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Service Quality Dynamics: Exploring the Impact of Novelty on Customer Enjoyment and Satisfaction with Serving Robots

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Executive Summary: This report examines the influence of customer novelty on enjoyment and satisfaction in the context of serving robots within the foodservice industry. With a focus on addressing concerns surrounding service quality, the study utilizes the SERVQUAL model to evaluate reliability, assurance, tangibles, empathy, and responsiveness. It further investigates the levels of enjoyment and satisfaction in robotic service interactions. Through a comparative analysis of two distinct consumer segments, Explorers and Traditionalists, the study reveals that Explorers, characterized by their novelty-seeking behavior, express higher satisfaction with robotic service. The findings suggest that businesses can enhance satisfaction by leveraging novelty in human-robot interactions. Furthermore, the study sheds light on the dynamics of human-robot interactions in hospitality, offering valuable insights for businesses aiming to optimize their use of serving robots. By understanding and capitalizing on evolving consumer preferences, businesses can effectively adapt their strategies to meet the changing demands of the market.

KEYWORDS: *Serving Robots, Customer Novelty, Enjoyment, Satisfaction, SERVQUAL Model*

Background

Service Robots in Hospitality and Tourism

Thanks to advancements in mechanical engineering and computer science, particularly artificial intelligence (AI) technologies, robots have expanded beyond factory settings to various complex human environments (Huang et al., 2021). Regarded as a disruptive innovation, service robots are increasingly prevalent in the hospitality and tourism sectors, including airports, hotels, restaurants, museums, and tourist attractions. These robots are

equipped with advanced interfaces capable of interacting, communicating, and delivering services to customers (Wirtz et al., 2018, p. 3). Recent developments in AI technology promise to expand the role of robots in human-centered innovation by identifying individuals and responding to their emotions (Jang & Lee, 2020).

In 2023, the service robot market was valued at $43 billion and is expected to surpass $500 billion by 2036 (Verman & Singh, 2024). Much of this substantial growth is driven by the benefits that robots bring through automated processes, such as reduced operational costs and increased productivity. Additionally, advancements in AI technology have enhanced robot capabilities and catalyzed innovative initiatives, further spurring adoption. The growth of the service robot market, combined with technological advancements, has increasingly positioned robots at the forefront of various service delivery tasks. As a result, these tasks require a diverse range of robot forms and roles, which are essential in shaping customer service experiences (Ivanov & Webster, 2019; Reis et al., 2020).

Service robots come in various forms and fulfill diverse roles within the hospitality industry (Higashinaka, 2022; Rajan & Cruz, 2022). These robots range from autonomous wheeled devices to humanoid forms, performing tasks such as serving, housekeeping, cooking, hosting, and working at travel agencies. For example, BellaBot is a mobile robot used in hotels, connected to the central property system. It assists with the delivery of requested items to guest rooms and monitors security issues (López et al., 2013). “Pepper” is another example, a semi-humanoid robot that stands 120 cm tall. It is designed for human interaction, capable of recognizing faces and basic emotions. Pepper serves in various customer service roles, such as an information concierge at airports and a server at popular venues like Nescafe coffee shops and Pizza Hut. As the deployment of service robots in real-world hospitality settings continues to evolve (Song & Kim, 2022), hospitality management must consider the benefits these robots offer and how to optimize them to enhance customer experience (Reis et al., 2020).

Benefits and Concerns in Adopting Service Robots in Restaurants

Service robots are transforming the dining experience by enhancing operational efficiency and consistency across various tasks. These robots excel in guest reception, cleaning, and performing simple, repetitive tasks with high consistency and reliability (Kim et al., 2021). Additionally, self-ordering kiosks enhance customer satisfaction by streamlining the ordering and payment process through interactive touch screens. The information customers input into the system provides valuable data for operational analysis and menu optimization (Shin & Jeong, 2020; Qiu et al., 2020). Robots equipped with advanced navigation systems and tray-carrying capabilities effectively manage the demands of

crowded dining areas, much to customers' amusement (Ivanov & Webster, 2019). The integration of these robots has resulted in more consistency, efficiency, and a wealth of customer data, benefiting restaurant operations and leading to increased enjoyment and satisfaction in the dining experience.

Along with the improve operational benefits, service robots offer tangible benefits such as saving expenses and reducing labor costs, and personalizing services (SoftBank Robotics, 2022). For instance, robots can streamline kitchen operations by automating food preparation processes, reducing the need for manual labor, and minimizing food wastage (Xenia, 2024). Moreover, in the front-of-house operations, robots can enhance table turnover rates by efficiently clearing and resetting tables, ultimately increasing restaurant revenue (Webstaurant Store, 2024). Additionally, service robots equipped with advanced AI algorithms can analyze customer preferences and behavior patterns to personalize dining experiences, fostering customer loyalty and repeat business (TechRyde, 2023). By leveraging service robots, restaurants can not only improve operational efficiency but also create unique and memorable dining experiences for their patrons through personalized service (Chowbus, 2024).

However, concerns linger among industry professionals regarding the potential impact of service robots on the human touch and dining experience (Choi et al., 2020). There is apprehension regarding the ability of robots to consistently deliver high-quality service, especially in nuanced situations requiring intuition, judgment, and empathy (Huang & Rust, 2018; Molly, 2016). Notably, some restaurants have discontinued their use of service robots due to perceived shortcomings in service quality (Molly, 2016).

Application of SERVQUAL Model in Service Quality Assessment

Service plays a significant part in shaping the customer experience, directly influencing customer satisfaction in the hospitality industry. According to the Computers Are Social Actions (CASA) paradigm, humans interact with service robots as if they were social beings, implying that social robots should meet similar expectations as human service agents (Kharub et al., 2021). Research by Amelia et al. (2021) revealed that participants engaged with social robots similarly to how they would with other humans, even offering social cues like "Thank You" or "Goodbye." Some service robots are even capable of making jokes.

Among various theories related to service quality, the SERVQUAL model proposed by Parasuraman et al. (1988) have been extensively applied across various sectors and customer segments. This model comprises five dimensions—reliability, responsiveness, assurance, empathy, and tangibles—that predict service quality when applied to human frontline service employees. However, the

same dimensions might not be able to explain service quality offered by service robots because service robots differ significantly from humans in service delivery, with enjoyment value being a crucial aspect of human-robot interactions (Morita et al., 2020).

Objectives of the Study

Given the substantial differences between service robots and humans in service delivery, it remains unclear whether the SERVQUAL dimensions can be good predictors of customers' enjoyment and satisfaction with robot servers. To fill this gap, this study aims to explore customers' perceptions of SERVQUAL dimensions—reliability, assurance, tangibles, empathy, and responsiveness—in addition to gauging their levels of enjoyment and satisfaction with serving robots.

Additionally, a key objective of this study is to compare customers' perceptions of SERVQUAL dimensions between "explorers" and "traditionalists" based on their level of novelty towards serving robots. By analyzing differences in perception between these two customer segments, the study aims to understand how novelty influences customer attitudes and experiences with serving robots. As such, the research questions for this study are as follows:

1) How do customers perceive the SERVQUAL dimensions—reliability, assurance, tangibles, empathy, and responsiveness—in interactions with serving robots in the hospitality industry?
2) To what extent do the SERVQUAL dimensions predict customers' enjoyment and satisfaction with serving robots?
3) How do customers categorized as "explorers" and "traditionalists" differ in their perceptions of the SERVQUAL dimensions in the context of serving robots?

Methodology

Given the increasing prevalence of serving robots in East Asian countries, data collection was carried out in South Korea using convenience sampling in 2023. The study focused on individuals aged 18 and above who had interacted with a serving robot in a restaurant setting within the past 12 months.

A total of 349 responses were initially gathered. During the data screening phase, 45 incomplete questionnaires were identified and subsequently excluded from the analysis. Following this screening process, 304 complete responses remained for further analysis.

A self-administered questionnaire was developed based on an extensive review of relevant literature. The questionnaire consisted of two sections: the first section comprised items measuring key study constructs, including SERVQUAL dimensions, enjoyment, and satisfaction with serving robots. Respondents were

asked to rate these items using a 7-point Likert scale, ranging from 1 = *strongly disagree* to 7 = *strongly agree*. The second section of the questionnaire focused on collecting socio-demographic information from the respondents.

The collected data were analyzed using IBM SPSS v29. Descriptive statistics, such as frequencies, means, and standard deviations, were computed to summarize the data. Additionally, independent samples t-tests and regression analysis were employed to further analyze the relationships between variables and explore potential predictors of consumer behavior towards serving robots.

Findings

Sample Profile

The sample profile of the participants in this study reflects a diverse range of demographics (*see* Table 1). Most respondents were female (57.6%), while male respondents accounted for 42.4% of the sample. The average age of participants was approximately 38.6 years, with the largest age group being individuals aged 21-30 years (37.2%), followed by those over 50 years (23.4%). Education levels varied among participants, with the highest proportion being college graduates (49.3%), followed by high school graduates (19.1%) and community college graduates (17.4%). In terms of marital status, the majority of respondents were married (55.9%), while single individuals accounted for 43.1% of the sample. Regarding annual household income, participants were distributed across various income brackets, with the highest proportion falling in the $20,000-$39,999 range (24.7%), followed closely by those earning $40,000-$59,999 (22.0%) and under $20,000 (18.1%). Overall, the sample represents a diverse cross-section of individuals with varying demographic characteristics.

Comparison Between Explorers and Traditionalists

This study aimed to investigate customers' perceptions of SERVQUAL dimensions—reliability, assurance, tangibles, empathy, and responsiveness—while also assessing their levels of enjoyment and satisfaction with serving robots. To further investigate the findings, participants were categorized into two distinct groups: Explorers and Traditionalists, based on their respective levels of novelty toward serving robots (i.e., determined by mean-split). The definitions of these groups are as follows:

- Explorers: Individuals who demonstrate a high level of novelty-seeking behavior in their interaction with serving robots. These individuals are enthusiastic about exploring and adopting new technologies, actively seeking out opportunities to engage with them.
- Traditionalists: Individuals who exhibit a low level of novelty-seeking behavior and prefer conventional or traditional methods over new technologies like serving robots. They may be hesitant or resistant to using such innovations and tend to stick to familiar practices.

Table 1. *Sample Profile* (*N* = 304)

Characteristics	Category	*n*	%
Sex	Male	129	42.4
	Female	175	57.6
Age	20 years or less	4	1.3
(*Avg* age: 38.6 years)	21-30 years	113	37.2
	31-40 years	61	20.1
	41-50 years	55	18.1
	Over 50 years	71	23.4
Education	Less than high school	2	0.7
	High school graduate	58	19.1
	Community college graduate	53	17.4
	College graduate	150	49.3
	Graduate degree	41	13.5
Marital status	Single	131	43.1
	Married	170	55.9
	Divorced	3	1.0
Annual household income	Under $20,000	55	18.1
	$20,000-$39,999	75	24.7
	$40,000-$59,999	67	22.0
	$60,000-$79,999	46	15.1
	$80,000-$99,999	34	11.2
	$100,000 or more	27	8.9

Figure 1 illustrates significant differences in service quality perceptions, enjoyment, and satisfaction levels between these two groups.

Figure 1. *Comparison of Scores Between Explorers and Traditionalists*.

Specifically, the results of independent samples t-tests indicate that the "Explorers" group consistently rates the assessed attributes higher and reports greater overall satisfaction with the service compared to their "Traditionalist" counterparts (see Figure 2). This finding underscores the impact of novelty perception on customer attitudes and experiences with emerging service technologies such as serving robots, highlighting the importance of considering individual differences in adoption behavior when implementing such innovations.

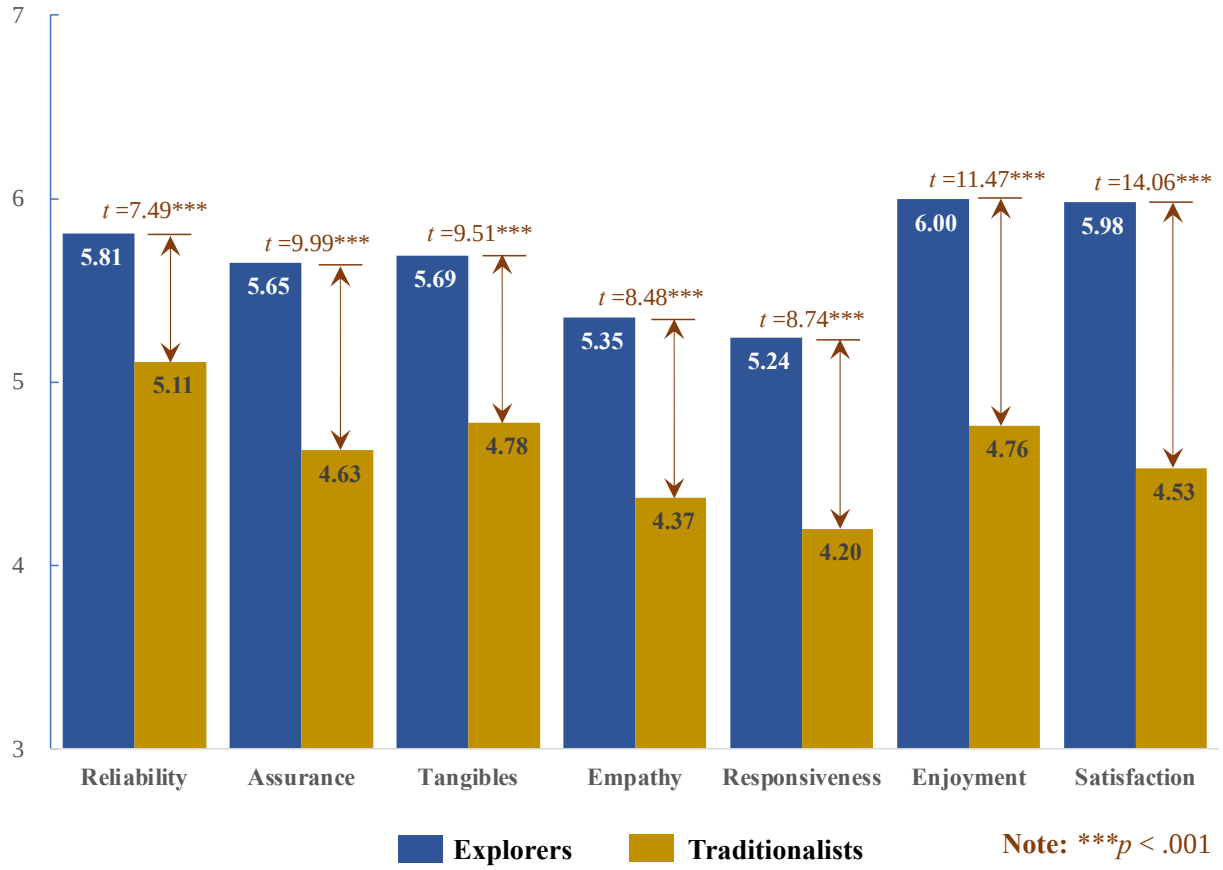

Figure 2. *Explorers versus Traditionalists: Quality Attributes and Customer Satisfaction.*

Impact of SERVQUAL Dimensions on Enjoyment and Satisfaction

In this section, we explored the impact of service quality attributes—reliability, assurance, tangibles, empathy, and responsiveness—on customers' enjoyment and satisfaction levels with serving robots using multiple regression analyses. In both the Explorers and Traditionalists groups, assurance and tangibles emerged as significant predictors of customers' enjoyment during interactions with serving robots, suggesting that customers value credibility/competence and physical attributes when interacting with serving robots. Notably, although not statistically significant, empathy displayed a negative

influence on customers' enjoyment in the Explorers group (= -.18, p = .06), suggesting potential discomfort or a mismatch in human-robot interactions for this group. Understandably, empathy emerged as a significant predictor of satisfaction in the Traditionalists group, implying that these customers may place greater emphasis on the perceived emotional connection or understanding provided by serving robots. Regarding customers' satisfaction with the serving robot, assurance, tangibles, and responsiveness were significant predictors in both groups, indicating their role in enhancing satisfaction. Interestingly, empathy was found to be an additional significant predictor of satisfaction in the Traditionalists group. However, the lack of significance for reliability suggests that factors beyond technical performance may play a more substantial role in shaping overall satisfaction levels, underscoring the complexity of customer perceptions in the context of human-robot interactions. These findings emphasize the importance of considering diverse customer preferences and attitudes when designing and implementing robot services in hospitality settings.

Table 2 *Regression Analysis: Impact of SERVQUAL Dimensions on Enjoyment and Satisfaction*

DV: Enjoyment	**Explorers**		**Traditionalists**	
Variables	β	*t*	β	*t*
Reliability	.11	1.46	.02	0.17
Assurance	.37	3.88***	.45	4.83***
Tangibles	.23	2.84**	.20	2.59*
Empathy	-.18	-1.91	.14	1.62
Responsiveness	.16	1.58	.01	0.08
F (R^2)	15.96*** (.35)		27.33*** (.49)	
DV: Satisfaction	**Explorers**		**Traditionalists**	
Variables	β	*t*	β	*t*
Reliability	-.01	-0.19	.19	2.58
Assurance	.29	3.10**	.30	3.47***
Tangibles	.20	2.52*	.19	2.58*
Empathy	.06	0.61	.17	2.19*
Responsiveness	.24	2.73**	.29	3.66***
F (R^2)	19.22*** (.39)		35.91*** (.56)	

Note. DV = dependent variable. * $p < .05$. ** $p < .01$. *** $p < .001$.

Practical Implications

This study presents several practical implications for the hospitality industry. While the adoption of robots in services is expected to accelerate, this study revealed that introducing service robots into service delivery does not guarantee enhanced service quality nor solve all service issues. Instead, it can lead to varying perceptions of service quality between customers who are technologically adept (i.e., Explorers) and those more resistant to change (i.e., Traditionalists).

Given these findings, service management is advised to adopt a service inclusion perspective (Lu et al., 2020), recognizing the need for a comprehensive strategy in robot deployment. This strategy should consider the role of service robots across different service types (hedonic vs. utilitarian), stages of the service delivery process, contexts (e.g., service failure), and customer characteristics (e.g., demographics, personality traits, attitudinal factors) (Lee et al., 2020; Lee et al., 2021; Wirtz et al., 2018), along with their propensity to embrace new technologies (Parasuraman & Colby, 2015).

To fully realize the potential benefits of robots in service delivery, service management must conduct a thorough assessment of the deployment across multiple dimensions. This comprehensive evaluation should include, among other factors, cost-benefit analysis, compatibility with assigned tasks, performance optimization, integration into existing work environments, and determining appropriate supervision levels to achieve the desired outcomes of the deployment (Rogelberg, 2024). Additionally, keeping abreast of AI advancements is essential for enhancing robot functionality, making them more relatable, interactive, and empathetic. Approaching the introduction of robots in this holistic manner not only improves acceptance among skeptics but also emphasizes the benefits of robot capabilities to meet and exceed the evolving expectations of customers in service delivery.

Furthermore, the introduction of robots into service settings should be strategically guided by the consideration of customer segmentation according to the technology adoption life cycle. Specifically, service customers can be categorized by their stage of robot adoption, such as Explorers (early adopters) and Traditionalists (skeptics) (Beldona & Cobanoglu, 2007; Lee et al., 2020). Recognizing this segmentation underscores what Moore and Benbasat (1991) described as a 'chasm' in technology adoption—a significant gap between early adopters and the early majority. Innovative service experiences like service robots can alienate segments of the customer base that are not fully ready for such experiences. Ignoring these segmentation differences can lead to significantly divergent evaluations of service quality delivered by robots between these groups. Consequently, service management must acknowledge this divide among customers and their limited capacity to

influence customers' adoption rates until robots are widely accepted.

In response, management can implement several actionable strategies. Initially, before the service delivery stage, it is advisable to gauge customers' preferences for service by robots, human servers, or a hybrid model that incorporates both robots and humans. Additionally, service quality can be improved by adjusting the role of humans in the service process to act as assistants or helpers for issues that robots cannot address effectively (Tuomi et al., 2020). Redirecting customers to a human for unresolved service issues may alleviate frustration but could also risk employee burnout due to the repetitive nature of these tasks. Therefore, management should educate employees about the varying levels of customer acceptance regarding robot-provided services and prepare them for their new roles working alongside robot colleagues. Management should also outline the capabilities of robots to employees and formulate strategies to protect them from repetitive tasks and difficult customer interactions, thereby enhancing their work environment regardless of the level of robot integration.

This study found a significant difference in perceived enjoyment and satisfaction levels of service provided by robots between the Explorer and Traditionalist groups. This finding suggests a nuanced decision-making process for service managers. Deploying service robots can improve the perceived quality of service, increasing enjoyment and satisfaction for the Explorer group. However, this advantage was not experienced by the Traditionalist group, who did not find the same level of enjoyment and satisfaction with robot-aided services. Essentially, services provided by robots failed to meet the functional and hedonic expectations of the Traditionalist group. Given these differing responses, management should carefully consider which tasks are most appropriate for robots according to customer preferences in their respective service environments. Robots are currently best suited for tasks that are automatic, repetitive, and standardized (Seyitoğlu & Ivanov, 2023). Allocating robots to these tasks within the service and delivery processes can maximize their value.

On the other hand, management must recognize the limitations of current robot technology, particularly in service roles that require soft skills such as dynamic customer interactions, emotional intelligence for special requests, complaint management, and personalized services. While customers might be more forgiving of service failures by emotionally expressive robots (Yam et al., 2021), robot deployment should be limited in these areas until technology advances further. This selective use of service robots ensures a balance between leveraging current automation benefits and retaining the essential human touch (Seyitoğlu & Ivanov, 2023). Additionally, the limited scope of service robots' contributions highlights the need to

redesign service processes, clearly separating tasks suitable for robots from those requiring human involvement. Strategically integrating robots and humans in the service process can benefit employees by relieving them of monotonous tasks and allowing them to focus on areas where they excel. This approach not only enhances job satisfaction but also opens opportunities for increased robot involvement in suitable tasks.

The distinct role of empathy in predicting customer enjoyment and satisfaction is noteworthy. Traditionalists perceive empathy as a significant predictor of service satisfaction, a sentiment was not shared by Explorers who deem this service attribute insignificant. This divergence holds profound implications for service management for two reasons. First, Traditionalists place a high value on the human aspects of service when evaluating service quality, with empathy being a primary driver of their satisfaction. This is supported by a study from Wang et al. (2022), which found that the display of human intelligence is particularly valued by certain individuals more than others. Second, the importance of the human element in service interactions extends to the assessment of service quality by robots, suggesting that Traditionalists may still seek human qualities in robot-aided services, even if robots do not fully meet their expectations in terms of sophistication.

On the other hand, Explorers' view of empathy as insignificant suggests that novelty alone does not mandate the presence of empathy. It is critical to acknowledge that individuals adept at adopting new technologies not only seek innovation but also demand practicality in these innovations (Song et al., 2022). This underscores the need for service robots to continuously advance to ensure that they remain practical and effective problem-solvers for this customer segment once the initial allure of novelty gives way to a practical motivation for using robots. Without such evolution, the initial enthusiasm of these early adopters may diminish.

Therefore, for effective service management, a dual approach is required: constant improvement in robot functionality for practical problem-solving and the maintenance of human touch in service delivery, whether through robots alone or in collaboration with humans. This balanced approach ensures that the evolving needs and values of both Traditionalists and Explorers are met, fostering satisfaction and loyalty in the long term.

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