

Understanding the robotic restaurant experience: a multiple case study

Faruk Seyitoğlu and Stanislav Ivanov

Abstract

Purpose – *The purpose of this study is to investigate the robotic restaurant experience of travellers around the world and understand the components of robotic restaurant experience.*

Design/methodology/approach – *Travellers who had experienced a robotic restaurant were purposefully selected as a sample group for the study. As the robotic restaurants are limited around the world, multiple case study method has been chosen to gather richer data. A user-generated content technique which is a form of qualitative case study method has been benefited to gather data from travellers' reviews.*

Findings – *The results reveal a model of components of robotic restaurant experience that include six main themes: attraction for kids, robotic system, memorable experience, ambience related attributes, food related attributes (economic value and gastronomic aspects) and deficiencies (in robotic system, in ambience related attributes and in food related attributes).*

Originality/value – *This paper is one of the first to investigate the robotic restaurant experience of travellers around the world. Moreover, it contributes to the research on restaurant experience and offers a model of components of the robotic restaurant experience.*

Keywords *Multiple case study, Service robots, Online reviews, Thematic content analysis, Restaurant experience, Robotic restaurant*

Paper type *Research paper*

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1. Introduction

Customer experience is defined as the overall experience which is formed through the interaction with service providers (Yrjölä *et al.*, 2019). The literature stresses that experiences may influence customers' decisions and behaviours (Helkkula, 2011; Gentile *et al.*, 2007); therefore, understanding the experience of customers is beneficial for managers, entrepreneurs, and destination planners (Yrjölä *et al.*, 2019).

Dining is an important integral element of the travel experience and it is one of the top five tourist activities while travelling (Vu *et al.*, 2019). Furthermore, travellers spend a significant amount of their overall budget on food and beverages (Seyitoğlu and Ivanov, 2020b; Coughlan and Saayman, 2018). In this respect, restaurants are playing an important supportive role for travellers through offering not only food and beverages but also enjoyable and memorable experiences (Karamustafa and Ülker, 2020) which customers may easily share on social media platforms (Nemeschansky, 2020). The literature indicates that the dining experience of customers has a close relationship with restaurant attributes which are affecting customers' satisfaction and future behavioural intentions (Kwun and Oh, 2006; Chen and Hu, 2010). It is shaped by various factors such as restaurant's food-related attributes, service quality, the staff, ambience related attributes, location, and the presence of other customers (Yrjölä *et al.*, 2019; Zhang *et al.*, 2019).

Recently, the tourism and hospitality industry has been affected significantly by the growth of information communication technologies (Buhalis and Law, 2008). The use of technology

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is seen beneficial in terms of competitive advantage, efficiency and creating a unique hospitality experience (Yu and Ngan, 2019). Defined as “actuated mechanism programmable in two or more axes with a degree of autonomy, moving within its environment, to perform intended tasks” (International Organization for Standardization, 2012), a robot is not a peculiarity in hospitality businesses any more. Currently, hospitality companies start to adopt service robots for various activities such as housekeeping attendants, bellboys, guides, hosts, porters, cooking staff, room servers, waiters, etc. (Ivanov and Webster, 2019c; Ivanov *et al.*, 2017; Lu *et al.*, 2019; Drexler and Lapré, 2019). The COVID-19 pandemic is expected to stimulate robot adoption in the future even further for cleaning, disinfection and provision of physically distant services (Seyitoğlu and Ivanov, 2020a; Zeng *et al.*, 2020). Therefore, naturally, the number of studies on service robots in hospitality and tourism industry is growing (Chan and Tung, 2019; Choi *et al.*, 2019; Ivanov *et al.*, 2019; Li *et al.*, 2019; Lu *et al.*, 2019; Murphy *et al.*, 2019; Murphy *et al.*, 2017; Tung and Law, 2017; Tung and Au, 2018; Yu and Ngan, 2019; Zhong *et al.*, 2020).

On the other hand, there is an extensive literature related to restaurant experience (Andersson and Mossberg, 2004; Jeong and Jang, 2011; Jin *et al.*, 2012; Kim and Jang, 2019; Pantelidis, 2010; Ryu and Han, 2011). However, despite the growing research on service robots in a restaurant context (Berezina *et al.*, 2019; Eksiri and Kimura, 2015; Lee *et al.*, 2018; Mathath and Fernando, 2017; Tuomi *et al.*, 2019), there is a lack research on the robotic restaurant experience in the current literature. In the restaurant dining experience, there is human-to-human contact between employees and customers. On the other hand, in the robotic restaurants, the frontline employees (waiters) are not human anymore. In this respect, the context of the robotic restaurant experience completely differs from the restaurant dining experience. Thus, the restaurants providing robotic services may enable different aspects of experiences to their customers. This makes it necessary to learn about visitor experience in robotic restaurants which will be helpful to guide restaurant businesses to increase the quality of experiences they provide to their customers. This study aims to partially fill in this research gap.

In light of the above discussion, this paper aims to investigate the robotic restaurant experience of consumers. In particular, the paper delves into how customers perceive the use of robotics in restaurants and how robotics contributes to their dining experience. The rest of the paper is organised as follows. Section 2 provides a focused review of the literature on customer experiences in robotic restaurants. Section 3 explains the methodology. Section 4 presents and discusses the findings, while Section 5 elaborates on paper’s theoretical contribution, managerial implications, limitations and future research directions and concludes the paper.

2. Literature review

2.1 Restaurant dining experience

Food has always been a necessary part of travel and the culinary experience provided in a destination attracts tourists (Cohen and Avieli, 2004; Hu *et al.*, 2009; Seyitoğlu, 2020). Restaurants allow customers to learn about different cultures via food from various regions which enable customers to have authentic and unique experiences (Ingerson and Kim, 2016). Restaurant dining experience is a multidimensional concept, that has various attributes that are determining the perception of customers (Yrjölä *et al.*, 2019), namely, service staff, cleanliness, location, décor, environment, atmosphere, food taste and menu (Andersson and Mossberg, 2004; Ryu and Jang, 2008; Heung and Gu, 2012). It is possible to group these attributes under three main categories such as ambience, food, and service-related attributes which are accepted as indicators of the quality of restaurant experience (Ryu *et al.*, 2012).

Ambience-related attributes refer to the physical aspects of the restaurants such as décor and interior, music, cleanliness, air quality, exterior view of employees, signs, facility aesthetics, comfort, temperature, noise, view, type of lighting and dining equipment (Heung and Gu, 2012; Jin *et al.*, 2015; Kim and Moon, 2009; Ryu and Jang, 2008; Ryu *et al.*, 2012). The quality of ambience-related attributes may be defined as customers' evaluations about the performance of the restaurant's physical environment (Yrjölä *et al.*, 2019). It is stressed in the literature that from the ambience-related attributes acoustic conditions, lighting, appropriate temperature, cleanliness, and décor are the most significant components determining the dining experience (Jin *et al.*, 2015). Therefore, creating and providing a dining area that offers a high standard of ambience to customers is vital for restaurant businesses (Zhang *et al.*, 2019).

The food-related attributes include the dimensions of food such as taste, freshness, menu content, food variety, portion sizes, and nutrition value. Further, the evaluation of customers related to these issues determines the food quality in restaurants (Yrjölä *et al.*, 2019), which is considered as one of the most significant components of the dining experience (Zhang *et al.*, 2019). As the third main component of the restaurant dining experience, service-related attributes include service speed, service failures and staff attitudes and abilities. These attributes influence the level of service quality in restaurants (Yrjölä *et al.*, 2019). Service quality has been defined as the judgment of customers towards the excellence or superiority of the service (Ribeiro and Prayag, 2019).

Among these attributes, the food-related attributes are considered the most important factors in dining experiences (Oh *et al.*, 2019), because customers pay significant attention to food presentation, taste, freshness, healthiness, portion sizes, menu variety, etc. (Namkung and Jang, 2007); however, the other attributes contribute to the quality of the restaurant dining experience as well (Longart *et al.*, 2018). For example, Choi and Zhao (2010) point out that cleanliness, service, ambience, price, and health issues are indicators of the restaurant experience of customers.

In summary, according to the related literature, many factors such as food quality, service, price, cleanliness, atmosphere, menu content, and health issues are shaping the restaurant experience (Choi and Zhao, 2010; Vu *et al.*, 2019). Besides, service quality, comfort, atmosphere, décor and location are vital elements in the creation of memorable restaurant experiences (Nemeschansky, 2020). Furthermore, the perceptions of customers about the restaurant attributes are accepted as one of the most significant concepts to understand the behaviour of customers (Ingerson and Kim, 2016). Therefore, knowing the effective restaurant attributes may help managers to develop more specific strategies to address customers' expectations (Vu *et al.*, 2019). Additionally, being aware of the components of the dining experience is seen as vital for the success of restaurants (Zhang *et al.*, 2019).

2.2 Robots in restaurant dining experience

The technological development has led the tourism and hospitality services to a future economy in which artificial intelligence and robots might be used at all stages of the service process (Kazandzhieva and Filipova, 2019). As experiencing service robots in daily life or hotels is a unique and new experience, customers may then want to interact with robots (Choi *et al.*, 2019) because they may feel more comfortable with robotic service and have a positive perception of robots (Kazandzhieva and Filipova, 2019). However, although robotic technology is developing, people are still unfamiliar with robotic devices, thus interacting with them does not happen frequently in their life. This makes the experience extraordinary and has the potential to enhance the satisfaction level of customers (Choi *et al.*, 2019). Additionally, as robots are considered novel, extraordinary, and unique, guests may have memorable experiences when they encounter robots in various tasks in a service environment (Sthapit, 2017), including in hospitality (Tung and Law, 2017; Tung and Au, 2018) and restaurant context.

Due to advances in artificial intelligence and robotics (Miller and Miller, 2017; Russell and Norvig, 2016), many tasks in a restaurant are possible to automate (Xiao and Kumar, 2019). Depending on their technological features, restaurant robots can serve, cook, take dirty dishes, host guests, dance, communicate with customers, etc. (Berezina *et al.*, 2019). Robot chefs prepare noodles, burgers, coffee, sushi, grill and mix drinks (Ivanov *et al.*, 2017). However, prior studies have indicated that not all tasks in a restaurant are considered by customers as appropriate for robotization. For example, based on a global sample of over 1,000 respondents, Ivanov and Webster (2019b) found that customers considered the most suitable application of robots in a restaurant context the following activities: cleaning the table, providing information about the menu and taking the orders; while serving the food and, especially, cooking food were considered as least appropriate for robotization. Moreover, the perceived appropriateness of robot application in a restaurant context influenced positively respondents' intention to use service robots (Ivanov and Webster, 2019a). Therefore, although the literature says that service robots may be used for creating experiences in hospitality (Tung and Law, 2017; Tung and Au, 2018), some activities are not acceptable for robotization and may lead to a potential loss of human contact (Tussyadiah, 2020) and customers' dissatisfaction with the dining experience.

3. Methodology

This study was designed to answer the question about the kind of experiences that robotic restaurants offer to their guests and to identify the components of the robotic restaurant experience. That is why inductive approach was chosen as a research approach, while travellers who had experienced a robotic restaurant around the world were purposefully selected as a sample group for the study. As robotic restaurants are limited around the world, multiple case studies have been chosen as a research strategy to gather richer data from more restaurants around the world. Case studies are considered as an appropriate research strategy to analyse social phenomena (Creswell, 2009). As travellers consult widely with user-generated content (UGC) to help them make travel decisions (Yoo and Gretzel, 2011), UGC is accepted as a significant source of information for travellers and tourism firms (Narangajavana *et al.*, 2019). Lately, travellers are mostly relying on UGC platforms and websites, to gather the information that is needed to make travel decisions (Assaker, 2019). Thus, the present study adopted the analysis of online reviews of robotic restaurants as an analytical technique.

On the other hand, the restaurant reviews are considered as valuable data resources to explore effectively and comprehensively the dining experiences of travellers (Vu *et al.*, 2019). That is why for the present qualitative case study, the authors focused on the reviews posted by customers who had experienced robotic restaurants. The data were gathered from tripadvisor.com which is one of the most popular review websites (Jeacle and Carter, 2011). Moreover, previous studies on robots in tourism have analysed customer reviews as well (Bhimasta and Kuo, 2019; Yu, 2020).

The data of this study were gathered between the 18th and 29th of November 2019 from travellers' online reviews in English ($n = 582$) posted between June 2012 and November 2019, describing experiences they had from 13 robotic restaurants. Three of the restaurants operated in India, three in Thailand, two in Malaysia, two in the USA, and the rest of them operated in Nepal, Canada, and Sweden. Table 1 presents the characteristics of restaurants included in the analysis. The data were collected from reviews starting from the beginning of November 2019 working back to older reviews. As it was decided that the themes and sub-themes were clear and theoretical saturation had been reached (Glaser and Strauss, 1967), the sampling was stopped after the 582nd review.

The comments were analysed through thematic content analysis which is the technique often benefited to investigate the textual data to shape structures and categories

Table 1 Restaurants included in the analysis

No. of restaurants	Location	Cuisine type	No. of reviews	Period of the reviews
1	Toronto, Canada	Japanese cuisine	31	03.09.2018–20.11.2019
2	Coimbatore, India	Chinese and Hindu cuisines	11	29.09.2018–18.11.2019
3	Chennai, India	Chinese and Thai cuisines	15	06.01.2018–05.10.2019
4	Jaipur, India	Mexican, Indian and Asian cuisines	24	01.08.2018–22.10.2019
5	Ipoh, Malaysia	Chinese cuisine	29	12.09.2016–12.11.2019
6	Kuala Lumpur, Malaysia	Cantonese and Malaysian cuisines	310	24.10.2018–29.11.2019
7	Kathmandu, Nepal	Indian and Nepalese cuisines	17	11.08.2019–23.08.2019
8	Bang Lamung, Thailand	Thai cuisine	4	08.03.2015–28.06.2018
9	Bangkok, Thailand	Japanese cuisine	77	09.08.2012–30.09.2019
10	Pattaya, Thailand	Chinese and Japanese cuisines	2	05.01.2019–03.08.2019
11	Brookhaven, Georgia, USA	Italian and American cuisines	5	18.02.2019–15.08.2019
12	Boston, Massachusetts, USA	Indian and Latin cuisines	46	07.05.2018–14.10.2019
13	Lidköping, Sweden	Indian and Thai cuisines	11	29.04.2016–13.10.2018

related to phenomenon (Stepchenkova *et al.*, 2009). At the initial stage of the analysis, after choosing the unit of analysis, the narratives of travellers were collected from TripAdvisor and transferred to a Word file. An inductive content analysis (Thomas, 2006) of the reviews was simultaneously performed by three independent human coders who have experience in qualitative data analysis and methods to determine themes and sub-themes. For example, the statements such as “the kids wanted to see the robots”, “kids really enjoyed when they saw Robo”, “my son loves robots”, “the robot was fun for the kids”, “kids seem excited when the robot serve”, “great place to bring the kids” were coded under the theme of “attraction for kids”. After coders’ agreement of emerged categories and sub-categories, the results have been reported and findings are written (Elo *et al.*, 2014).

4. Findings

The data analysis revealed that the travellers’ comments could be classified into six major categories: “attraction for kids,” “robotic system,” “memorable experience,” “ambience related attributes,” “food related attributes (economic value and gastronomic aspects)” and deficiencies (in robotic system, in ambience related attributes and in food related attributes).

4.1 Attraction for kids

Most of the travellers assert that robotic restaurants are attractive places for kids. As parents expressed, children are the main motivation sources for them to visit robotic restaurants. It is clear from the statements of travellers that kids wanted to see robots, they really enjoyed them, had fun, took pictures with robots, etc. In particular, customers commented that:

[...].The key attraction is the dancing robot serving us. [...] The kids were extremely thrilled and curious by the robot [...]. [C201].

We came here merely for the robotic waitresses [...]. The kids would love the robots and the environment [C94].

A great number of restaurant customers mentioned that robots had the potential to distract children which enables a better dining experience for parents. For instance, customer 172 [C172] says that:

[. . .] if you have kids, this appears to be a great place to bring children as they will be distracted by the robots going around the restaurant delivering food orders and taking guests to their table [. . .] [C172].

Several other customers indicate that robots were entertaining and keep kids excited because robots are not only serving but also dancing. For example, C236 hints that “It’s fun to watch the robots serve and do the dance. Quite entertaining and keeps kids excited and busy [. . .]” [C236]. Some additional comments which show that robots are fun for kids are given below:

Admittedly this has become more of a tourist attraction, than a serious place to eat! But it’s great fun to see the robot deliver your food and the food itself is what you would expect from a (Thai) Japanese restaurant [. . .] a fun experience for the kids rather than a place to sample Japanese cuisine [. . .]. They even dance to Gangnam Style! [C235].

The kids enjoyed the meal here, just because of the robo [. . .][. . .]. However, the robot service will make up for it. When we were there the robot did a Gangnam style dance, which, was entertaining. Try to spread out your orders to get more attention from the robot [. . .] [C260]

These findings confirm findings in prior studies that service robots are a strong pull motivation for guests as they provide enjoyment for their children (Choi *et al.*, 2019). Considering that children have a significant impact on decision-making process (Kim *et al.*, 2010; Rhoden *et al.*, 2016), including on the decision to dine out and on selecting a restaurant (Labrecque and Ricard, 2001; Chen *et al.*, 2016), robot restaurants need to pay special attention on how their robots are perceived and accepted by children.

4.2 Robotic system

The results demonstrate that travellers explained the working system in robotic restaurants. According to the posts of a significant number of travellers, the restaurants providing robotic dining experience use robot servers and benefit from tablets or touch screen tables with menus for ordering food and beverages. Further, the touch screen tables may also be used as a television or to watch the cooking process in the kitchen. For instance, one of the customers (C44) indicates that “Imagine ordering food as soon as you choose [. . .] from a KIOSK table [. . .] and getting served by a robot”.

On the other hand, when it comes to robot servers, some customers shared that robots in restaurants have names and serve as hosts/hostesses who take guests to their tables.

[. . .] Long story short, but make sure you have one of the robot servers lead you to your table! It’s a cute experience [. . .]. On our tables were iPads for ordering the food [. . .] It turns out there are two types of robots at Robo Sushi. One type is the small attendant with a cute face made to act like hosts/hostesses to guide you to your table while the second type are faceless with shelves to deliver food [. . .]. When this second type of robot brought some of our orders to our table, we took the plates of food from the robot ourselves. Then an actual human server came around and pressed a button on the robot to send it back to the kitchen. It was pretty cool to see the robot automatically programmed to come to our table to deliver the food [. . .] [C174].

One of the restaurants included in the sample was a fast-food restaurant operating in the USA. As customers explain, the meals get cooked by robots then humans add some vegetables and dressing. The concept, named “robotic cooking,” is fast food and only several items can be made via this method. Some of the relevant comments of customers include:

Wow! This place is great! You choose a meal, enter your info and pay and up pops your name welcoming you to the restaurant. A few seconds later a pan magically appears cooking the meat for your bowl meal, you can watch the show! Your meal gets cooked then the humans add some

vegetables and dressing and shazaamm! [...]. What a great idea! Congratulations to whomever put this one together [...] [C124].

These findings contradict the results of [Ivanov and Webster \(2019b\)](#) who found that cooking food was not considered as acceptable task for robotization in restaurants. The reasons might be due to the fact that the reviews in this research were written by people who have actually experienced the robotic service, while the sample of [Ivanov and Webster \(2019b\)](#) included respondents who had not necessarily experienced a robot-delivered service.

4.3 Memorable Experience

The memories of people are believed to be the most reliable source to guide their post-purchasing behaviours and decisions ([Zhang et al., 2018](#)). In addition, if they remain in the memory of people, experiences are seen as valuable ([Di-Clemente et al., 2019](#)). Moreover, extraordinary, unusual, new and unique events or experiences are better remembered than ordinary ones ([Sthapit, 2017](#)).

Unique Dining Experience [...]. Took my mum and sister here to provide a unique dining experience [...]. All in all, a pleasant dining experience [...] [C88].

[...] This is probably more fun and memorable than any of the best restaurants in Boston [...]. Might this be the future of cooking? [C142]

[...] the robot system really made the experience unique [C313]

The findings demonstrate that the travellers experiencing robotic restaurants generally found the experience new and unique which is considered as components of memorable experience ([Kim et al., 2012](#)). The memorable experience perception of travellers may affect the revisit and positive word of mouth intention of them ([Ali et al., 2016](#)). Therefore, a memorable restaurant experience may be accepted as motivation to try the experience again ([Antón et al., 2019](#)).

4.4 Ambience related attributes

Ambience related attributes refer to the components such as atmosphere, décor, cleanliness, environment, comfort level, music and a sound level of robotic restaurants that customers had experienced.

[...] were indeed impressed with the decor & set-up of this restaurant [...] [C499].

Atmosphere: they play great music, there are tables and two counters to eat (with chairs), just a cool new little spot! [...] [C156].

Ambience is comfortable and decent. With spacious seating area this is one good location for spending good time with your family and loved ones! [C59]

Ambience-related attributes are some of the indicators of the quality of restaurant experience ([Ryu and Han, 2010](#); [Ribeiro and Prayag, 2019](#)); they have also a significant role in creating a memorable dining experience and influencing customer satisfaction of restaurants ([Zhang et al., 2019](#)). According to the research findings, customers' words such as "lovely ambience," "nice ambience," and "good ambience" show that they generally liked the ambience of robotic restaurants.

4.5 Food related attributes

Food-related attributes in customers' comments referred to economic aspects of food (such as the price fairness, the comparison of portion size and price, and value for money) and gastronomic aspects of food (e.g. taste, harmony, freshness and menu diversity).

4.5.1 Economic value. The value for the money that consumers perceive is dependent on the balance between price and quality (Kim *et al.*, 2019), often referred to as the economic value of the product (Yrjölä *et al.*, 2019). On the other hand, the price perception of consumers may affect their satisfaction and behaviours in the restaurant experience. Therefore, the prices of food in restaurants should be in line with the balance of quality (Jin *et al.*, 2012). The reasonable prices have been accepted as a significant component of restaurant experience for visitors (Karamustafa and Ülker, 2020). Our findings confirm this. A large number of customers found the price of food in robotic restaurants to be low, reasonable, and value for the money. Moreover, the portion size was also found convenient when compared with the price. Customers commented specifically that:

It's reasonably priced and the portions were good [C25].

[...] this place is good value for the money [...] [C239].

[...] a generous, tasty, and healthy meal at a more than reasonable price [...] [C119].

4.5.2 Gastronomic aspects. As a sub-theme of food-related attributes, the gastronomic aspects consist of taste, harmony, freshness, and menu diversity. The customers' words related to the gastronomic aspects emerged as "tasty," "delicious," "yummy," "super," "nice," "good," "lots of options," "various menu choices," "innovative dishes," "good quality ingredients," "rightly spiced and fresh":

[...] taste is delicious [...] they have variety of food selection [C587].

[...] the most surprising part truly was the taste! I commented to a staff member that I've never tasted this kind of (healthy) deliciousness at a quick food restaurant. The unique combination of flavours and textures will keep me coming back for more [...] [C151].

The features of gastronomic aspects such as taste, menu variety, and freshness are related to food product quality (Zhu *et al.*, 2019), and influence customers' restaurant decisions, satisfaction, and loyalty (Jin *et al.*, 2012; Kivela *et al.*, 2000). Additionally, food quality may also positively affect the emotions of customers (Peng and Chen, 2015) and is one of the most significant dimensions of dining experience which has the potential to influence restaurant success (Ribeiro and Prayag, 2019). The findings confirm the results of previous studies that the gastronomic aspects created positive customer experience with the restaurant (Harrington *et al.*, 2012) and stimulate revisit intentions (Yan *et al.*, 2015).

4.6 Deficiencies

Similar to any technology, robots have disadvantages. According to the results, although most of the comments of travellers towards robotic restaurants are positive, there are also some deficiencies pointed out by customers which are related to "robotic system," "ambience related attributes" and "food related attributes."

4.6.1 Deficiencies in the robotic system. The findings revealed that most of the customers liked the robotic system. However, some of them reported that the robots were not able to serve all items in the menu, causing service failures, and were not qualified enough to replace human employees in restaurants. For instance, several customers commented that:

Robots only served dim sum [...] Other food and drinks served by humans [C97].

[...] but felt a bit unnecessary. The reason is [...] only [...] serve the dimsum [...] While it is cool that there is a robot server, it was useless [C426].

Other instances of service failure included incorrect orders, technical errors, and not implementing the required tasks:

[...] the robots are so much fun! They aren't really accurate so when we got there, the robot that was supposed to take us to our table, crashed into another robot and couldn't move again [...]. A human came to solve the problem. The robots come to your table with your food, but some make errors and bring food that should go to other tables [...] [C167].

Finally, customers stressed that they needed to tap the head of robots to let them know that their tasks are completed. Others pointed out that human waiters were more efficient and better than robot waiters, because robots were not able to serve without being assisted by humans. Furthermore, several customers pointed out that they prefer humans instead of robots:

Using electronic screen to place order is not as fun as someone talking to you. I like more human touch. The ordering process takes longer time than traditional ordering [...] [C462].

And now the food is served by robot, which I think human is obviously more efficient [C111].

The findings indicate robots were not capable and qualified enough to replace human employees in restaurants, because they cannot act independently and efficiently to address customers' needs and fulfil guest experiences (Choi *et al.*, 2019; Ivanov and Webster, 2018). That is why some hospitality firms, especially hotels, preferred not to use service robots anymore (Qiu *et al.*, 2019). The most notable example is the Henn na hotel that turned off half of its robots because they reportedly malfunctioned and created more work for the human employees (Shead, 2019). As the inimitable feature of human employees is needed for the hospitality and service (Golubovskaya *et al.*, 2017), the robotic service may negatively affect the customers' experience (Gursoy *et al.*, 2019). Therefore, high-quality service with robots may not be possible for hospitality firms, but simple requirements of consumers can be met (Lee *et al.*, 2020).

4.6.2 Deficiencies in ambience-related attributes. Although most of the customers evaluated positively the ambience-related features, a few of them reported some deficiencies, mostly about cleanliness:

The lady's bathroom was horrible, I never went to a restaurant that the tissue rolls were not placed inside the dispenser but just on top of the toilet, and in the middle of lunch, it went of toilet paper already [C185].

Cleanliness is one of the most important attributes of ambience in restaurant experience, because it is an indicator of the first impression of customers entering the restaurants (del Chiappa *et al.*, 2019; Jang and Namkung, 2009). Therefore, managers of robotic restaurants need to pay special attention to this element of the customer experience.

4.6.3 Deficiencies in food-related attributes. The findings show that some customers were not satisfied with the taste of food offered by robotic restaurants:

[...] we ended up absolute disappointment with this num heong noodles, tasteless and oily, not only this, but also the other food served are not warm and equally dull. The poor taste ipoh coffee ice served here is spoiling not less [C90].

The food taste is one of the gastronomic aspects of food-related attributes and is considered as an indicator of food quality in restaurants (Zhu *et al.*, 2019). It also affects the satisfaction and loyalty of customers (Kivela *et al.*, 2000). Therefore, although not directly connected to the robots used in the restaurant, the food taste contributes to the overall dining experience created by robotic restaurants.

5. Conclusion and implications

5.1 Contribution

This paper contributes to the body of knowledge by identifying the components of the robotic restaurant experience based on their online reviews. In total 582 reviews of

customers who experienced 13 different robotic restaurants in 7 different countries around the world were analysed. Additionally, the paper offers a model of components of the robotic restaurant experience (Figure 1), namely, “attraction for kids,” “robotic system,” “memorable experience,” “ambience-related attributes,” “food-related attributes (economic value and gastronomic aspects)” and “deficiencies” (in the robotic system, in ambience-related attributes and food-related attributes). As it is mentioned in the literature review section, food-related attributes and ambience-related attributes are not only connected to the robotic restaurant experience, but they are parts of the overall dining experience as well. The results may help restaurant managers design memorable experiences with service robots and mitigate robots’ deficiencies perceived by customers.

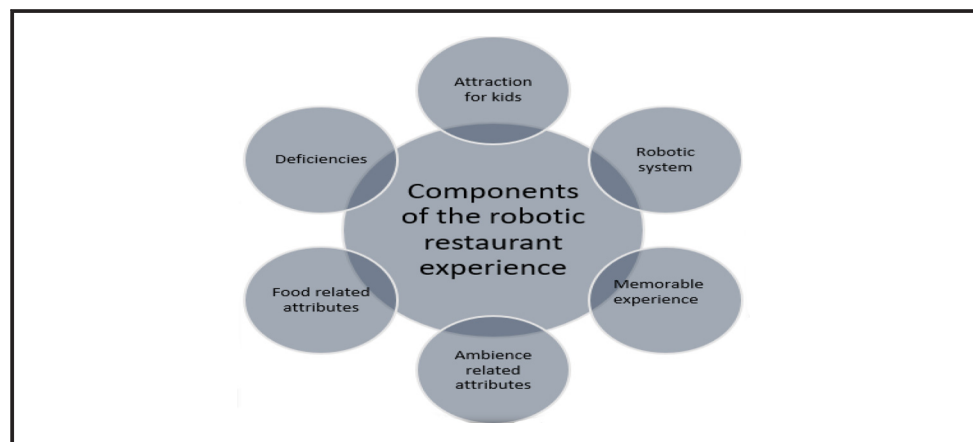
5.2 Theoretical implications

The paper has several theoretical implications. First, the results reveal that the experience of the robotic restaurants is an integral concept that consists of various components, and robots are only one of them. In that sense, the robotic restaurant experience concept steps on the general restaurant experience concept (Andersson and Mossberg, 2004; Hu *et al.*, 2009; Kim and Jang, 2019) and evolves beyond it by adding an autonomous non-human agent (a service robot) in the experience equation. The use of service robots inevitably influences on the other restaurant experience components and the overall customer experience, e.g. by creating an attraction for kids, delivering memorable experiences to customers, saving on costs and transferring these cost savings to customers through lower prices.

Second, service robots cause some inefficiencies and service delivery failures that may decrease the quality of customers’ experience (Gursoy *et al.*, 2019). Therefore, although the use of service robots in the front-of-house activities of restaurant saves on costs, these financial benefits for the restaurant might be offset by the financial and non-financial costs of service failures (compensation for complaints, negative word-of-mouth) (Ivanov and Webster, 2018). That is why, robots need to be well integrated with the other components to provide a coherent and consistent restaurant product/experience (Mosley, 2007).

Third, the findings indicate that while customers enjoyed service robots in a restaurant context, they did not perceive robots as a threat to human employees. They considered that robots were not capable enough to replace human employees to deliver high quality restaurant service. The tasks robots performed were quite basic and sometimes they were supported by humans. Hence, robots could be used as a tool to attract and entertain

Figure 1 Components of the robotic restaurant experience



customers, rather than in replacing human employees. The current COVID-19 pandemic, however, may challenge this finding, because restaurants might be forced to look at technology, including robots, for disinfection and provision of physically distant service to protect the health of restaurant customers and employees (Seyitoğlu and Ivanov, 2020a).

Finally, the findings reconfirm the importance of food-related attributes (Ryu *et al.*, 2012; Longart *et al.*, 2018; Karamustafa and Ülker, 2020), ambience related attributes (Ryu and Han, 2010; Ribeiro and Prayag, 2019; Zhang *et al.*, 2019) and memorable experience (Cao *et al.*, 2019; Tsaor and Lo, 2020) in the restaurant experiences similar to previous studies.

5.3 Managerial implications

The number of robotic restaurants will increase in the future due to the advances in robotic technologies, and their decreasing prices. Demography (decreasing populations and insufficient number of born children) (Webster and Ivanov, 2020) and biosecurity threats such as COVID-19 (Zeng *et al.*, 2020) will drive automation in the sector as well. Therefore, restaurant managers will need to consider the use of service robots in the service delivery process. In this context, this study provides important implications for restaurant managers.

First, findings clearly show that restaurant managers need to involve children in their marketing and promotional strategies. Both the results of this study and the literature support the notion that robots in restaurants enable children's enjoyment. Considering children's influence in the decision-making process in hospitality and tourism (Rhoden *et al.*, 2016; Wu *et al.*, 2019), including in dining out decisions (Labrecque and Ricard, 2001; Chen *et al.*, 2016), restaurant managers can develop promotional materials that appeal to the youngest consumers and their parents. Additionally, the robots need not only to entertain the kids but also to provide opportunities for their parents to take photos and videos of their happy kids with the robots, thus further enhancing the restaurant experience of the parents.

Although most customers' comments about their robotic restaurant experience are positive, some deficiencies were also identified. The deficiencies in the robotic system relate to the inability of the robot to serve all items in the menu, service failures (e.g. incorrect orders, technical errors, forgetting the tasks and slow service), limited language capabilities, no smiles, and inability to work without human assistance, causing some customers to prefer being served human employees rather than robots. Some of these deficiencies could be easily fixed, while others may be harder to overcome. For instance, proper programming, hardware, and software upgrades can decrease or even eliminate the deficiencies related to the inability of the robot to serve all items in the menu and to the service failures, although this would probably increase the costs of the restaurant. On the other hand, the robot's dependence on human assistance cannot be overcome easily at the current technological level of service robots used in restaurants. In this regard, restaurant managers need to plan the use of service robots carefully. It would be best if the facilities of the restaurant are designed in advance with the perspective that they would be used by robots, because this would make them robot-inclusive, will facilitate the robots in implementing their tasks (Ivanov and Webster, 2017), hence decreasing their errors, and improving customers' dining experience. Furthermore, it would be wise for the managers to consider the functionalities and the appearance of the robots and adopt those that are most suitable for the tasks they need to do, although this would not necessarily mean that the robot is humanoid. For example, a humanoid robot can be used as a host inviting and entertaining guests in the restaurants, while a non-humanoid robot could be used to deliver the food.

Among the ambience-related attributes, only cleanliness was mentioned negatively by several customers. As it is one of the most significant attributes of ambience in restaurant experience (Jang and Namkung, 2009), the deficiency should be fixed by managers of robotic restaurants if they want their outlets to be competitive and profitable. Small

autonomous cleaning robots (supported by human staff when necessary) can provide visual clues to customers about the level of hygiene in the restaurant.

Finally, our findings show that the customers' experience of robotic restaurants is shaped by non-robotic attributes such as food taste and ambience as well. Therefore, managers of robotic restaurants should not be preoccupied with service robots at the expense of the gastronomic aspects of the dining experience, for example. Robots may be novel, entertaining, attractive for kids, but if a restaurant fails to deliver its core product appropriately, it may be difficult for the robots to compensate for the restaurant's failure in the food-related attributes. Furthermore, solely adding robots to their service might not be enough for restaurants' success. It should not be forgotten that restaurants are businesses that provide food and beverage services and that the main aim of the customers visiting restaurants is to eat. In this sense, providing gastronomically valuable food and beverages that are fresh, tasty, harmonic, etc. will add value to the customers' experience. Moreover, providing food and beverages should also be economically valuable from the eyes of customers. In other words, the price and quality of food offered by restaurants should be balanced. These aspects of food quality of restaurants should be given importance by managers to enhance the customers' restaurant experience. At the end of the day, it is the customer experience that is important, not whether a restaurant is using robots or not. If robots improve customers' experiences, companies will use them; if robots make guests feel uncomfortable, companies will avoid them, similarly to Henn na hotel's decision.

5.4 Limitation and future research directions

This research is not without limitations. First, the sample included only 13 robotic restaurants and evaluated only the comments in the English language. There may be more robotic restaurants around the world, but due to the difficulties of reaching them, only these restaurants included in the study. Future research may use face-to-face interviews with the customers of robotic restaurants to provide richer data and more in-depth insights into customer perceptions of robotic restaurants. Since the robotic restaurants found to be attractive and entertaining for children, a study related to the children's robotic restaurant experience may be an important direction for future research. Finally, research may focus on the economic aspects of the customer experience and the employees' experience in working in robotic restaurants.

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Further reading

Merriam-Webster (2020), available at: <https://learnersdictionary.com/> (accessed 08 February 2020).

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