Examining how coolness of service robots influences customers’ delight: mediating role of perceived values

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Abstract

Purpose – When encountering novel technology, customers often use the term “cool” to express their thoughts; therefore, coolness has become crucial for launching service robots. However, research on the impact mechanism of “coolness” is lacking. This study explored the relationship between delight and behavioral intention regarding the coolness of service robots in the food and beverage industry while discussing the mediating roles of utilitarian and hedonic values.

Design/methodology/approach – Questionnaires were distributed online with links to the survey posted on restaurant discussion boards on Facebook and online community platforms such as Dcard. In total, 540 responses were deemed valid. The hypotheses were tested using the partial least squares structural equation modeling method.

Findings – The results indicate that coolness positively impacted both utilitarian and hedonic values and that both perceived values positively impacted delight. Moreover, coolness does not directly impact delight but must be mediated by perceived value to be effective.

Practical implications – Increasing customer perceptions of the coolness of service robots is recommended. Moreover, regarding customer revisits, utilitarian value services can delight customers more effectively than hedonic value services.

Originality/value – The stimulus-organism-response model was used to identify the relationships among coolness, perceived value, delight, and behavioral intention. Moreover, the authors investigated the impact of coolness on utilitarian and hedonic values. These findings are significant for the development of smart restaurants and provide a critical reference for exploring service robots.

Keywords Coolness, Utilitarian value, Hedonic value, Delight, Behavioral intention

Paper type Research paper

Introduction

People often exclaim about the “coolness” of new technologies. In the service marketing and management literature, “coolness” is defined as the extent to which users perceive a product or service to possess visual attractiveness (Kang et al., 2023; Tiwari et al., 2021). Recent studies have indicated that when people think service robots are cool, they have more positive emotional responses toward them, thereby increasing their willingness to use them (Huang...
Following the rapid development of technology and increased labor costs, automatic services are being widely used as labor force replacements (Hwang et al., 2020). For example, these services supplement the labor force during peak hours and keep customers distracted during long waiting periods. Service robots are particularly popular in the food and beverage industry (Wirtz et al., 2018). Recent studies have indicated that Gen Z customers are more inclined to accept service robots than human employees in certain situations. Moreover, consumers tend to prefer service robots for daily services (Chen et al., 2022). According to Hwang et al. (2021), few studies have explored consumers’ perceptions of service robots. Therefore, the first motivation for this study was to investigate service robots and customer perceptions.

According to Huang et al. (2021), as service robots are a novel technology, customers are likely to believe that artificial intelligence (AI)–based robots will improve the service standards of hotels. Cha (2020) found that customer willingness to visit robot-served restaurants is related to the perceived coolness of robots. Similarly, Chen and VG (2023) found a positive relationship between the coolness of airport service robots and passenger satisfaction. Hlee et al. (2023) indicated that robot services are more likely to be implemented when customers perceive service robots as cool. However, these studies did not explore the potential mechanisms through which coolness affects customer behavior. Therefore, the second motivation of this study was to identify the possible mediating factors between coolness and customer behavior.

The perceived value of services in the tourism and recreation industries can be divided into utilitarian and hedonic values (Prebensen and Rosengren, 2016). Utilitarian values emphasize function and efficiency, whereas hedonic values focus on attributes related to people’s feelings. The former refers to a customer’s overall evaluation of the functional benefits and utility of their consumption experiences (Babin et al., 1994). The latter reflects a customer’s emotive benefits through the consumption experience, such as novelty, fun and pleasure (Hu et al., 2021; Lin and Mattila, 2021). A recent study indicated that utilitarian and hedonic values help form a memorable brand experience (Hwang et al., 2021). This study predicted that in a utilitarian value service environment, customers react positively to capable service robots. By contrast, in a hedonic value service environment, customers prefer service robots with a friendly appearance. Thus, the third research motivation of this study was to explore how utilitarian and hedonic values affect customer behavior toward service robots.

According to Svotwa et al. (2023), delight is fundamental to customer loyalty. Meyer et al. (2017) noted that delight plays a crucial role in determining whether customers choose to revisit. Berman (2005) discovered that customers are satisfied when their needs are met or exceeded. Satisfied customers feel delighted when they experience both joy and surprise. However, little attention has been paid to customer delight related to service robots. Therefore, this study employed satisfied customers as research participants to explore how delight affects service-robot usage intentions.

The stimulus-organism-response (SOR) theory has been applied to research in the tourism and hospitality industry, for example, in restaurants (Chen et al., 2015), self-service technology (Ahn and Seo, 2018; Leung and Wen, 2020), theme parks (Chang et al., 2014) and hospitality (Jani and Han, 2015). A few studies have used this theory to explore service robots (Chen and VG, 2023; Gupta and Pande, 2023; Hlee et al., 2023) and have shown that the theoretical framework is suitable for examining the relationships between variables. Therefore, this study applied the SOR theory as the theoretical background.

This study investigated three key aspects: the influence of the perceived coolness of service robots on utilitarian and hedonic values, impact of utilitarian and hedonic values by service robots on delight and, if applicable, the potential mediating effect of utilitarian and hedonic values on the relationships mentioned above. While recent research has examined the influence of coolness on satisfaction (Chen and VG, 2023), this study explored the impact
of coolness on delight via perceived value and analyzed its mechanisms. This can provide a reference for developing smart restaurants in the food and beverage service industry and for exploring the potential use of service robots. The results of this study can enhance relevant industry practitioners’ understanding of customers’ thoughts about service robots and may serve as a reference for developing smart restaurants.

Theoretical background and hypotheses

Development and characteristics of service robots in Taiwan
Service robot development in Taiwan has thrived, with an estimated annual growth rate of 8.6% from 2021 to 2026 (Trade Insight, 2021). Businesses in the hospitality industry, such as Din Tai Fung and Parkview Taipei, have begun introducing service robots. Currently, the services provided by robots in Taiwan have the following characteristics: First, they assist with simple and repetitive tasks, such as ordering and bringing food to a table, to increase efficiency. Second, systematic operational processes are implemented to reduce the error rate and minimize issues, such as incorrect or missed orders. Third, service robots can attract more customers by providing novel dining experiences. Fourth, service robots highlight companies’ investments in technology and innovation, thereby enhancing their brand image.

SOR model
Mehrabian and Russel (1974) developed the SOR theory in environmental psychology. Specifically, stimulus (S) affects psychological factors, organism (O) affects internal evaluations, and response (R) affects behaviors. Within the SOR model framework, various environmental factors are the stimuli that affect people’s internal evaluations and subsequent responses. A stimulus can be any triggering factor that induces behavioral changes. Following Chen and VG (2023), this study also considers the coolness of service robots as a stimulating factor. When an environment generates stimuli, it triggers an intermediary process of cognitive and affective perceptions in customers, that is, the organism (Chang and Chen, 2008). Previous research has indicated that perceived value plays the role of the organism in the SOR theory (Hu et al., 2016; Yang et al., 2021). Therefore, this study views perceived value (i.e. cognitive and affective responses) as an organism’s response. Individuals’ ultimate responses, including feelings, evaluations, approaches, and/or avoidance behaviors (or behavioral intention) (Chen and VG, 2023; Zhang et al., 2015), are considered delight and behavioral intentions in this study.

Coolness
Coolness is associated with being unique, highly technological, outstanding, and impressive (Warren and Campbell, 2014). Coolness also refers to customers’ strong interests and positive cognitive perceptions when a product or service meets their expectations. In the leisure and tourism industries, coolness shapes customers’ perceptions when they first encounter a service robot (Tung and Au, 2018), and is likely to affect customers’ subsequent behavioral patterns. Cha (2020) stated that coolness is critical for customer acceptance of service robots and indicated that coolness positively affects customer satisfaction.

Perceived values
Hu (2021) explored the perceived value of service robots by separating them into utilitarian and hedonic values. Utilitarian values are goal-oriented; they are practical and facilitate the completion of tasks or problem-solving (Ponsignon, 2023). Hedonic values are pleasure-oriented and driven by feelings of delight, happiness, and freedom (Kusmarini et al., 2020).
Im et al. (2015), Kim et al. (2015), and Park (2020) studied the influence of coolness in different contexts and discovered that coolness and perceived value are positively correlated. Coolness can reinforce the perceived functional value if a cool product or service is beneficial or useful (Dehghani, 2018; Park et al., 2018; Yang et al., 2016). Im et al. (2015) argued that novelty affects coolness and hedonic value, ultimately affecting customers’ behavioral intentions. de Kervenoael et al. (2020) studied human–computer interaction and revealed that social robots generate cool, novel, pleasurable, and “wow” experiences for customers, subsequently increasing customers’ willingness to use social robots. Hyun et al. (2022) stated that the coolness of service robots facilitates customer interest and allows customers to interact with robot services, thereby experiencing positive emotions, such as excitement and joy, which lead to hedonic perceptions. Thus, the following hypotheses were proposed.

**H1.** Coolness is positively associated with utilitarian value.

**H2.** Coolness is positively associated with hedonic value.

**Delight**

Delight refers to a higher state of emotion and excitement than satisfaction (Torres and Kline, 2013). Liu and Keh (2015) found that customer delight is rooted in both emotions and demands. According to Berman (2005), customer delight is frequently accompanied by emotions, such as surprise and joy. When customers’ expectations are exceeded and combined with surprise, they experience delight (Berman, 2005). Customer delight and exceeding customer expectations are crucial for service industry operators to retain customers and positively influence their behavioral intentions.

Loureiro et al. (2014) stated that perceived value and customer satisfaction are directly correlated, with satisfaction being a prerequisite for customer delight (Bowden-Everson et al., 2013). Additionally, surprise has been shown to positively impact customer delight (Bowden and Dagger, 2011). A service robot is an innovative technology that is expected to surprise customers and trigger delight. Thus, the following hypotheses were proposed.

**H3.** Utilitarian values are positively associated with delight.

**H4.** Hedonic values are positively associated with delight.

**Behavioral intention**

Behavioral intention refers to the connection between customers and their future behaviors. Venkatesh and Davis (2000) verified that behavioral intention and subsequent actual behavior are highly correlated. According to Su et al. (2016), behavioral intention can be divided into purchase intention and word-of-mouth. Purchase intention refers to customers’ intentions to purchase a product or service (Fishbein and Ajzen, 1975). Isaid and Faisal (2015) stated that purchase intention directly affects customer purchase behavior. Actual purchase behavior is determined by perceptions of cost, quality, and price (Ali, 2016). Moreover, word-of-mouth refers to the “informal, person-to-person communication between a perceived non-commercial communicator and a receiver regarding a brand, a product, an organization, or a service” (Harrison-Walker, 2001).

Schneider and Bowen (1999) and Schlossberg (1993) stated that customer delight refers to customers’ emotional reactions to an experience and strongly affects their future behavioral intention. Alexander (2012) reported that when customers are offered a service, they expect their needs to be met, and whether their needs are met affects their subsequent behavioral intentions. Additionally, customers make future consumption decisions based on their expectations (Suri et al., 2020). After experiencing a service, customers’ perceived value may
reconstruct their expectations for future consumption and affect their subsequent behaviors, including acceptance (Lin and Mattila, 2021), continued usage, and recommendation intention (Lee and Kim, 2018). Thus, we proposed the following hypothesis.

H5. Delight is positively associated with behavioral intention.

Therefore, our theoretical framework involved five hypotheses (see Figure 1).

Methodology
Sample and procedure
An online questionnaire was administered from April 22nd to May 7th, 2022. Taiwan has a population of approximately 23 million, and over 90% of the population uses the internet, 90% of whom are active social media users. Thus, it was reasonable to employ online questionnaires to collect data (Sujood and Siddiqui, 2022). Links to the questionnaire were posted on restaurant discussion boards on Facebook and online community platforms, such as Dcard. To help participants understand the context of restaurants using service robots in Taiwan, this study provided a two-minute video about service robots in the questionnaire. Subsequently, the participants were asked two screening questions. The first relates to whether participants had visited restaurants with service robots, and the second relates to whether participants were satisfied with their service experience. Relevant research on delight found that satisfaction is a prerequisite for customer delight. These studies considered satisfied customers as research participants (Bowden-Everson et al., 2013; Roberts-Lombard and Petzer, 2018; Torres et al., 2020).

Previous studies on service robots typically used sample sizes ranging from 252 to 415 (Cha, 2020; Chen and VG, 2023; Hlee et al., 2023; Hwang et al., 2021; Hyun et al., 2022), which provided reliable results and conclusions. This study also followed the recommendations of researchers to have a sample size 10–15-times the number of items for the structural equation modeling (SEM) (Kline, 2015; Hair et al., 2019). Bentler and Chou (1987) suggested that the sample size should be at least five times the number of estimated parameters under a normal distribution without missing values or outliers; otherwise, the sample size should be 15-times the estimated parameters. In summary, with 33 items and a sample size 15-times larger, the study would require at least 495 valid questionnaires. A total of 946 completed questionnaires were finally collected. After screening the two items, 540 valid responses were identified, yielding a valid sample rate of 57.08%.

Figure 1.
Research model

Source(s): Author’s own creation
Measurement

All constructs were measured in accordance with previous studies. First, seven items for coolness were adapted from Chen and Chou (2019). Second, utilitarian value was measured using the seven items cited by Hu (2021), and hedonic value was measured using the seven items employed by Hu (2021). Third, delight was measured using the five items described by Hao and Chon (2022). Fourth, regarding behavioral intention, seven items were employed from Hwang et al. (2020) and Hu (2021), specifically, three and four items were used to measure word-of-mouth and repurchase intention, respectively. Finally, except for demographic variables and consumption behavior (i.e. sex, age, marital status, educational attainment, monthly salary, occupation, previous dining experience, how long since visiting a service robot restaurant, how many times service robot restaurants had been visited, and how much money was spent on those visits), the rest of the items were evaluated via 5-point Likert-type scales ranging from strongly disagree (1) to strongly agree (5). These items are listed in the Appendix.

Data analysis

Two types of SEM were developed: covariance-based SEM (CB-SEM) and partial least squares (PLS) path-modeling SEM (Partial Least Squares Structural Equation Modeling (PLS-SEM)). In CB-SEM, theories are confirmed or rejected depending on the covariance matrices of the samples, which are estimated using pre-set theoretical models. PLS-SEM uses a theoretical model to explain variance in the dependent variable. This study employed PLS-SEM to verify this hypothesis. The PLS-SEM has been widely used in food and beverage research (Fakih et al., 2016; Merli et al., 2019; Pookulangara et al., 2023) to study the relationships between variables and predictive models. Compared with CB-SEM, it is more suitable for this study for the following reasons: First, it is suitable for data that do not follow a normal distribution; second, it is employed for prediction; and third, it can address multiple mediating variables (Hair et al., 2019; Khan et al., 2019). We divided the analysis and estimation processes into two stages using the PLS method. The first stage involved reliability and validity analyses of the measurement model. The second stage involved estimating and verifying the path coefficients and explanatory power of the structural model (Anderson and Gerbing, 1988). Other data analysis methods included descriptive analysis, reliability analysis, construct validity, and linear structural equations. Reliability and construct validity analyses were used to verify the consistency and stability of each measured item and the overall constructed validity of each scale, respectively. Finally, we used linear structural equations to clarify the relationships among coolness, utilitarian value, hedonic value, delight, and customer behavioral intention.

Results

Sample characteristics

Among the 540 valid responses, the largest proportion of participants were female (63.9%), aged 31–40 years (38.5%), single (57%), with a bachelor’s degree (60.2%), had worked in the industrial or commercial industry (37.8%), and had a monthly salary in the range of US$1,001–1,333 (28.1%). Regarding consumption behavior, the largest proportion of the participants had visited service robot restaurants 2–3 months ago (36.5%), had visited such restaurants once (42.2%), and had spent US$18–33 (38.7%; see Table 1).

Measurement properties

This study explored the relationships among coolness, perceived value (i.e. utilitarian and hedonic values), delight, and behavioral intention. The measurement model was used to evaluate the ability to assess the relationship between the latent variables and their indicator
variables (observable constructs). Previous studies indicated that factor loadings that reflect the correlations between each research construct must be greater than 0.7 to be representative (Fornell and Larcker, 1981). Additionally, the average variance extracted (AVE) must be greater than 0.5 to have conversion validity (Bagozzi and Yi, 1988). In this study, all factor loadings and composite reliability of the constructs met the standard except for the factor loadings of the measurement indicators C6 (service robots have cool features) and U7 (I can use service robots smoothly), which were less than 0.7 (Table 2) and were not included in the subsequent analysis.

The Fornell-Larcker criterion and heterotrait-monotrait ratio (HTMT) of correlations were used to assess convergent validity. According to previous studies, the correlation coefficients of the Fornell-Larcker criterion must be less than the square root of the AVE (Grant, 1989), and HTMT ratio must be less than 0.9 (Henseler et al., 2016) to indicate discriminant validity. In this study, the correlation coefficients of all constructs were less than the square root of the AVE (Table 3). Additionally, the HTMT ratio was less than 0.9 (Table 4). Thus, the variables for the same constructs in this study were closely related.

**Correlation analysis**
Table 3 presents the means, standard deviations, and correlation coefficients of the variables used in this study. The findings demonstrated that coolness is significantly and positively
correlated with utilitarian value \((r = 0.672; p < 0.01)\), hedonic value \((r = 0.750; p < 0.01)\),
delight \((r = 0.634; p < 0.01)\), and behavioral intention \((r = 0.718; p < 0.01)\). Utilitarian value
was significantly and positively correlated with hedonic value \((r = 0.709; p < 0.01)\), delight

**Table 2.**
Assessment of the measurement model: validity and reliability

<table>
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<tr>
<th>Construct</th>
<th>Measurement indicator</th>
<th>Mean</th>
<th>S.D.</th>
<th>Factor loading</th>
<th>t-value</th>
<th>CR (&gt;0.7)</th>
<th>AVE (&gt;0.5)</th>
<th>Cronbach’s alpha</th>
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<td>Coolness</td>
<td>C1</td>
<td>4.16</td>
<td>0.668</td>
<td>0.779</td>
<td>40.086</td>
<td>0.893</td>
<td>0.581</td>
<td>0.855</td>
</tr>
<tr>
<td></td>
<td>C2</td>
<td>4.25</td>
<td>0.666</td>
<td>0.760</td>
<td>39.728</td>
<td>0.816</td>
<td>0.571</td>
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<tr>
<td></td>
<td>C3</td>
<td>3.76</td>
<td>0.845</td>
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<td>27.693</td>
<td>0.784</td>
<td>0.547</td>
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<td>0.676</td>
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<td>43.720</td>
<td>0.938</td>
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<td>C5</td>
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<td>C7</td>
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<td>0.698</td>
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<td>41.349</td>
<td>0.921</td>
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<td>0.780</td>
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<td>0.597</td>
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<td>U4</td>
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<td>46.162</td>
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**Note(s):** CR = composite reliability; AVE = average variance extracted; see the list of items in the Appendix

**Source(s):** Authors’ own work

**Table 3.**
Discriminant validity

<table>
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<th>Construct</th>
<th>Mean</th>
<th>S.D.</th>
<th>Coolness</th>
<th>Utilitarian value</th>
<th>Hedonic value</th>
<th>Delight</th>
<th>Behavioral intention</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coolness</td>
<td>4.08</td>
<td>0.55</td>
<td>0.762</td>
<td>0.762</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Utilitarian value</td>
<td>4.01</td>
<td>0.53</td>
<td>0.646</td>
<td>0.672</td>
<td>0.762</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hedonic value</td>
<td>4.11</td>
<td>0.55</td>
<td>0.749</td>
<td>0.749</td>
<td>0.708</td>
<td>0.773</td>
<td></td>
</tr>
<tr>
<td>Delight</td>
<td>4.00</td>
<td>0.58</td>
<td>0.635</td>
<td>0.743</td>
<td>0.742</td>
<td>0.712</td>
<td>0.800</td>
</tr>
<tr>
<td>Behavioral intention</td>
<td>4.01</td>
<td>0.55</td>
<td>0.719</td>
<td>0.743</td>
<td>0.743</td>
<td>0.712</td>
<td>0.728</td>
</tr>
</tbody>
</table>

**Note(s):** Fornell–Larcker criterion: Diagonal elements in bold are the square root of the AVE, which is the shared variance within a construct. Off-diagonal elements are the correlations between constructs. To have discriminant validity, diagonal values must be larger than off-diagonal values

**Source(s):** Authors’ own work
(r = 0.735; p < 0.01), and behavioral intention (r = 0.743; p < 0.01). Hedonic value was significantly and positively correlated with delight (r = 0.712; p < 0.01) and behavioral intention (r = 0.712; p < 0.01). Furthermore, delight and behavioral intention were significantly and positively correlated (r = 0.780; p < 0.01).

Hypothesis testing
In this study, 5,000 samples were acquired using the bootstrap resampling method to estimate the parameters and evaluate the significance of the model coefficients (Hair et al., 2011). Bootstrap resampling is a non-parametric statistical inference method that can produce favorable results even when the sample size is relatively small (Zhang et al., 1991). The variance, $R^2$, in this study was between 0.452 and 0.621 (see Figure 2).

The standardized root mean square residual (SRMR) (Hu and Bentler, 1998) and RMS-theta (Henseler et al., 2014) were used to examine the model fit of the research model. The model fit indices of the estimation model were as follows: SRMR = 0.059 (<0.08) and RMS-theta = 0.11 (<0.12); thus, the overall model fit was favorable.

The $f^2$ value is mainly used to assess whether an exogenous variable has significant power to explain an endogenous variable. According to Cohen’s (1988) $f^2$ value evaluation principles, this study’s $f^2$ values (0.101–1.280) model indicated medium-sized explanatory power, except for the small $f$-square value of coolness to delight. Stone-Geisser $Q^2$ was employed to assess predictive relevance (Geisser, 1974). A $Q^2$ value of >0 indicates that the model has predictive power (Chin, 1998). In this research model, the $Q^2$ values ranged from 0.399 to 0.449, indicating that the model had predictive relevance.

Harman’s single-factor test was employed to assess the common method variance (CMV), as proposed by Podsakoff and Organ (1986). After scrutinizing the questionnaire items, the factor loading of the first principal component before rotation was only 20.59%, indicating

<table>
<thead>
<tr>
<th></th>
<th>Coolness</th>
<th>Utilitarian value</th>
<th>Hedonic value</th>
<th>Delight</th>
<th>Behavioral intention</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coolness</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Utilitarian value</td>
<td>0.778</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hedonic value</td>
<td>0.859</td>
<td>0.808</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Delight</td>
<td>0.736</td>
<td>0.859</td>
<td>0.809</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Behavioral intention</td>
<td>0.821</td>
<td>0.845</td>
<td>0.798</td>
<td>0.828</td>
<td></td>
</tr>
</tbody>
</table>

**Note(s):** Heterotrait–monotrait ratio: Off-diagonal elements are the shared variances between constructs. Discriminant validity, which measures the distinctiveness of a construct, is achieved if the elements are lower than the cutoff score of 0.90.

**Source(s):** Authors’ own work

<table>
<thead>
<tr>
<th>Coolness</th>
<th>Utility Value</th>
<th>Delight</th>
<th>Behavioral Intention</th>
</tr>
</thead>
<tbody>
<tr>
<td>$R^2 = 0.452$</td>
<td>$R^2 = 0.621$</td>
<td>$R^2 = 0.530$</td>
<td></td>
</tr>
</tbody>
</table>

**Note(s):** ***p < 0.01

**Source(s):** Author’s own creation

---

Table 4. Heterotrait–monotrait ratio

Figure 2. Structural equation model
that it did not account for a substantial portion of the total variance (i.e. less than the recommended threshold of ≥50%). Hence, the CMV was not a major problem in this study.

Furthermore, a structural model was used to examine the hypotheses of the research model, specifically the relationships among coolness, utilitarian value, hedonic value, delight, and behavioral intention. First, the path coefficients from coolness to utilitarian value ($\beta = 0.672, p < 0.01$) and from coolness to hedonic value ($\beta = 0.750, p < 0.01$) both presented a significant positive relationship, indicating that coolness positively affects both utilitarian and hedonic values. Thus, Hypotheses 1 and 2 were supported. Second, the path coefficients from utilitarian value to delight ($\beta = 0.481, p < 0.01$) and from hedonic value to delight ($\beta = 0.370, p < 0.01$) presented a positive relationship, indicating that utilitarian and hedonic values positively affect delight. Thus, Hypotheses 3 and 4 were supported. Third, the path coefficient from delight to behavioral intention ($\beta = 0.728, p < 0.01$) presented a significant positive relationship, demonstrating that delight positively affects behavioral intention; thus, Hypothesis 5 was supported. Table 5 presents the path coefficients of the structural model.

### Mediation analysis

This study adopted the method proposed by Zhao et al. (2010). Table 6 shows that utilitarian and hedonic values mediated the relationship between coolness and delight but had only indirect effects. The relationship between coolness and behavioral intention was mediated by utilitarian and hedonic values as complementary mediation. Finally, coolness had a direct effect on behavioral intention, and delight did not mediate the relationship between coolness and behavioral intention.

### Post-hoc analysis

To verify whether the research framework proposed in this study differed depending on people revisiting service robot restaurants, we conducted a post-hoc analysis by dividing the sample into two groups: those who had visited service-robot restaurants for the first time, and those who had revisited such restaurants.

### Table 5. Research hypothesis verification results

<table>
<thead>
<tr>
<th>Hypothesis</th>
<th>Path</th>
<th>Coefficient</th>
<th>t-value</th>
<th>p-value</th>
<th>Result</th>
</tr>
</thead>
<tbody>
<tr>
<td>H1</td>
<td>Coolness $\rightarrow$ Utilitarian value</td>
<td>0.672</td>
<td>23.925</td>
<td>0.000</td>
<td>Supported</td>
</tr>
<tr>
<td>H2</td>
<td>Coolness $\rightarrow$ Hedonic value</td>
<td>0.750</td>
<td>31.973</td>
<td>0.000</td>
<td>Supported</td>
</tr>
<tr>
<td>H3</td>
<td>Utilitarian value $\rightarrow$ Delight</td>
<td>0.481</td>
<td>10.814</td>
<td>0.000</td>
<td>Supported</td>
</tr>
<tr>
<td>H4</td>
<td>Hedonic value $\rightarrow$ Delight</td>
<td>0.370</td>
<td>6.960</td>
<td>0.000</td>
<td>Supported</td>
</tr>
<tr>
<td>H5</td>
<td>Delight $\rightarrow$ Behavioral intention</td>
<td>0.728</td>
<td>31.456</td>
<td>0.000</td>
<td>Supported</td>
</tr>
</tbody>
</table>

**Source(s):** Authors’ own work

### Table 6. Results of mediation analysis

<table>
<thead>
<tr>
<th>IV</th>
<th>Mediating variable (MV)</th>
<th>Independent variable (DV)</th>
<th>Direct effect</th>
<th>Indirect effect</th>
<th>Total effect</th>
<th>Results</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coolness</td>
<td>Utilitarian value</td>
<td>Delight</td>
<td>0.087 (1.842)</td>
<td>0.305*** (9.879)</td>
<td>0.636*** (21.625)</td>
<td>Only indirect effect, no direct effect</td>
</tr>
<tr>
<td></td>
<td>Hedonic value</td>
<td></td>
<td></td>
<td>0.244*** (6.720)</td>
<td></td>
<td>Only indirect effect, no direct effect</td>
</tr>
</tbody>
</table>

**Note(s):** $t$-value in the parentheses, ***$p < 0.01$

**Source(s):** Authors’ own work
Figures 3 and 4 present the path coefficients of the structural models for first-time visitors and visitors who visited service robot restaurants, respectively. Although the relationships among the variables in the two groups supported these hypotheses, a few notable phenomena were observed. First, the results for the two groups showed that the impact of coolness on hedonic value was greater than that of coolness on utilitarian value. This result was consistent with the overall model. Regardless of whether people had previously visited service robot restaurants, coolness had a greater impact on hedonic value than on utilitarian value. Second, for people who visited service-robot restaurants for the first time, the difference between the effect of utilitarian value on delight and hedonic value on delight was small; both positively affected delight. Third, for those who revisited, utilitarian value had a greater impact on delight than hedonic value. Whether revisiting customers felt delighted was determined by whether the utilitarian value service, and not the hedonic value service provided by the robots, was satisfactory.

Discussion and conclusions

Conclusions
In recent years, many studies have been conducted on the application of service robots in the tourism and hospitality industries (Huang et al., 2022; Shukla et al., 2023; Yu et al., 2022). This study explored the relationships among coolness, perceived value (i.e. utilitarian and hedonic values), delight, and behavioral intention. Few studies have explored how the coolness and perceived value of emerging technologies affect customer delight and behavioral intention. Therefore, we applied the SOR theory to present hypotheses and concluded as follows.

First, the results indicate that coolness positively affects utilitarian value (Hypothesis 1). Coolness affects customer perceptions of service robots, thereby resolving utilitarian value problems. Second, coolness positively affects hedonic value (Hypothesis 2), and its impact is stronger than that of coolness on utilitarian value. This result aligns with that of Hwang et al.
(2020), who discovered that for hedonically motivated customers, innovativeness had a positive effect in a restaurant with robots.

Third, utilitarian value positively affects delight (Hypothesis 3), which is consistent with Lee and Kim’s (2018) conclusion that utilitarian value positively affects customer satisfaction. Fourth, although the impact of hedonic value on customer delight was less than that of utilitarian value, it was still a crucial factor affecting customer delight. Similar to Lee and Kim’s (2018) findings, hedonic value affects customer satisfaction. However, the results of this study were inconsistent with those of Lee and Kim (2018). Their study focused on the services provided by Airbnb (a platform for renting accommodation), which largely offered hedonic experiences. Thus, customers were more concerned with hedonic value than utilitarian value. Fifth, we verified that delight positively affects customers’ subsequent behavioral intentions (Hypothesis 5). This result aligns with that of Roberts-Lombard and Petzer (2018), who suggested that in an emerging market, the satisfaction of cellphone Internet customers positively correlated with delight.

Finally, previous research indicates that coolness shapes customers’ perceptions of adopting service robots for the first time (Tung and Au, 2018). We conducted a post-hoc analysis by dividing customers into two groups: (1) those who visited service robot restaurants for the first time, and (2) those who had visited such restaurants multiple times. Groups were created to explore the relationships between the constructs and five hypotheses. For customers who revisited service robot restaurants, the impact of utilitarian value on delight was greater than that of hedonic value. This reveals that for revisiting customers, the determining factor of delight is derived from the utilitarian value of services provided by robots.

Theoretical implications
This study has several implications. First, we comprehensively investigated the antecedents and consequences of customer acceptance of service robots. The SOR model was adopted as the theoretical basis for exploring the relationships among stimulus (coolness), organism (utilitarian and hedonic values), and response (delight and behavioral intention).

Second, recent studies on service robots have focused on the influence of their coolness. Chen and VG (2023) stated that the coolness of service robots can enhance customer word-of-mouth and satisfaction, and that the latter can lead to delight. Coolness has a positive impact on consumers, thereby affecting their usage intentions (Huang et al., 2023). Additionally, it positively affects perceived value (Kang et al., 2023). However, this study found that coolness does not directly impact delight; rather, it has an indirect impact through the mediating factors of utilitarian and hedonic values. These findings contribute to a comprehensive understanding of the underlying mechanisms of new technology on coolness.

Third, we divided the research sample based on whether participants visited service robot restaurants for the first time or multiple times. Compared with customers who were visiting for the first time, the impact of utilitarian value on delight was greater than that of hedonic value for revisiting customers. This finding suggests that, as service technology enters the growth stage, the utilitarian value of service robots will be a significant factor influencing customer delight.

Practical implications
This study has several practical implications. First, it confirmed that increasing customer perceptions of the coolness of service robots is beneficial. Thus, when restaurants launch utilitarian value service robots, they should incorporate cooler elements in addition to making them efficient and easy to operate. For example, service robots could recite customer orders and, after delivering meals, play games with customers, through which customers could win restaurant coupons. These steps may increase customer perceptions of the coolness of service robots and trigger revisit intentions.
Second, regarding customer revisits, the results indicate that restaurant owners should enhance utilitarian value service robots instead of hedonic value service robots to generate delight. Restaurants should ensure that service robots have practical functions and increase convenience, efficiency, and time-saving to delight customers. With the increasing introduction of service robots to the market, more customers are gaining usage experience. Thus, utilitarian values must be reinforced. In other words, when service robots and other new technologies are still in the introductory stage, most customers have little to no prior experience. At this stage, the utilitarian value triggered by the coolness of service robots attracts customers. However, once customers experience these technologies, the utilitarian value becomes more significant in generating delight than the hedonic value. Therefore, businesses should continue to enhance the utilitarian value of their services.

Third, the emergence of new technologies evoke a perception of coolness among customers. However, this perception alone does not directly affect delight; it requires the mediation of the corresponding perceived values. Therefore, businesses should emphasize the utilitarian and hedonic values that service robots provide when designing and developing them. These values are crucial for the design process.

Finally, according to previous studies, customer delight affects subsequent behavioral intentions (Roberts-Lombard and Petzer, 2018; Svatwa et al., 2023). This study revealed that utilitarian value services can delight customers more effectively than hedonic value services. Therefore, restaurants that seek to prompt customers’ positive word-of-mouth and repurchase intentions through service robots must focus on utilitarian value services to increase customer delight, such as offering discounts on certain dishes or free drink refills.

Limitations and future research
This study has the following limitations. First, it adopted a survey method that may not have examined other potential reasons for using service robots beyond the variables investigated. Therefore, future studies should incorporate qualitative research to comprehensively understand these influencing factors. Second, this study used an online questionnaire, which may have resulted in inaccurate responses. In future research, on-site surveys targeting specific restaurant types could minimize such inaccuracies. Third, this study focused exclusively on service robots in restaurants; therefore, the results may not apply to other industries such as the hospitality industry. Furthermore, it did not distinguish between types of restaurants. Future research could explore restaurant types to examine interference effects. Fourth, although dissatisfied customers were also considered, this study primarily focused on satisfied customers. Future studies should expand the sample size to include a broader range of customers. Finally, this study did not examine the characteristics of service robots or their interactions with customers. Recent studies have suggested that the characteristics of service robots and their interactions with customers can significantly impact customer satisfaction and experience (Odekerken-Schröder et al., 2021). Therefore, future studies should delve deeper into these aspects.

References


Influence of coolness of service robots


### Appendix

**Constructs and Measurement items**

<table>
<thead>
<tr>
<th>Constructs</th>
<th>Measurement items</th>
<th>Adopted from</th>
</tr>
</thead>
</table>
| Coolness            | C1: When I first heard about service robots, I thought they were so cool, and I intended to experience them  
                       C2: Being served by robots makes me feel cool  
                       C3: When I picture something cool, service robots come to mind  
                       C4: Service robots are cool  
                       C5: When I see service robots, my reaction is, “They are so cool!”  
                       C6: Service robots have cool features  
                       C7: If I were to list cool things, restaurants with service robots would be on it | Chen and Chou (2019)                    |
| Utilitarian value   | U1: Using service robots seems worthwhile to me  
                       U2: Using service robots improves my experience  
                       U3: Using service robots is helpful to me  
                       U4: Service robots are efficient  
                       U5: Using service robots can save me time  
                       U6: Using service robots is convenient for me  
                       U7: I can use service robots easily | Hu (2021)                               |
| Hedonic value       | H1: Using service robots is fun  
                       H2: Using service robots makes me feel thrilled  
                       H3: Using service robots makes me feel delighted  
                       H4: Using service robots is interesting  
                       H5: Using service robots is entertaining  
                       H6: Using service robots is trendy  
                       H7: Using service robots satisfies my curiosity | Hu (2021)                               |
| Delight             | D1: Service robots give me unprecedented feelings  
                       D2: The performance of service robots exceeded my expectations  
                       D3: The performance of service robots often exceeds my expectations  
                       D4: I typically feel surprised and delighted by the services provided by service robots  
                       D5: The service provided by service robots was memorable | Hao and Chon (2022)                     |
| Behavioral intention| B1: I share positive comments about service robot restaurants with other people  
                       B2: I encourage people to go to service robot restaurants  
                       B3: I might recommend service robot restaurants to other people  
                       B4: I will revisit this service robot restaurant  
                       B5: I will consider revisiting service robot restaurants  
                       B6: In the future, when I have the opportunity, I intend to use service robots  
                       B7: I hope that in the future, I can continue to use service robots | Hwang et al. (2020), Hu (2021) |

**Source(s):** Adopted from Chen and Chou (2019), Hu (2021), Hao and Chon (2022), Hwang et al. (2020) and modified by author

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