. To measure four dimensions (experience, disadvantage, advantage, and social skill) of attitudes towards robot use, 15 items from Ivanov, Webster and Garenko (2018) were adapted. Acceptability of robot use scale (8 items) was also adapted from Ivanov, Webster and Garenko's study. Behavioral intention was measured using 3 items adapted from Lee- Wingate & Xie (2013). All the items were rated using a 5-point Likert type scale (1– strongly disagree to 5 – strongly agree). In addition, the survey includes questions (sex, marital status, age and education) regarding the demographic characteristics of the participants.

This study employs a quantitative method and a self-administered survey to collect data. Convenience sampling method, one of the non-random sampling techniques, was used in the study. In convenience sampling, data are collected from the population in the easiest, fastest and most economical way. The data were collected from individuals who agreed to participate in the research. The survey was prepared online, and the data were collected between January-February 2022. The prepared questionnaire was shared on various social media platforms. As a result of the sharing, a total of 477 valid responses were gathered. 50.1% (239 respondents) of which were completed by females. Out of 477 respondents, 251 (52.6%) respondents were single, 2020 (42.3%) respondents were between 18 and 29 years old, and 237 (49.7%) respondents were university graduates. Therefore, ethics committee approval was received for this study from the Harran University in 2021 (2021/172).

In an attempt to assess overall measurement quality and test the hypothesized relationships, a two-step approach (Anderson & Gerbing, 1988) was applied. In the first step, confirmatory factor analysis (CFA) was performed to test the validity of the

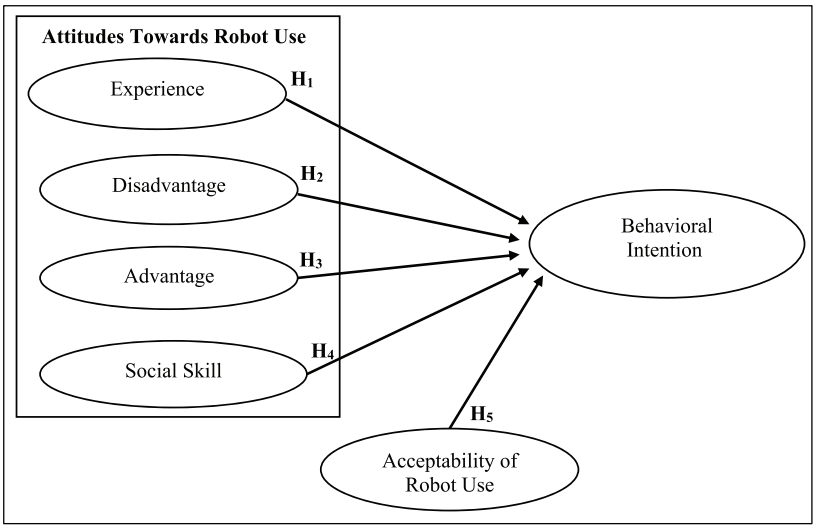

Figure 2. Conceptual model of the study. **Source:**Authors' Own Compilation from Literature Review

measurement scales. Then, structural equation modelling (SEM) was conducted to investigate the relationships hypothesized in the model proposed.

Results

The first step in analyzing the data was the analysis of the measurement model through confirmatory factor analysis (CFA). The CFA results revealed a good model fit with the CFA chi-square at 810.374 with 209 degrees of freedom ($p<.001$) and $x^2/df=3.877<5$ (Hair et al., 2010). Besides, other goodness of fit (GoF) statistics indicated a good theoretical model fit based on the reference values ($0.90 <CFI <1$, $0.90 < NFI < 1$, $0.90 < IFI < 1$, $0.95 < TLI < 1$, $RMSEA < 0.08$) (Hair et al., 2010). The results are presented in Table 1.

Table 1. *CFA Results for the Model's GoF*

GoF Statistics	*Results*
X^2/df	3.877
Comparative Fit Index (CFI)	0.946
Normed Fit Index (NFI)	0.929
Incremental Fit Index (IFI)	0.946
Tucker-Lewis Fit Index (TLI)	0.966
Root Mean Square Error of Approximation (RMSEA)	0.078

Source: Created by the Authors.

The reliability of the scales was evaluated by Cronbach's Alpha and Composite Reliability (CR). As described in Table 2, all Cronbach's Alpha values are greater than 0.7, and all CR values are greater than 0.60, so it is said to demonstrate reliability (Nunnally, 1970). The validity of the scales was assessed with two methods as convergent validity and discriminant validity by investigating the AVE (Average Variance Extracted) of each construct. All AVEs are greater than the 0.50 standard for all of the constructs proposed, so the convergent validity of the structure is considered sufficient (Fornell & Larcker, 1981). Also, the factor loadings of all measures were significant at the $p<.001$ level and above 0.70. The results are presented in Table 2.

In order to secure discriminant validity, the values of the square roots of AVEs were compared with inter-construct correlation. Correlation between constructs must be smaller than the square roots of the AVE value for each construct (Fornell & Larcker, 1981). As shown in Table 3, all correlations between pairs of constructs were less than the corresponding square roots of AVEs.

Consequently, all findings confirm that the measurement model represents satisfactory convergent, discriminant validity and reliability. After confirmatory factor analysis (CFA), in the second step, structural equation modelling (SEM) was employed to test the five hypotheses. The conceptual model developed for the research affirmed significant relations among variables except for H_4 Table 4 summarizes the results of testing the hypotheses.

Finally, the effect of "Experience, Disadvantage, Advantage, Social Skill and Acceptability" variables on "Behavioral Intention"

Table 2. *Reliability and Convergent Validity of the Scales*

Constructs and scale items	**Standardized Loadings***	**AVE**	**CR**	**Cronbach's Alpha**
Attitudes towards Robot Use				
Experience		0.705	0.870	0.904
Being served by robots will be an interesting experience.	0.741			
Being served by robots will be a memorable experience.	0.858			
Being served by robots will be a pleasurable experience.	0.875			
Being served by robots will be an exciting experience.	0.879			
Disadvantage		0.506	0.814	0.749
Robots consume too much electricity.	0.731			
Robots can malfunction during service.	0.795			
Robots can misunderstand a question/an order.	0.506			
Robots can't do special requests/they work only in a programmed frame.	0.561			
Robots can't understand a guest's emotions.	0.545			
Advantage		0.655	0.823	0.860
Robots will be faster than human employees.	0.825			
Robots will deal with calculations better than human employees.	0.863			
Robots will provide more accurate information than human employees.	0.785			
Robots will be able to provide information in more languages than human employees.	0.761			
Social Skill		0.562	0.746	0.704
Robots will be friendlier than human employees.	0.643			
Robots will be more polite than human employees.	0.844			
Acceptability		0.728	0.893	0.951
I would like the home delivery service to be done by robots.	0.838			
I would like the guests to be greeted by robots in the restaurant.	0.854			
In the restaurant, I would like the guests to be guided to the tables by robots.	0.866			
I would like robots to take orders at the restaurant.	0.870			
I would like the food service in the restaurant to be done by robots.	0.885			
I would like the beverage service in the restaurant and bar to be done by robots.	0.904			
I would like the drinks (coffee, tea, cocktail) to be prepared by robots at the bar.	0.908			
I would like the tables to be cleaned by robots.	0.682			
Behavioral Intention		0.773	0.853	0.910
I have positive impressions of restaurants where robots are used.	0.810			
I would revisit restaurants where robots are used.	0.880			
I recommend restaurants where robots are used to other people.	0.943			

***:** All factor loadings are significant at the 0,001 level, N=477. **Source:** Created by the Authors.

Table 3. *Discriminant Validity (Fornell-Larcker Criterion)*

		1	2	3	4	5	6
1	Experience	**0.839**					
2	Disadvantage	0.158	**0.711**				
3	Advantage	0.561	0.056	**0.809**			
4	Social Skill	0.326	0.252	0.364	**0.749**		
5	Acceptability	0.672	0.324	0.515	0.575	**0.853**	
6	Behavioral Intention	0.728	0.243	0.630	0.590	0.779	**0.879**
Note: The square roots of all constructs' AVEs are in bold along the diagonal. Lower diagonal values indicate factor correlations. **Source:** Created by the Authors.							

was analyzed in line with the purpose of the study. Structural equation modeling (SEM) was employed for the analysis. The final model along with standardized path coefficients is illustrated in Figure 3.

Table 4. *Hypotheses Test Results*

Hypothesis	Path	Standardized Coefficients	t-value	Hypothesis Supported
H_1	Experience → Behavioral Intention	0.330^{**}	6.938	YES
H_2	Disadvantage → Behavioral Intention	-0.159^{**}	3.574	YES
H_3	Advantage → Behavioral Intention	0.251^{**}	3.164	YES
H_4	Social Skill → Behavioral Intention	0.081^{NS}	1.520	NO
H_5	Acceptability → Behavioral Intention	0.454^{**}	7.639	YES

Note: **p<0.001, NS = non-significant. **Source:** Created by the Authors.

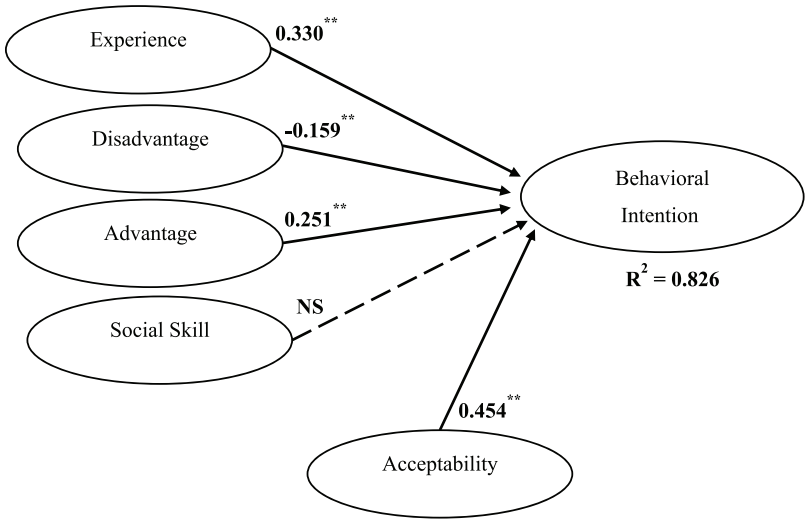

Figure 3. Path results of structural model. **p<0.001, NS=non-significant. **Source:** Created by the Authors.

The statistical results ensure empirical validation for the approval of the fifth hypothesis, with a significant positive impact of acceptability of robot use on behavioral intention (0.454, p<0.01). This variable has the greatest effect on behavioral intention (0.454, p<0.01). This variable has the greatest effect on behavioral intention. The experience variable is the most prominent variable among the attitudes towards robot use with the highest coefficient (0.330, p<0.01). Lastly, according to R-square, 82.6% of behavioral intention is explained by attitudes and acceptability towards the use of robots in restaurants.

Conclusion

The purpose of this study is to determine the effect of attitudes and acceptability towards the use of robots in restaurants on behavioral intention. Based on the literature review, five hypotheses were developed. Relationships were tested with the path analysis created within the scope of structural equation modelling. The structural model affirmed significant relationships between variables except for H4. Social Skill does not have a significant effect on the behavioral intention. The finding can be interpreted as participants do not believe that robots have as many social skills as humans do.

The acceptability of the use of robots in restaurants by customers positively and significantly affects behavioral intention. This variable has the greatest influence on behavioral intention. In addition, experience and advantage dimensions of attitude towards robot use have significant positive effects, and the disadvantage dimension has a negative effect on behavioral intention.

Theoretical Implications

The research sheds light on the literature in determining the effect of customers' attitude and acceptability regarding the use of robots in restaurants on their behavioral intentions. Restaurants are gradually including robots into their operational processes by using them not only as waiters, but also as chefs in the kitchen during the service phase. Stakeholders (service providers and

customers) need to act together in order to robotize experiences in food and beverage businesses, which are important parts of the tourism industry (Fusté-Forné, 2021). In the study, it has been concluded that the factor of experiencing robots has an effect on behavioral intention. Restaurants offering robotic services are able to offer different experiences to their customers (Seyitoğlu & Ivanov, 2020). The more customers perceive and experience service robots as useful, the more they tend to visit restaurants where robots are used (Seo & Lee, 2021). The use of service robots in restaurants is largely expressed with the positive experiences of customers (Huang et al., 2021). Different experiences provided to customers increase the attractiveness of businesses.

The opinions of customers on the functional value of robots, namely their advantages, have an impact on their behavioral intentions. In terms of service procurement, it is very important for robots to facilitate and accelerate processes, provide accurate information (Zhu & Chang, 2020), improve cleaning, hygiene and communication opportunities (Zemke et al., 2020) and improve service quality. Such advantages can affect the customer's attitude towards robots and enrich the experience. However, despite the expectations of efficient, effective and quality service by robots, there have been many failures that have negatively affected customers' perceptions and satisfaction levels. For instance, failures in human-robot interaction, the difficulties to create value together, especially the perception and experience of older customers pose some disadvantages (Lu et al., 2020). Thus, the negative situations that robots may cause during service also affect the behavioral intention of customers. Businesses should control such positive and negative situations that can have an impact on customers' behavioral intentions. Creating a control system is crucial for the sustainability of the enterprise.

Another conclusion reached in the study is that social skill does not have a significant effect on behavioral intention. This finding can be interpreted as the participants do not believe that robots have as many social skills as humans do. The impression of customers when they meet and interact with service workers provides some clues about the service they will receive. This situation greatly affects the perceptions and satisfaction levels of customers (Park et al., 2021). Robots used in the service field today are programmed machines. Therefore, since robots do not have human characteristics such as the ability to feel and think, they cannot empathize with customers and help to solve unexpected problems (Fusté-Forné, 2021). Therefore, it can be said that their social skills are not fully developed yet. While service robots perform well in providing functional value, their social interaction skills need to be improved (Huang et al., 2021).

Finally, within the scope of the research, it was determined that the acceptability of robot use had a significant positive effect on behavioral intention. Customers' intention to use robots in restaurants depends on their feelings of trust, their enjoyment of interacting with robots, and their attitudes towards the use of robots (Seyitoğlu, Ivanov, Atsız & Çifçi, 2021). Lee, Lin & Shih (2018) similarly emphasize that the attitude towards the use of robots in restaurants has a positive effect on perceived usefulness and acceptance.

Practical Implications

The innovation of robotic technologies attracts customers to restaurants (Seyitoğlu et al., 2021). In particular, the attractiveness, unforgettable experience, distinctiveness of the ambiance, and food-related features (Seyitoğlu, & Ivanov, 2020) make the use of robots attractive. Robots offer a significant competitive advantage for restaurants. In this sense, businesses can make a sectoral difference by making the right investments. Jain, Liu-Lastres & Wen (2021) state that the use of robots in service processes plays an important role in enriching dining experiences and can enable higher levels of satisfaction. Technologies that restaurants will use in reception, service, kitchen and payment processes can contribute to standardizing services, minimizing errors, creating hygienic conditions and enriching the experience.

Limitations and Future Research Within the scope of the research, the effect of attitude and acceptability towards the use of robots in restaurants on behavioral intention has been examined. Future studies may examine variables that may have an impact on behavioral intention, such as experience innovation, customers' perceptions of prestige, and generational differences. Besides, the study was limited to restaurants. The research can be applied to different areas within the tourism industry such as travel agencies and animation services. Finally, when restaurants implement robots in their operations, they may face the expectation of price reductions (labor cost savings obtained through robotization, etc.) demanded by customers for robotized service (Seyitoğlu et al., 2021). Therefore, such economic expectations of customers can be analyzed.

Ethical Approval: Ethics committee approval was received for this study from the Harran University in 2021 (2021/172). No financial support for the study was received from any institution.
Peer Review: Externally peer-reviewed.
Conflict of Interest: The authors have no conflict of interest to declare.
Grant Support: The authors declared that this study has received no financial support.

Author Contributions: : Conception/Design of study: A.E., M.B.; Data Acquisition: A.E., M.B.; Data Analysis/Interpretation: F.Ş.; Drafting Manuscript: F.Ş., M.B.; Critical Revision of Manuscript: A.E.; Final Approval and Accountability: A.E., A.Ş.

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How cite this article

Erdem, A., Barakazi, M., & Seker, F. (2023). The effect of attitude and acceptability of robot use in restaurants on behavioral intention. *Journal of Tourismology, 9*(1), 1-11. https://doi.org/10.26650/jot.2023.9.1.1191050