Received 30 October 2020
Revised 29 April 2021
16 July 2021
Accepted 27 July 2021

The service triad: an empirical study of service robots, customers and frontline employees

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Abstract

Purpose – Recent service studies suggest focusing on the service triad consisting of technology-customer-frontline employee (FLE). This study empirically investigates the role of service robots in this service triad, with the aim to understand the augmentation or substitution role of service robots in driving utilitarian and hedonic value and ultimately customer repatronage.

Design/methodology/approach – In study 1, field data are collected from customers ($n = 108$) who interacted with a service robot and FLE in a fast casual dining restaurant. Structural equation modeling (SEM) is used to test

The authors wish to thank the Dadawan team and CEO Danny Deng for their participation in and contribution to this research project. The support and advice of Jay Kandampully (Editor), Werner Kunz and Arne De Keyser (Co Guest-Editors), two anonymous reviewers, and Dominik Brandmayr and Joep van Haren (Research Assistants) were invaluable during the revision process.

Journal of Service Management
Vol. 33 No. 2, 2022
pp. 246-292
Emerald Publishing Limited
1757-5818
DOI 10.1108/JOSM-10-2020-0372

hypotheses about the impact of service robots' anthropomorphism, social presence, value perceptions and augmentation opportunities in the service triad. In study 2, empirical data from a scenario-based experimental design ($n = 361$) complement the field study by further scrutinizing the interplay between the service robot and FLEs within the service triad.

Findings – The study provides three important contributions. First, the authors provide empirical evidence for the interplay between different actors in the "customer-FLE-technology" service triad resulting in customer repatronage. Second, the empirical findings advance the service management literature by unraveling the relationship between anthropomorphism and social presence and their effect on perceived value in the service triad. And third, the study identifies utilitarian value of service robots as a driver of customer repatronage in fast casual dining restaurants.

Practical implications – The results help service managers, service robot engineers and designers, and policy makers to better understand the implications of anthropomorphism, and how the utilitarian value of service robots can offer the potential for augmentation or substitution roles in the service triad.

Originality/value – Building on existing conceptual and laboratory studies on service robots, this is one of the first field studies on the service triad consisting of service robots – customers – frontline employees. The empirical study on service triads provides evidence for the potential of FLEs to augment service robots that exhibit lower levels of functional performance to achieve customer repatronage. FLEs can do this by demonstrating a high willingness to help and having excellent interactions with customers. This finding advocates the joint service delivery by FLE – service robot teams in situations where service robot technology is not fully optimized.

Keywords Service robot, Service triad, Frontline employee (FLE), Augmentation, Substitution service encounter

Paper type Research paper

Introduction

In hospitality services such as restaurants, service triads consisting of technology, customers and frontline employees (FLEs) are becoming more common (Li *et al.*, 2021). FLEs are more and more supported by a growing number of service robots that perform advanced frontline tasks involving social interactions with customers by talking with customers and serving food (Belanche *et al.*, 2020a; Tuomi *et al.*, 2020). In India, the restaurant "Robot" opened in 2017 as the country's first restaurant that uses robots to serve food (Raman, 2018). More recently, in China, the first robot restaurant complex employs more than 40 robots capable of serving and cooking over 200 dishes, and customers make their orders with robot waiters (Davis, 2020). In the USA, a group of 20 robotics engineers partnered with a Michelin-starred chef to found a restaurant in downtown Boston where human chefs are replaced by robots. The necessity to minimize human-to-human contact during the 2020/2021 COVID-19 pandemic has given robots an amplified platform (Davis, 2020; Odekerken-Schröder *et al.*, 2020). In Europe (the Netherlands), the fast casual dining Asian-style restaurant Dadawan introduced service robots to deliver trays to help human FLEs keep a safe distance when serving customers (Brady, 2020).

The competitive nature of hospitality services forces service providers to place the customer experience at the heart of strategic decision-making (Hunter-Jones, 2020; Kandampully *et al.*, 2018). It is typically challenging to combine service excellence and productivity (Wirtz and Zeithaml, 2018) as customer experiences imply hybrids of both human and technological interfaces (Singh *et al.*, 2019) could be the solution for realizing valued customer experiences in a cost efficient way. Larivière *et al.* (2017, p. 239) introduced the concept of service encounter 2.0, which can be defined as "any customer-company interaction that results from a service system that is comprised of interrelated technologies (either company- or customer-owned), human actors (employees and customers), physical/digital environments and company/customer processes." This novel perspective emphasizes the need to understand the service triad of customer – frontline employee (FLE) – technology (De Keyser *et al.*, 2019; Larivière *et al.*, 2017). In the case of service robots, the FLE can be either substituted or augmented by the service robot (Larivière *et al.*, 2017). Service research suggests that the service robot's role might be contingent on its level of anthropomorphism (Mende *et al.*, 2019; Van Doorn *et al.*, 2017), which can be defined as "the extent to which

service robots are imbued with human-like characteristics, motivations, intentions, or emotion" (Xiao and Kumar, 2021, p. 7).

However, most of the existing research about frontline service robots is conceptual (e.g. Belanche *et al.*, 2020b; Huang and Rust, 2018; Van Doorn *et al.*, 2017; Wirtz *et al.*, 2018), with some notable laboratory studies in hospitality and tourism (e.g. Choi *et al.*, 2019; Ho *et al.*, 2020). In hospitality, the existing research mainly focuses on welcoming or greeting hotel customers, while the impact of service robot waiters in the customer frontline experience in restaurants remains largely under-researched (Zemke *et al.*, 2020). Lu *et al.* (2020) conclude that present research on service robots is fragmented, mostly conceptual in nature and misses out on the social complexity that determines technology adoption.

This study therefore addresses the knowledge gap that Rafaeli *et al.* (2017, p. 94) summarized as understanding "how to use the right technology for the right purpose in the right context by the right frontline employees for the right customers". More recently, specifically, Yoganathan *et al.* (2021) identified the knowledge gap related to service scenarios in the concurrence of service robots and human staff (Yoganathan *et al.*, 2021), reflecting our service triad of technology-customer-FLE.

The current article contributes to the literature by addressing the mentioned knowledge gaps by studying the interplay within the service triad of service robots, human FLEs and customers, and how it affects customer repatronage in hospitality. To draw insights, we employ a field study as well as a scenario-based experimental design with frontline service robots in a fast casual dining restaurant and refer to service robots as "system-based autonomous and adaptable interfaces that interact, communicate and deliver service to an organization's customers" (Wirtz *et al.*, 2018, p. 909). The insights enrich scholarly understanding of the interplay between the different actors in the service triad and the potential role the service robot and FLE can play in the service encounter 2.0 (De Keyser *et al.*, 2019; Huang and Rust, 2018; Larivière *et al.*, 2017).

Specifically, this research employs an exploratory observational study, a field study with $n = 108$ customers who interacted with a service robot in a fast casual dining restaurant and a scenario-based experimental study with $n = 361$ participants. The results show that customer repatronage is to a large extent determined by the utilitarian and hedonic value of the service robot, which in turn are driven by the humanoid characteristics of the service robot. In particular, we find that anthropomorphism exerts a stronger influence on the utilitarian value compared to the hedonic value of the service robot. The effect of the utilitarian value of the service robot is affected by the interaction quality of FLEs, such that lower utilitarian value can be compensated by high FLE interaction quality, implying potential augmenting roles for the service robot and FLE. In contrast, we find that higher utilitarian value of the service robot decreases the need for compensation through FLE interaction, suggesting the potential for highly functional service robots to substitute FLEs in fast casual dining settings.

Next, the theoretical background section elaborates about the main constructs in our service triad, comparing these insights to recent empirical studies on service robots in hospitality and beyond. Afterward, hypotheses are developed resulting in our conceptual model, followed by the methodology and results section derived from our field study and from our scenario-based experimental design. Finally, a discussion of the main findings and theoretical implications precede suggestions for future research. Managerial implications are provided for service managers responsible for employing tandems of service robots and FLEs, for robot engineers and designers and for policy makers.

Theoretical background

Service robots in hospitality services

While still being a nascent field, various scholars have recently studied the role of (service) robots in hospitality and tourism services. Table 1 provides an illustrative overview of

Table 1. Literature overview: service robots in hospitality services and other industries

Citation	Research method/ Type of study	Anthropo-morphism	Social presence	Service triad: FLE considered	Outcome variables	Findings	Context
Tussyadiah and Park (2018)	Online survey/ Laboratory study	X			Intention to adopt service robots	Consumer's intention to adopt hotel service robots is influenced by human-robot interaction dimensions of: (1) Anthropomorphism (2) Perceived intelligence (3) Perceived security	Hotel
Ivanov *et al.* (2018)	Online survey/ Laboratory study				Attitudes toward the use of robots in hotel services	(1) Respondents have positive attitudes toward the introduction of robots in hotels, but lower than toward service robots in general (2) Respondents' attitude toward the use of robots in hotel services is influenced by: gender (male +), general attitude toward robots and perceptions of the experience provided by robots, advantages of robots and social skills of robots	Hotel

(*continued*)

Table 1.

Citation	Research method/ Type of study	Anthropo-morphism	Social presence	Service triad: FLE considered	Outcome variables	Findings	Context
Lu *et al.* (2019)	Online Survey/ Laboratory study	X			Consumers' acceptance of service robots	(1) Performance efficacy, intrinsic motivation, facilitating conditions and emotions positively influence consumers' acceptance of service robots (2) Human appearance may backfire for intelligent products due to the deterrence of perceived threats to human identity. Anthropomorphism negatively affects consumers' willingness to use robots in restaurants and retail stores	Hospitality industry
Choi *et al.* (2019)	Online survey/ Laboratory study	X			Customer service evaluations	(1) Consumers respond more favorably to human service agents who use literal (vs figurative) language and due to the notion of anthropomorphism such an effect extends to service robots (2) This language style effect is not observed among service kiosks as they lack humanlike features	Hotel

(*continued*)

Table 1.

Citation	Research method/ Type of study	Anthropo-morphism	Social presence	Service triad: FLE considered	Outcome variables	Findings	Context
Ivanov and Webster (2019)	Online survey/ Laboratory study				Perceived appropriateness and intention to use service robots	Most commonly approved usage of robots is perceived to be: (1) Information provision (2) Housekeeping activities (3) Processing bookings, payments and documents (4) The best indicator of willingness to use a robot in a hospitality setting is a person's general attitude toward robots	Hospitality/ Tourism Industry
Qiu *et al.* (2020)	Online Survey/ Laboratory Study *Results from qualitative interviews used as input for conceptual framework*	X		X	The hospitality experience	(1) Robots being perceived as humanlike or intelligent positively affects customer-robot rapport building and the hospitality experience (2) Customer-employee rapport building was found to mediate the relationship between robot attributes and the hospitality experience, but customer-robot rapport building was not	Restaurant

(*continued*)

Table 1.

Citation	Research method/ Type of study	Anthropo-morphism	Social presence	Service triad: FLE considered	Outcome variables	Findings	Context
De Kervenoael *et al.* (2020)	Online Survey/ Laboratory Study *Structural equation modeling with data collected from semi-structured interviews*				Social robot usage intentions	(1) Visitors' intentions to use social robots stem from the effects of technology acceptance variables and service quality dimensions (perceived usefulness, perceived ease of use, service assurance, personal engagement and tangibles) leading to perceived value, and two further dimensions from human-robot interaction (HRI): empathy and information sharing	Hospitality Industry
Ho *et al.* (2020)	Online survey/ Laboratory study				Service experience evaluation	(1) Service recovery from the human staff and from the service robot resulted in similar service evaluations (2) Customers evaluate their service experience less favorably when receiving service recovery from fellow customers in comparison to human staff and service robots	Hotel

(*continued*)

Table 1.

Citation	Research method/ Type of study	Anthropo-morphism	Social presence	Service triad: FLE considered	Outcome variables	Findings	Context
Belanche *et al.* (2020)	Online survey/ Laboratory study	X			Customer behavioral intentions to use and recommend service robots	(1) Attributions mediate the relationships between affinity toward the robot and customer behavioral intentions to use and recommend service robots (2) Customer's affinity toward the service robot positively affects service improvement attribution, which in turn has a positive influence on customer behavioral intentions (3) Affinity negatively affects cost reduction attribution, which in turn has a negative effect on behavioral intentions (4) human likeness has a positive influence on affinity	Restaurant

(*continued*)

Table 1.

Citation	Research method/ Type of study	Anthropo-morphism	Social presence	Service triad: FLE considered	Outcome variables	Findings	Context
Tuomi *et al.* (2020)	Observations and semi-structured interviews/Field study			X	Role of service robots in relation to service production and delivery	The study reviews applications of robotics in actual hospitality service (1) Service robots either support or substitute employees in service encounters (2) Service robots offer hospitality businesses a novel point of differentiation, but only if properly integrated as part of wider marketing efforts (3) Automation of tasks, processes and, ultimately, jobs has serious socioeconomic implications at both the micro level and macro level	Hospitality industry

(*continued*)

Table 1.

Citation	Research method/ Type of study	Anthropo-morphism	Social presence	Service triad: FLE considered	Outcome variables	Findings	Context
Fan *et al.* (2020)	Online survey/ Laboratory study	X			Customer dissatisfaction after a service failure	(1) Technology anthropomorphism generally alleviates consumer dissatisfaction. Consumers show varying levels of dissatisfaction with a service failure caused by an anthropomorphic (vs non-anthropomorphic) self-service machine depending on their levels of interdependent self-construal (high vs low) and technology self-efficacy (high vs low). The underlying mechanism is self-blame (2) Consumers low in technology self-efficacy and low in interdependent self-construal tend to blame themselves more when facing a service failure	Hospitality/ Tourism Industry
Choi *et al.* (2020)	Online Survey/ Laboratory study *Results from qualitative interviews with hotel staff were used as input*				Perceived service quality: (1) Interaction quality (2) Outcome quality (3) Physical service environment	(1) Understanding the influence of human-robot interaction from the viewpoint of hoteliers and guests (2) Human staff services are perceived higher than the services of service robots in terms of interaction quality and physical service environment. However, no significant difference in outcome quality	Hotel

(*continued*)

Table 1.

Citation	Research method/ Type of study	Anthropo-morphism	Social presence	Service triad: FLE considered	Outcome variables	Findings	Context
Zhong *et al.* (2020)	Online survey/ Laboratory study				(1) Attitude (2) Purchase intention (3) Purchase behavior	(1) Purchase intention and attitude of the experimental group (robot hotel service) was higher than the control group (traditional hotel service) (2) No effect found for purchase behavior	Hotel
Lin*et al.* (2020)	Online survey/ Laboratory study	X			Hospitality customers willingness to accept the use, and objection to the use of artificially intelligent devices	(1) Intention to use artificially intelligent devices is influenced by social influence, hedonic motivation, anthropomorphism, performance and effort expectancy, and emotions toward the artificially intelligent devices (2) Anthropomorphism positively influences the effort expectancy of respondents (3) Results are contingent on the type of hotel (limited-service hotel vs. full-service hotel)	Hotel
Jia *et al.* (2021)	Online Survey/ Laboratory study	X			Hotel visitors' satisfaction and purchase intention	(1) User satisfaction with service robots in a hotel had a positive impact on user satisfaction, attitude toward the hotel and room purchase intention (2) Users were most likely to accept medium-human likeness robots and least likely to accept high–human likeness robots	Hotel

(*continued*)

Table 1.

Citation	Research method/ Type of study	Anthropo-morphism	Social presence	Service triad: FLE considered	Outcome variables	Findings	Context
Lu *et al.* (2021)	Online Survey/ Laboratory study	X	X		Consumption outcomes: (1) Service encounter evaluation (2) Revisit intentions (3) Positive WOM intentions	(1) Robotic service staff's humanlike attributes are key determinants of consumption outcomes (2) Humanlike voice increases service encounter evaluation and behavioral intentions (revisit intentions and WOM intentions) (3) Humanlike language positively affects service encounter evaluation (4) Positive emotion accounts for the positive effect of humanlike voice (5) Perceived credibility and positive emotion explain the language effect	Restaurant
Other industries							
Heerink *et al.* (2008)	Survey after actual experience with robot/ Field study		X		Robot acceptance	Social abilities contribute to the sense of social presence when interacting with a robotic companion and this leads, through higher enjoyment to a higher acceptance score	Elderly-Healthcare

(*continued*)

Table 1.

Citation	Research method/ Type of study	Anthropo-morphism	Social presence	Service triad: FLE considered	Outcome variables	Findings	Context
Barrett *et al.* (2012)	Divers- site visits, observations, formal interviews, informal discussions and publicly available documents/Field study			X	Impact of robots on hospital pharmacies	(1) Benefits for employees include that (a) robots facilitates team collaboration, (b) free up time for the employees to engage in specialized and customer-centered work, (c) increase employees' institutional legitimacy (i.e. employees reinforcing their role and status in the organization) and (d) employees can upgrade their technical skills as authorized caretakers of the robots (1) Potential negative employee consequence include (a) a loss of autonomy and frustration due to lack of interaction with customers and (b) employees feel a disruption to their normal routine when robots bring changes to their jobs	Healthcare

(*continued*)

Table 1.

Citation	Research method/ Type of study	Anthropo-morphism	Social presence	Service triad: FLE considered	Outcome variables	Findings	Context
Fan *et al.* (2016)	Quasi-experimental design/Laboratory study	X			Customers' switching intentions following a robotic service/self-service technology machine failure	(1) Anthropomorphism negatively influences customer's switching intentions; e.g. a humanlike voice encourages customers to continue using the machines (rather than switching to a human) (2) Powerful customers exhibit higher switching intentions when a machine has an anthropomorphic (vs robotic) voice in the absence of other customers, yet they show an opposite tendency in the presence of other customers. Therefore, the presence of other customers moderates the voice type effects on powerful customers' switching intentions (3) Powerless customers demonstrate lower switching intentions when they experience a service failure with a humanlike (vs robotic) SST, regardless of the absence or (presence of other customers)	Retail

(*continued*)

Table 1.

Citation	Research method/ Type of study	Anthropo-morphism	Social presence	Service triad: FLE considered	Outcome variables	Findings	Context
Mende *et al.* (2019)	Online survey/ Laboratory study	X		X	Customer experience after interacting with humanoid service robots	(1) Interaction with humanoid service robots elicits compensatory responses compared to interactions with human employees (2) Higher compensatory consumption poses opportunity to use service robots for upselling (3) Higher compensatory consumption is due to greater consumer discomfort, i.e. eeriness and a threat to human identity (4) Consumers respond more favorably to humanoid service robots that are less (vs more) humanlike (5) Compensatory responses are (1) mitigated when consumer-perceived social belongingness is high, (2) attenuated when food is perceived as more healthful and (3) buffered when the robot is mechanized (rather than anthropomorphized)	Across service contexts

(*continued*)

Table 1.

Citation	Research method/ Type of study	Anthropo-morphism	Social presence	Service triad: FLE considered	Outcome variables	Findings	Context
van Pinxteren *et al.* (2019)	On-site survey/ Experimental field study	X			Trust in humanoid robots	(1) Anthropomorphism drives trust, intention to use and enjoyment (2) If customers are comfortable with robotic interactions, humanlike appearance of robots is more effective than social functioning features (3) If they are uncomfortable this effect is reversed	Public service
Current study	Study 1: Online survey after actual service robot experience/Field study Study 2: Scenario-based experimental design	X	X	X	Customer repatronage	*See findings*	Restaurant

empirical studies using primary data sources. Almost all studies rely on laboratory experiments, while field data are rare, with some notable exceptions (e.g. Tuomi *et al.*, 2020). Anthropomorphism is an often included construct, while only very few studies consider the service robot's social presence. Finally, the studies by Qiu *et al.* (2020) and Tuomi *et al.* (2020) take a service triad perspective by also including FLEs in their study. Extending prior research, our current field study includes both, anthropomorphism and social presence and investigates the interaction within the service triad of service robot – customer – FLE to further develop our understanding of service robots in FLE encounters. Table 1 also presents a few illustrative empirical studies in other industries that address anthropomorphism, social presence and/or the service triad. The studies by Barrett *et al.* (2012) and Mende *et al.* (2019) acknowledge the service triad and study the effects of service robots on human employees in healthcare and other settings, whereas Heerink *et al.* (2008) focus on robot acceptance in healthcare. None of these studies include the related but distinct concepts of anthropomorphism and social presence, which can be seen as first and second degree social responses (Lee *et al.*, 2006). In order to enhance our understanding of the interplay between these concepts on utilitarian and hedonic value, ultimately resulting in customer repatronage, this paper introduces an exploratory observation study, a field study and a scenario-based experimental design.

To introduce a conceptual model contributing to the nascent field depicted in Table 1, we summarize the ongoing debate on the core concepts of the conceptual model below.

Anthropomorphism

The first concept is anthropomorphism. Anthropomorphism describes a main feature of humanoid robots and has its roots in the Greek words "*anthropos*" (human) and "*morphe*" (shape or form). It originally refers to the phenomenon by which nonhuman entities are given human shape or form (Wan and Aggarwal, 2015). Social psychology expands the view on anthropomorphism to the "tendency to imbue the real or imagined behavior of non-human agents with human-like characteristics, motivations, intentions, or emotions" (Epley *et al.*, 2007, p. 864), offering a foundation for research on service robots (Xiao and Kumar, 2021).

While marketing has found anthropomorphism to increase product and brand liking (Aggarwal and McGill, 2012), it is unclear whether anthropomorphism in a frontline service triad including service robots enhances customers' repatronage. Contemporary service research acknowledges the importance of the human tendency to anthropomorphize robots (Mende *et al.*, 2019; Van Doorn *et al.*, 2017), but the question remains whether customers' anthropomorphism of robots facilitates or constrains use intention (Blut *et al.*, 2021).

One stream of research argues that anthropomorphizing a nonintelligence product (e.g. service robot) is a useful strategy to increase consumer preferences because the human intentions and emotions are associated with intelligence and competence in task performance (Wan and Aggarwal, 2015). Taking this perspective would favor the use of anthropomorphized robots in the service triad of technology-customer-FLE (Duffy, 2003; Reed *et al.*, 2012). A recent meta-analysis conducted by Blut *et al.* (2021) demonstrates that anthropomorphism is in the eye of the beholder rather than referring to the extent to which firms design robots as humanlike.

A second stream of research emphasizes the paradoxical effect that increased anthropomorphism can result in consumers experiencing discomfort such as feelings of eeriness or a threat to their human identity and feelings of human inadequacies (Lu *et al.*, 2019; Mende *et al.*, 2019; Reed *et al.*, 2012). This view is in line with the uncanny valley theory postulating that the customer's affinity for a robot does not continuously increase with its human likeness as customers may find a highly humanlike robot creepy and uncanny (Mori, 1970; Mori *et al.*, 2012). Strong anthropomorphic qualities may also lead to overly

optimistic expectations about a robot's abilities, which can be disappointing (Wirtz *et al.*, 2018). Fostering scholarly understanding on the service triad technology-customer- FLE and the role of anthropomorphism is an important research direction (Van Doorn *et al.*, 2017).

Social presence

A related, but distinct concept is social presence. In virtual reality studies, Heeter (1992) indicates that presence consists of the three dimensions personal presence (extent to which you feel you are in a virtual world), environmental presence (the extent to which the environment seems to know you are there) and social presence (the extent to which someone or something, like computer generated beings, believes you are there). Social presence has the most implications for human-robot-interactions (HRI) because it is the ultimate aim of designing socially, interactive robots (Lee *et al.*, 2006).

Origins of social presence of robots can be found in symbolic interactionism and social psychological theories of interpersonal communication (Biocca *et al.*, 2003). The emphasis of social presence is on the agent's capacity for social interaction and verbal or nonverbal cues in communication. Therefore, physically present (e.g. sculptures) would not suffice to be perceived as socially present (e.g. beings) as social presence is mainly based on the sense that one has "access to another intelligence" (Biocca *et al.*, 2003).

Media equation theory argues that customers equate social robots with real social actors as they rely on their natural tendency of accepting things at their face validity and react to robots as if they were human (Lee *et al.*, 2006). The computers are social actors (CASA) research paradigm is derived from media equation theory and is frequently used to understand HRI. CASA is based on the idea that when confronted with an anthropomorphic robot, (a) humans respond to the robot socially, (b) humans are persuaded by the imitation of human characteristics of the robot and (c) humans do not process the fact that the robot is not a human (Lee *et al.*, 2006).

Although in service research Van Doorn *et al.* (2017, p. 43) refer to *automated* social presence (ASP) as "the extent to which technology makes customers feel the presence of another social entity", the original construct of social presence can be either a human or artificial intelligence evoking reactions to social cues (Biocca *et al.*, 2003). Therefore, in the current study, we focus on social presence. For engineers and designers of social robots, increasing the experience of social presence is typically a design goal (Biocca *et al.*, 2003). Recently, Gambino *et al.* (2020) summarize that engineers and designers aim for natural forms of social interaction between service robots and users to minimize the cognitive effort it takes human actors to use service robots.

Utilitarian and hedonic value

Anthropomorphism and social presence are expected to result in utilitarian and/or hedonic value. Motivation theory suggests that customers behave to satisfy their needs. Rooted in motivation theory, the more recent self-determination theory (SDT) provides a substantive basis for human behavior, distinguishing between extrinsic (utilitarian/instrumental) and intrinsic (hedonic) motivations (Deci, 1975; Deci and Ryan, 1985; Ryan and Deci, 2001). In marketing, Hirschman and Holbrook (1982) introduced a more experiential view of consumption, including hedonic reasons to the more traditional utilitarian reasons for a purchase. Likewise, contemporary studies investigate the effect of utilitarian and hedonic value on repeat patronage (Hepola *et al.*, 2020) or as dimensions of experiential value of robots in the service encounter (Wu *et al.*, 2021).

This study focuses on the value of service robots in hospitality which is inherent to the service perspective implying that "value is created collaboratively in interactive configurations of mutual exchange" (Vargo and Lusch, 2008, p. 145). The concept of value has its origins in other disciplines. Sociology, psychology and economics, for example, have a

long tradition of investigating instrumental and hedonic dimensions of attitude (Voss *et al.*, 2003).

In restaurants, it is also commonly known that the value customers perceive is not merely based on utility (utilitarian) but to a large extent also on gratification (hedonic) (Noone *et al.*, 2009). The distinction between utilitarian and hedonic value also found its way into recent research on service robots. In their study on service robots' value co-creation and value co-destruction potential, Čaić *et al.* (2018) argue that service robots offer new value propositions, where value is created when engaging in the service leaves actors better off relative to their initial conditions. Demonstrated in the context of elderly care, socially assistive robots positively impact both utilitarian (e.g. effectiveness) as well as hedonic value (e.g. fun) (Čaić *et al.*, 2019).

FLE interaction quality

Taking a service triad perspective consisting of service robots, customers and FLEs, implies that the interaction quality of FLEs plays a role during the service encounter. The nature of interactions is widely seen as the nucleus for value creation during the service encounter exercising a strong impact upon customer responses. Early, service researchers positioned service encounters as role performances in which the so-called service script would contain information about the role set related to one's own expected behavior as well as to the expected complementary behavior of others reflecting the prototypical service experience (Hui and Bateson, 1991; Solomon *et al.*, 1985).

While service research evolved, scholars in marketing and organizational behavior were giving increasing attention to the personal interaction between the customer and the FLE of service businesses. The service encounter became a focal point in consumer evaluations of the entire service organization and implied a great opportunity for a service firm to customize the delivery of its service to help the individual consumer. This customization opportunity is a potential source of competitive advantage for the service firm, which can lead to favorable service quality evaluations by consumers (Bettencourt and Gwinner, 1996; Bitner *et al.*, 1990; Bock *et al.*, 2016).

FLE performance quality is concerned with how the service is delivered, especially emphasizing the demand for emotional labor. For example, a service employee is expected to express positive emotions when interacting with a customer and act in a way to build trust, demonstrate promptness and reliability, and give a sense of personal attention (Singh, 2000). Therefore, we define quality of FLE interaction as consumers' perception of the *interpersonal* interactions with human employees that take place during service delivery (cfr. Brady and Cronin, 2001) and the FLEs willingness to help (cfr. Singh, 2000). In turn, a high-quality performance is thought to enhance customer intentions (Singh, 2000).

In the 2017 special issue on organizational frontlines, service scholars acknowledge the emerging role of technology resulting in a triadic (technology-customer-FLE) rather than a dyadic service encounter. Research recognizes that the human connection between staff and consumers can be challenging in technology-infused service interactions, and there will be a greater desire for employees who can connect with customers (Rafaeli *et al.*, 2017).

Along the continuum ranging from technologies that replace FLEs to those that augment FLEs to provide service, smart technologies (e.g. service robots) provide value and an important question is how such technologies can be leveraged and integrated in the triadic service encounter technology-customer-FLE to create value. Marinova *et al.* (2017) define frontline interactions to also include interactions between a customer and an artificial intelligence-powered machine, which connects the customer with the organization by replacing or augmenting FLEs to coproduce value. In a similar line, Singh *et al.* (2017) describe organizational frontline as interactions and interfaces at the point of contact between an organization and its consumers that promote, facilitate or enable value creation and

exchange. They explicitly argue that interfaces refer to the characteristics of modes, agents (or robots), artifacts and servicescapes that serve as the medium for the contact between the customer and the organization, acknowledging the role of service robots.

Most recently, Yoganathan *et al.* (2021) argue that robots and human staff can deliver services in collaboration. The interaction quality between robots and FLE in a service setting is expected to influence consumer service outcomes differently. Knowledge on the conditions under which service robots-FLE collaboration generate positive or negative outcomes is still scarce (Larivière *et al.*, 2017). For that reason, the current study investigates the role of FLE interaction quality in the triadic service encounter including service robots, customers and FLE.

Customer repatronage

The knowledge gap on how repatronage intentions in the service triad evolve is central to our study. In the contemporary service industry, facing numerous alternative offerings, service providers first encourage consumers to make an initial purchase, and in a second stage, they encourage existing customers to revisit or repurchase, based on their previous experiences (Ho and Chung, 2020). In highly competitive hospitality services such as restaurants, repatronage is an important loyalty indicator (Wirtz and Mattila, 2004). Customer repatronage reflects the likelihood that a customer will visit the restaurant again (Atulkar and Kesari, 2017). The service robot literature recently studied the effect of human likeness of the robot service (Lu *et al.*, 2021) and customer satisfaction with service robots (Jia *et al.*, 2021) on repatronage intentions (e.g. revisit intentions and purchase intentions) resulting in mixed findings.

Hypotheses development and conceptual model

Based on the concepts discussed in the literature review, this section will develop the hypotheses underlying our conceptual model.

As discussed, in this study, anthropomorphism refers to humanoid thoughts and emotions, whereas social presence refers to the sense of being with another. Heeter (1992) argues that the characteristics of the agent/service robot (anthropomorphism) affect the strength of the sense of social presence that is created.

Anthropomorphization can be seen as a "*first degree social response*", referring to the identification of fundamental human characteristics. Social presence, on the other hand, can be seen as a "*second degree social response,*" implying more subtle and complicated attitudinal and behavioral responses after identifying fundamental human characteristics (Lee *et al.*, 2006). HRI research argues that the user's response to anthropomorphism precedes the user's realization of the robot's presence (Lee *et al.*, 2006), and its positive effects are widely supported in the literature (Kim *et al.*, 2013; Mende *et al.*, 2019; Van Doorn *et al.*, 2017). Therefore, we expect also for our hospitality context that the more robots are perceived as humanlike, the stronger customers feel a social presence triggering social interaction and hypothesize the following:

H1. Service robot's anthropomorphism will exhibit a positive relationship with the service robot's social presence.

Based on our review of the literature on service robots in hospitality services, we observe a recent interest in the role of anthropomorphism on customer outcome variables (see Table 1). Existing studies provided mixed evidence as to the role of anthropomorphism. In contrast to the assumption that humanlike service robots positively impact consumer preference, Lu *et al.* (2019) argue that humanoid cues might backfire due to the perceived threat to human identity. In the customer service context, customers are likely to perceive utility and/or gratification in their interaction with a service robot. Utilitarian value suggests that

customers will have more confidence in the accuracy and consistency of the service provided, whereas service robot's hedonic value relates to fun and entertainment (Arnold and Reynolds, 2003; Lu *et al.*, 2019; Ryan and Deci, 2001). Service providers implement anthropomorphic service robots to create value and encourage customer loyalty (Blut *et al.*, 2021; Zemke *et al.*, 2020). Therefore, for our context of hospitality services, we expect that being perceived as a human as the *first degree of social response* (anthropomorphism) translates into the provision of the core service such as serving food and drink rather than into entertaining guests. Our assumption is that in the case of consistently serving food and drinks (utilitarian), anthropomorphism is not perceived by customers as a threat to human identity, while entertaining guests (hedonic) would. Hence, we expect a stronger impact of anthropomorphism on utilitarian rather than on hedonic value perceptions and hypothesize the following:

H2. Service robot's anthropomorphism exhibits a stronger positive relationship with the service robot's utilitarian value than with its hedonic value.

In hospitality, customers frequently have high expectations of being with another other and having pleasant social interactions (Fuentes-Moraleda *et al.*, 2020). Based on laboratory experiments in communication research, Lee *et al.* (2006) empirically demonstrate that social presence has a positive impact on utilitarian value (e.g. consistency and accuracy) and on hedonic value (e.g. fun and entertainment). In their field studies, Čaić *et al.*, 2019 demonstrate that automated social presence has a positive effect on both hedonic (e.g. fun) as well as on utilitarian value (e.g. effectiveness) in the context of socially assistive robots in an elderly care setting. We argue more specifically for our context of service robots in hospitality that social presence triggers social interaction between customers and the hospitality provider and – as *second degree of social response* (social presence) – seems to match the auxiliary services (e.g. entertainment and fun) rather than to the core service provision (e.g. serving food and drinks). Therefore, we expect a stronger impact of social presence (Biocca *et al.*, 2003) on hedonic rather than on utilitarian value perceptions and hypothesize the following:

H3. Service robot's social presence exhibits a stronger positive relationship with the service robot's hedonic value than with its utilitarian value.

The decision whether or not to return to a service provider typically depends on the utilitarian hedonic value the customer perceives (Atulkar and Kesari, 2017; Hepola *et al.*, 2020). In retailing, it is to be expected that utilitarian value (rather task-oriented) results in repatronage as higher levels of excitement (e.g. fun and enjoyment) will do too (Wakefield and Baker, 1998). We apply a similar reasoning to service robots in hospitality, assuming that if customers perceive service robots to offer utilitarian and hedonic value, this will encourage them to repatronage the restaurant. Therefore, we hypothesize the following:

H4. Service robot's utilitarian value exhibits a positive relationship with customer repatronage intentions.

H5. Service robot's hedonic value exhibits a positive relationship with customer repatronage intentions.

Moderating hypotheses

Contemporary service research views augmentation from the perspective that technology enhances human actors (De Keyser *et al.*, 2019; Larivière *et al.*, 2017; Marinova *et al.*, 2017). Taking a service triad perspective, we reason that actors can augment each other's tasks in the service encounter, implying that a service robot can augment FLEs or that FLEs can augment service robots. Augmentation involves assisting and complementing other actors in the service triad to perform their tasks better and achieve their goals in the service encounter.

Service triads, consisting of service robots, customers and FLEs by definition imply that the physical encounter between customer and FLE is augmented by technology (De Keyser *et al.*, 2019; Hilken *et al.*, 2017). In order to guide service managers in setting-up these service triads, an increased understanding is needed as to how human and nonhuman actors work in tandem.

Previous studies show that customer needs for a human touch can be especially relevant when handling failures (De Keyser *et al.*, 2015). In case the service robot's utilitarian or hedonic value is low, which can be thought of as some kind of failure, we expect the FLE to compensate for this failure and augment the service robot's value resulting in repatronage intentions.

More specifically, for our context of hospitality service, triads with a strong emphasis on the provision of the core service such as serving food and drinks (utilitarian elements) we expect that high-quality interactions with FLEs can augment lower levels of service robot utilitarian value. In other words, customers in the service triad who lack the robot's accuracy and consistency feel supported by employees' efforts in the interaction (Stein and Rameseshan, 2019) and decide to revisit the venue. In a similar vein, for our people-oriented service encounter (Li *et al.*, 2021) in a restaurant that people typically visit for enjoyment (hedonic elements), we expect that high-quality interactions with FLEs can also augment lower levels of service robot hedonic value (Qiu *et al.*, 2020).

Summarizing, a positive customer perception of interpersonal interactions with FLEs (Brady and Cronin, 2001) and their demonstrated willingness to help (Singh and Sirdeshmukh, 2000) can increase customer repatronage intentions in cases when the service robot functional performance and entertainment are relatively low. Therefore, we hypothesize the following:

H6. Quality of FLE interactions *augments* the service robot's utilitarian value resulting in customer repatronage intentions.

H7. Quality of FLE interactions *augments* the service robot's hedonic value resulting in customer repatronage intentions.

The conceptual model is visualized in Figure 1.

Study 1 – Method

Empirical context

Our empirical context reflects a triadic encounter consisting of service robots – FLEs – customers. It entails a fast casual dining restaurant in Europe that offers Asian-style dining.

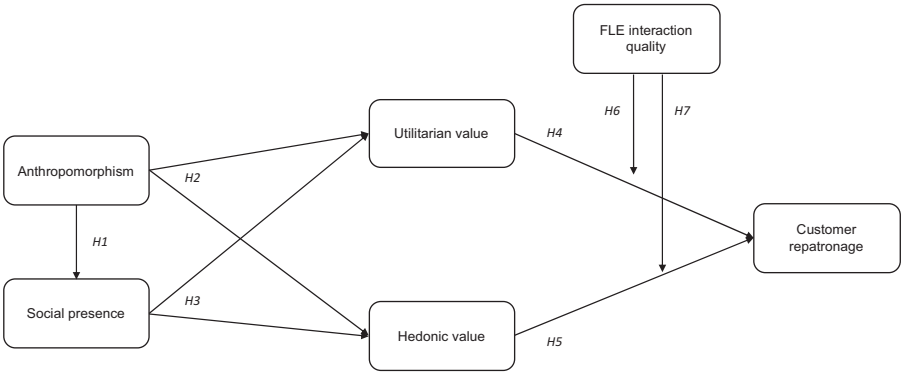

Figure 1.
Conceptual model

The restaurant promises worldly food for small town prices and strives for revenue management, described by Noone *et al.* (2009) as reducing service encounter duration to welcome more customers and generate more revenues during high demand periods. The restaurant can typically be recognized by a long waiting line outside that customers gladly accept in return for an affordable and fast casual dining experience.

In the COVID-19 pandemic, this restaurant implemented two frontline service robots, resulting in a service triad of service robots, FLEs and customers. First, these service robots minimized human-to-human contact and, thereby, the risk of spreading the virus (Davis, 2020). Second, substituting human FLEs with service robots increased the maximum number of customers that could be seated as the particular government only allowed a maximum number of people in a restaurant at the same time, including staff. Third, this limited amount of customers allowed, (normal maximum capacity of the restaurant is approximately 300 customers) created a smaller setting which was an excellent environment to experiment with the service robots. Both service robots – Amy and Akatar, displayed in Plate 1 – can be considered humanoid, which refers to a robot with humanlike features

Plate 1.
Field study robots Amy (left) and Akatar (right)

(Mende *et al.*, 2019). Namely, they both have a face and a name (van Pinxteren *et al.*, 2019). Moreover, they can communicate unilaterally with the customers with a humanlike voice (they can speak to the customers, but they do not respond) (Złotowski *et al.*, 2015). Each service robot has its own shape that supports a distinctive set of tasks: Amy serves drinks and picks up the empty glasses, and Akatar delivers dishes from the kitchen to the customer's table.

Exploratory field observations

To gain a better understanding of this triadic service encounter, data collection started with a field observation during the first three days of the implementation of the service robots (June 3 until June 5, 2020). Field observations typically clarify and focus initial ideas and give concrete insights into the context and the people involved (Goodman *et al.*, 2012). A semi-structured observation protocol was followed that allowed for deviation and comments, allowing a rich description of the hospitality context at hand (Denzin, 2001). In total, data were collected during 9 h of field observation, spread across three researchers. Field observations in the restaurant were covert, with permission of the restaurant owner, to ensure that interactions with the service robot were not influenced by the observer, avoiding the Hawthorn effect (Jones, 1992). The field observation enabled the research team to get a rich understanding of the service triad and resulted in two main insights. First, the field notes uncovered dyadic and triadic interactions in the triad "service robot-customer-FLE". Second, the field notes revealed two potentially different benefits of the service robot: (1) utilitarian value: service robot serves food and drinks to the customers and by doing so also offers functional support to the FLE and (2) hedonic value: service robot offers entertainment and enjoyment to customers, which can for example be observed by customers taking selfies with the service robot. These insights were used as an input for the survey development of our field study and subsequent scenario-based experimental design.

Sample and measures

Based on extensive discussions with the restaurant owner and store manager, it became clear that the typical segment of the restaurant consists of relatively young customers such as students, young couples and families with young kids. Therefore, we decided for a QR-code that quickly and efficiently converse the survey URL to customers. The main reasons underlying this decision are: (1) the free Internet access in the restaurant, (2) the high likelihood of customers bringing their smart phone, (3) aim for minimal human-human interaction in the COVID-19 pandemic and (4) environmental friendliness.

Before the first day of our data collection, we prepared a podcast with instructions for the team of human FLEs. The store manager shared this podcast with his team via the team's Whats App group to emphasize the importance of timing of showing the flyer with QR-code (i.e. after customers completed their main course to make sure they experienced FLEs and service robot interactions). In addition to the podcast, we also provided instruction flyers for the team including the steps they had to recall in the data collection stage. These flyers were located at various backstage locations in the restaurant, reminding the human staff of the research taking place.

The FLEs showed a plasticized flyer (Appendix 1) to customers after they finished their main course. This ensured that customers did experience the triadic service encounter.

As an incentive, the customers were offered a free homemade iced tea in return for completing the online survey on their mobile device. Data collection took place over the course of one month, from September 14 to October 14, 2020. In total, 124 customers who interacted with the service robot completed the survey, resulting in a final dataset of 108 responses after elimination of incomplete answers. Of the respondents, 70.8% were female, and in terms of

age, 81.5% fell within the range of 18 and 34 years. In addition, 69.4% of the sample consisted of repeat customers (i.e. had visited this fast casual dining restaurant before). The respondents mainly visited the restaurant with friends (62%), their partner (21.3%) or family (13.9%).

All items in the survey were adapted from existing measurement scales, which were partially reduced to fit our context of fast casual dining. The items were assessed on a seven-point Likert scale (1 = "strongly disagree", 7 = "strongly agree"). Our dependent variable, customer repatronage intention, was captured by the respondent's intention to revisit the restaurant within the next six months and was measured with a two-item scale adapted from Maxham and Netemeyer (2002). The moderating variable, FLE interaction quality, was adapted from three items of Brady and Cronin's (2001) interaction quality construct. The service robot's utilitarian and hedonic value were both assessed based on four items adapted from the recently developed service robot adoption willingness scale (Lu *et al.*, 2019). Specifically, the utilitarian value construct was composed of items focusing on the service robot's accuracy and consistency in performance, whereas hedonic value was assessed through customer's fun and entertainment experienced while served by the robot (Lu *et al.*, 2019). The service robot's social presence comprised of five items adapted from Lee *et al.* (2006). Lastly, anthropomorphism was captured by five items developed by Lu *et al.* (2019). To answer the questions related to the service robot, we asked the respondents to answer these questions while keeping in mind the robot they interacted with the most. We included this baseline service robot as a control variable in our PLS model. A complete list of the items and their factor loadings can be found in Table 2, whereas their scale reliabilities are displayed in Table 3.

Data analysis

We turn to partial least squares structural equation modeling (PLS-SEM) to test our hypotheses. PLS-SEM is an estimation technique based on OLS regressions. It focuses on the prediction of a specific set of hypothesized relationships that maximizes the explained variance in the dependent variables, similar to OLS regressions (Hair *et al.*, 2016). This makes PLS-SEM particularly useful for success driver studies (Hair *et al.*, 2011). The decision to apply this method of analysis was driven by two main reasons. First, PLS-SEM can handle small sample sizes of less than 200 respondents (Bacile, 2020; Chin, 1998; Hair *et al.*, 2012). Hair *et al.* (2016) provide minimal sample size requirements to detect various R^2 values at a 5% significance level while taking the complexity of the PLS path model into account. The maximum number of arrows pointing at a construct in this study is three, so we need at least 37 respondents to pinpoint R^2 values of at least 0.25 at a 5% significance level. Thus, we can conclude that our sample size of 108 is sufficiently large. Second, the method is nonparametric in nature and can therefore deal with nonnormal data (Chin, 1998; Hair *et al.*, 2016). Hair *et al.* (2012) recommend performing Shapiro–Wilk or Kolmogorov–Smirnov tests to evaluate whether data are normally distributed. Both tests in SPSS indicate that our anthropomorphism, service robot's hedonic value, FLE interaction quality and customer repatronage variables are nonnormally distributed. Additional checks for skewness and kurtosis (Hair *et al.*, 2016) confirm that our data are nonnormally distributed. For these reasons, we use PLS-SEM. More specifically, SmartPLS 3.3.2 software (Ringle *et al.*, 2015) was applied to conduct the analyses. We used the standard, recommended algorithm and settings, and administered case-wise deletion for missing variables.

Since the data from both our dependent and independent variables come from the same source, common method bias could be a potential threat (Podsakoff *et al.*, 2003). To evaluate the extent to which our data suffers from common method bias, we employ the procedure suggested specifically for PLS-SEM research by Kock (2015). As our estimations indicate that our highest VIF is 1.73, we can confirm our VIF values do not exceed the 3.3 threshold, suggesting that common method bias is not a concern for this study.

Construct (source)	Items		Standardized loadings
Service robot anthropomorphism (Lu *et al.*, 2019)	(1)	The robot has a mind of its own	0.85
	(2)	The robot has consciousness	0.90
	(3)	The robot has its own free will	0.92
	(4)	The robot experiences emotions	0.90
	(5)	The robot has intentions	0.73
Service robot social presence (Lee *et al.*, 2006)	(1)	I feel as if I was interacting with an intelligent being	0.86
	(2)	I feel as if I was accompanied by an intelligent being	0.84
	(3)	I was involved with the robot	0.82
	(4)	I feel as if I was responding to the robot	0.82
	(5)	I feel as if I and the robot were communicating to each other	0.85
Service robot utilitarian value (Lu *et al.*, 2019)	(1)	The robot is more accurate than human employees	0.76
	(2)	Information provided by the robot is more accurate with less human errors	0.90
	(3)	The robot provides more consistent service than human employees	0.87
	(4)	Information provided by the robot is more consistent	0.72
Service robot hedonic value (Lu *et al.*, 2019)	(1)	I have fun interacting with the robot	0.91
	(2)	Interacting with the robot is fun	0.90
	(3)	Interacting with the robot is entertaining	0.82
	(4)	The actual process of interacting with the robot is pleasant	0.79
FLE interaction quality (Brady and Cronin, 2001)	(1)	Overall, I'd say the quality of my interaction with this restaurant's employees is excellent	0.88
	(2)	I would say that the quality of my interaction with this restaurant's employees is high	0.92
	(3)	The attitude of this restaurant's human employees demonstrates their willingness to help me	0.90
Customer repatronage intentions (Maxham and Netemeyer, 2002)	(1)	I expect to eat at this restaurant again in the next six months	0.94
	(2)	I am certain that I will be eating at this restaurant again in the next six months	0.96

Table 2.
Items and factor loadings

Construct	Mean	SD	AVE	CR	α	1	2	3	4	5	6
1. Anthropomorphism	3.34	1.69	0.75	0.94	0.91	*0.86*					
2. Social presence	4.31	1.56	0.70	0.92	0.89	0.65	*0.84*				
3. Utilitarian value	3.86	1.45	0.67	0.89	0.83	0.71	0.65	*0.82*			
4. Hedonic value	4.97	1.49	0.73	0.92	0.88	0.50	0.58	0.56	*0.85*		
5. FLE interaction quality	6.14	0.96	0.81	0.93	0.89	0.17	0.30	0.05	0.18	*0.90*	
6. Customer repatronage	5.88	1.57	0.90	0.95	0.89	0.33	0.39	0.24	0.23	0.48	*0.95*

Note(s): All constructs were measured on seven-point interval scales; SD = standard deviation; AVE = average variance extracted; CR = composite reliability; α = Cronbach's alpha. The square root of the average variance extracted for each construct is indicated in *italics* on the diagonal of the correlation matrix

Table 3.
Means, standard deviations, correlations and reliability estimates

In the next section, we first evaluate our measurement model, which attaches manifest variables to their latent variables. After that, we test the relationships between the latent variables by assessing the structural model (Fornell and Larker, 1981; Hulland, 1999).

Results

Measurement model – validity and reliability

To ensure construct reliability, we check the item loadings, composite reliability and Cronbach's alpha values. First, for individual item reliability, we investigate the loadings. A generally accepted heuristic is that item loadings should be 0.7 or higher (Hair *et al.*, 2016). All our items exceed this threshold. For construct reliability, Hair *et al.* (2016) detail that the composite reliability and Cronbach's alpha values should exceed 0.7. As Table 3 shows, construct reliability was established with strong composite reliability values ranging from 0.89 to 0.95 and Cronbach's alpha ranging from 0.83 to 0.91.

The AVE values for all constructs highly exceed 0.50 (see Table 3), indicating sufficient levels of convergent validity (Bagozzi and Yi, 1988; Hair *et al.*, 2016). To ensure discriminant validity, we follow both the Fornell-Larcker criterion and the Heterotrait-Monotrait (HTMT) ratio criterion. For the Fornell-Larcker criterion, each construct must share more variance with its own measures than with any of the other constructs. This is reflected by a higher square root of the AVE for each construct compared with its correlations with other constructs (Fornell and Larker, 1981; Hair *et al.*, 2016). In addition, the square root of the AVE should not be lower than 0.7 (Chin, 1998). As Table 3 shows, all constructs meet these criteria. Following the HTMT ratio criterion, the HTMT values for all pairs of constructs should be below 0.85 (Voorhees *et al.*, 2016). The HTMT values for our constructs range from 0.07 to 0.81 and are below the accepted threshold. Lastly, we can confirm that multicollinearity was not a threat to the measures as none of the variance inflation factor values exceeded the threshold level of 5 (Hair *et al.*, 2016).

To evaluate the predictive relevance of the model, we examine the effect size and explained variance of the endogenous constructs. Table 4 indicates the R^2 values of the endogenous

Table 4.
Results of hypotheses testing and explained variance

Hypothesized relationships	Standardized path coefficient	Hypothesis supported or not supported	R^2 (construct)
H1: Anthropomorphism → Social presence	0.65^{***}	Supported	0.42 (Social presence)
H2: Anthropomorphism → Utilitarian value stronger than Anthropomorphism → Hedonic value	0.49^{***} Utilitarian value 0.21^{*} Hedonic value	Supported	0.57 (Utilitarian value)
H3: Social presence → Hedonic value stronger than Social presence → Utilitarian value	0.33^{***} Utilitarian value 0.45^{***} Hedonic value	Not supported	0.36 (Hedonic value)
H4: Utilitarian value → Customer repatronage	0.23^{*}	Supported	0.31 (Customer repatronage)
H5: Hedonic value → Customer repatronage	NS	Not supported	
H6: Moderation: FLE interaction quality on utilitarian value → customer repatronage	-0.26^{*}	Supported	
H7: Moderation: FLE interaction quality on hedonic value → customer repatronage	NS	Not supported	

Note(s): $^{*}p < 0.05$; $^{***}p < 0.001$; NS = not significant

constructs range from 0.31 to 0.57, all exceeding the commonly accepted thresholds set by Falk and Miller (1992), Chin (1998) and Hair *et al.* (2011). In addition to the R^2, it is increasingly encouraged to report the f^2 effect sizes (Hair *et al.*, 2016). The f^2 effect sizes for the supported hypotheses range from 0.04 to 0.73 and, thereby, vary from small to large effects (Hair *et al.*, 2016). As such, the model's predictive relevance is supported.

Structural model – hypotheses testing

To evaluate the structural model and test the significance of the path coefficients, we ran a bootstrapping procedure with 5,000 samples (Hair *et al.*, 2011). The effect of the control variable related to the baseline service robot was insignificant on all endogenous variables ($p > 0.1$). The estimation results supported a positive effect ($\beta = 0.65$; $p < 0.001$; $f^2 = 0.73$) of anthropomorphism on social presence, in support of H1. To test H2 and H3, we employed Rodríguez-Entrena *et al.*'s (2018) approach to test the statistical differences between path coefficients. Using 95% basic bootstrap confidence intervals, we find support for H2, in that anthropomorphism has a statistically significant (CI [0.1190, 0.4748]) stronger effect on utilitarian value ($\beta = 0.49$; $p < 0.001$; $f^2 = 0.32$) than on hedonic value ($\beta = 0.21$; $p < 0.05$; $f^2 = 0.04$). Despite the larger positive effect size of social presence on the service robot's hedonic value ($\beta = 0.45$; $p < 0.001$; $f^2 = 0.18$) than its utilitarian value ($\beta = 0.33$; $p < 0.001$; $f^2 = 0.15$), this difference is not statistically significant as its confidence interval includes zero (CI [–0.3165, 0.0637]). Therefore, we cannot find support for H3. We did find support for H4, with a positive effect of a robot's utilitarian value on customer's repatronage intention ($\beta = 0.23$; $p < 0.05$; $f^2 = 0.05$). Surprisingly, the path between the robot's hedonic value and customer's repatronage intention was not significant and failed to provide support for H5 ($\beta = 0.02$; $p > 0.05$; $f^2 = 0.00$). Further, we find a negative moderation effect of human employees' interaction quality on the relationship between the service robot's utilitarian value and customer's repatronage intention ($\beta = -0.26$; $p < 0.05$; $f^2 = 0.04$), supporting H6. Finally, we report an insignificant moderation effect of human employees' interaction quality on the relationship between the service robot's hedonic value and customer's repatronage intention ($\beta = 0.22$; $p < 0.05$; $f^2 = 0.05$), thereby rejecting H7. Figure 2 and Table 4 summarize the results of the hypothesis testing.

To further expand on the moderation effects found in H6, Figure 3 illustrates the relationships between the constructs. It displays the relationship between the service

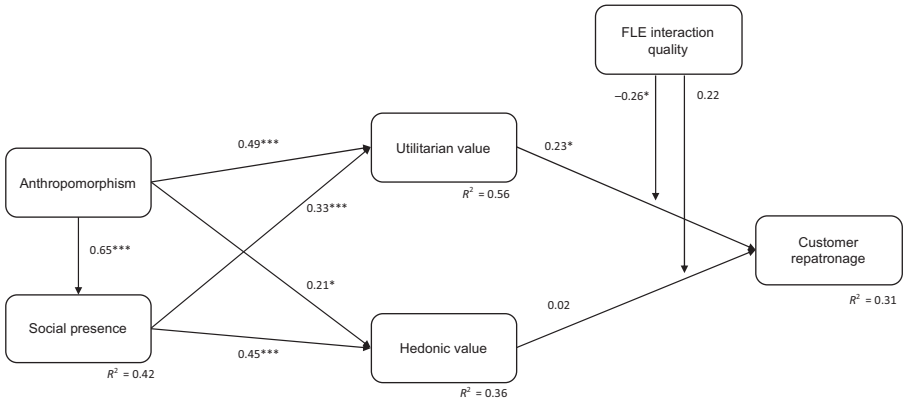

Figure 2.
Structural model

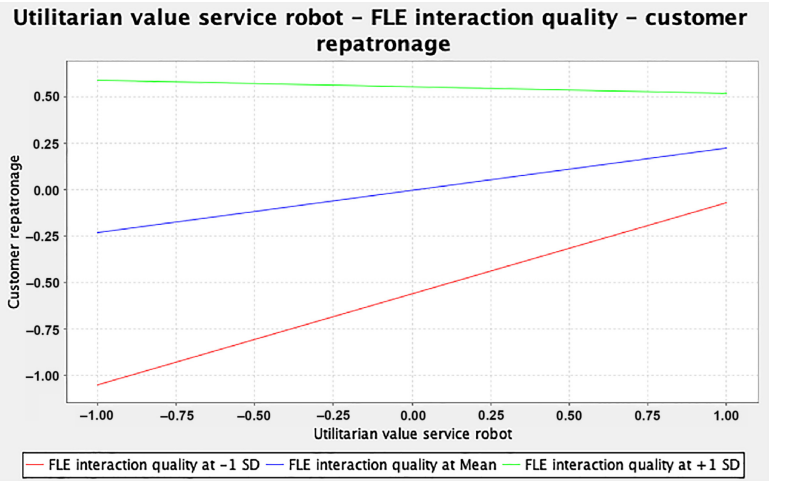

Figure 3.
Simple slope plot representing moderation effect H6

robot's utilitarian value, customer repatronage intentions and FLE interaction quality. The figure shows that in situations where the service robot's utilitarian value is at the mean and – especially – at lower levels, the FLE interaction quality does have a pronounced effect on customer repatronage intentions. In other words, FLE interaction quality can compensate for suboptimal levels of service robot utilitarian value, and FLEs can augment the service robots. However, in situations where service robot utilitarian value is high, there is not a pronounced relationship between the FLE interaction quality and customer's repatronage intentions.

Study 2

Scenario-based experimental design

To test the robustness of the findings related to hypotheses 4–7 from our field study, we conducted a scenario-based online experimental design. This setup allowed us to ensure more variation in FLE interaction quality and recruit a sufficiently large sample size during the 2020/2021 COVID-19 lockdowns.

Design, procedure and stimuli

We adopted a 2 (service robot utilitarian value: high, low) × 2 (service robot hedonic value: high, low) × 3 (FLE interaction quality: high, low, no interaction) between-subject design. For the high (low) service robot utilitarian value condition, the service robot took orders and served food and drinks in a highly (in)consistent and very (in)accurate manner. With respect to the service robots high (low) hedonic value, the service robot brought (did not bring) fun while serving drinks and foods by, for example, making jokes and was (not) entertaining by, for example, posing for pictures, making the interaction with the robot very (un)enjoyable. For high (low) FLE interaction quality, human employees were very (un)helpful, and how they interacted with the customers was excellent (horrible). For the FLE *control* condition of NO FLE, customers did not interact with any of the human employees and were only served by the robot.

At the start of the survey, participants were asked the following: "Imagine you visit a fast casual dining restaurant. The restaurant promises wordly food for small town prices. Customers typically come here for healthy dishes and fast service at an affordable price hence

fast casual dining. In addition to the human employees that work at the restaurant, they recently also employed a new service robot, Akatar. Together with human employees, Akatar is serving the customers of the restaurant. A picture of the service robot Akatar is shown below (see Plate 1). Thereafter, participants were randomly assigned to one of the experimental conditions. The exact information provided to the participants is shown in Appendix 2 for each experimental scenario.

Sample and measures

Participants were recruited via Amazon Mechanical Turk (MTurk). We took several measures to ensure the quality of our data. First, we included an attention check (open ended question asking what the scenario was about) next to the standard manipulation checks. Second, we determined *a priori* that we only considered MTurkers from the US, as a native English-speaking country (Aguinis *et al.*, 2021). Third, we designed a short questionnaire (Hamby and Taylor, 2016). Fourth, we avoided using scales that only have the "end" points labeled (Goodman *et al.*, 2013). Fifth, only participants who passed the attention check and did not take less than 230 s or more than 10 min were retained as part of the final sample. Taking response times into consideration is a method to screen MTurk data for careless responding (Aguinis *et al.*, 2021). This resulted in a final sample of 361 useable responses (all from the US) (M_{age} = 43.9, 51% male).

After exposure to the scenarios, our dependent variable customer repatronage was identical to our field study. In addition, we included prior experience with service robots, prior experience with fast casual dining restaurants and participant's gender and age as control variables. We used items from our field study constructs, which were based on existing measurement scales as manipulation checks. The manipulation check for utilitarian value was "To what extent would you rate the service robot Akatar as effective?". We used the statement "I have fun interacting with the robot" as a manipulation check for service robot hedonic value. As a manipulation check for FLE interaction quality, we included the item "Overall, I'd say the quality of my interaction with this restaurant's employees is excellent."

Results

Table 5 shows an overview of the responses per experimental group. Construct validity and reliability tests were conducted and showed that individual item loadings, composite reliability and Cronbach's alpha values all exceed their minimum threshold of 0.7. Next to this, the AVE value exceeds 0.5, as indicated in Tables 6 and 7. The manipulation checks indicated a significant effect for all three manipulated factors: service robot utilitarian value (M_{low} = 3.73, SD = 2.16 vs. M_{high} = 5.73, SD = 1.20), $F(1,359) = 168.85$, $p < 0.001$, service robot hedonic value (M_{low} = 2.98, SD = 1.86 vs. M_{high} = 5.28, SD = 1.46), $F(1,359) = 25.08$, $p < 0.001$ and FLE interaction quality (M_{low} = 3.10, SD = 1.88 vs. M_{high} = 5.46, SD = 1.24), $F(1,359) = 39.00$, $p < 0.001$.

To verify the robustness of the findings of our field study related to hypotheses 4 and 6, we first analyzed a subset of our sample, leaving out the respondents who were in the control condition and did not experience any FLE interaction in their scenario. We conducted our analyses based on ordinary least squares regression using Hayes's PROCESS tool (custom model 1). We employed bootstrapped (N = 5,000) 95% bias-corrected confidence intervals. In addition, heteroscedasticity-consistent standard errors were computed as recommended by Hayes (2017). The effect of service robot utilitarian value on customer repatronage is positive and statistically significant ($\beta = 1.5476$; $p < 0.001$; CI [0.9735, 2.1218]). Therefore, we provide additional evidence to support hypothesis 4. With respect to hypothesis 6, we found a negative moderation effect of FLE interaction quality on the relationship between service robot's utilitarian value and customer repatronage intentions

($\beta = -1.0919$; $p < 0.01$; CI [−1.8980, −0.2858]), providing additional evidence for hypothesis 6. Namely, in situations where the service robot's utilitarian value is low, FLE interaction quality has a pronounced effect on customer repatronage. Thus, FLEs can augment service robots by compensating suboptimal levels of service robot utilitarian value through FLE interaction quality. In contrast, if service robot utilitarian value is high, there is not a pronounced relationship between FLE interaction quality and customer repatronage. This effect is visualized in Figure 4. We controlled and found significant effects on customer

Table 5.
Number of responses for study 2 per experimental group

Factor	Category	*n*
Service robot utilitarian value	High	188
	Low	173
Service robot hedonic value	High	186
	Low	175
FLE interaction quality	High	117
	Low	126
	Control condition (no FLE interaction)	118

Table 6.
Items and factor loadings for study 2

Construct (source) (Maxham and Netemeyer, 2002)	Items		Standardized loadings
Customer repatronage	1	I would expect to eat at this restaurant again in the next six months	0.977
	2	I am certain that I would be eating at this restaurant again in the next six months	0.976

Table 7.
Mean, standard deviation and reliability estimates for study 2

Construct	Mean	SD	AVE	CR	α
Customer repatronage	4.382	1.945	0.953	0.976	0.951

Note(s): The construct was measured on a seven-point interval scale; SD = standard deviation; AVE = average variance extracted; CR = composite reliability; α = Cronbach's alpha

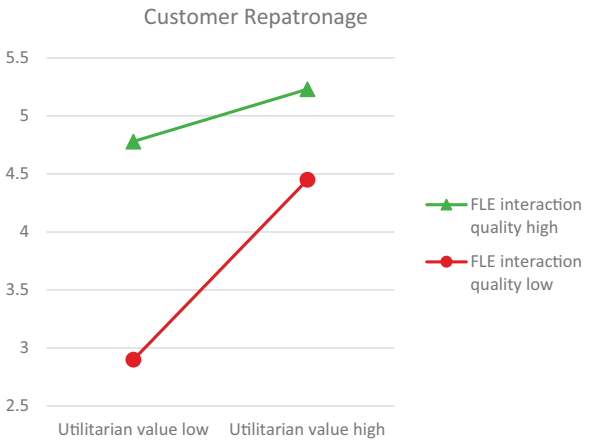

Figure 4.
Visualized results of study 2 for H6

repatronage for service robot hedonic value (β = 0.8622; p < 0.001; CI [0.4540, 1.2704]), participant's prior experience with service robots (β = 0.8394; p < 0.01; CI [0.3042, 1.3745]) and fast casual dining (β = 0.5936; p < 0.05; CI [0.0773, 1.1100]), age (β = −0.0217 p < 0.05; CI [–0.0386, −0.0049]) and gender (β = 0.4362; p < 0.01; CI [0.0137, 0.8588]).

Employing the same procedure, we checked the robustness of the findings from our field study related to hypotheses 5 and 7. In contrast to the field study, the effect of service robot hedonic value on customer repatronage is positive and highly significant (β = 1.0690; p < 0.001; CI [0.4872, 1.6507]), providing new evidence to support hypothesis 5. We again find significant effects on customer repatronage for our control variables service robot utilitarian value (β = 1.0120; p < 0.001; CI [0.6014, 1.4226]), participant's prior experience with service robots (β = 0.8705; p < 0.01; CI [0.3312, 1.4098]) and fast casual dining (β = 0.5326; p < 0.05; CI [0.0231, 1.0422]), and age (β = −0.0203; p < 0.001; CI [–0.0374, −0.0032]). However, there is no evidence that the effect of service robot hedonic value on customer repatronage is moderated by FLE interaction quality. This insignificant effect is visualized for customer repatronage in Figure 5. As such, we fail to find support for hypothesis 7 in study 2, corroborating the result from our field study.

Additional moderation analyses including control condition

The service triad of technology-customer-FLE is central to study 1 and study 2. So far, the setup of our studies allowed us to investigate possible augmentation between FLE and service robot. To potentially isolate a substitution role in the scenario-based experimental design as well, we included a control condition in which customers were only served by the robot and not by human FLEs. We employed the same procedure as in hypotheses 6 and 7 (PROCESS custom model 1) but coded the three categories of our moderator FLE interaction quality (no interaction, low interaction quality and high interaction quality) using the indicator method (Hayes and Preacher, 2014).

Overall, we find that the relationship between the service robot's utilitarian value and customer repatronage intentions is moderated by the multicategorical moderator FLE interaction (p < 0.05). The effect of the service robot's utilitarian value on customer repatronage intentions is positive when there is no FLE interaction (β = 1.3167; p < 0.001; CI [0.6110, 2.0224]), similar to when FLE interaction quality is low (β = 1.5298; p < 0.001; CI [0.9554, 2.1042]). In contrast, the effect is not statistically significant if FLE interaction quality is high (β = 0.4571; p > 0.1; CI [–0.1053, 1.0195]). This indicates that service robots can potentially substitute customers' interaction with human FLEs if their utilitarian value is

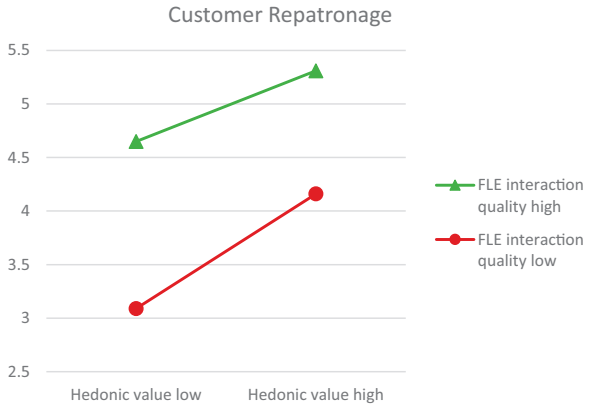

Figure 5.
Visualized results of study 2 for H7

optimized. We find that the effect of the service robot's hedonic value on customer repatronage is not moderated by the multicategorical moderator FLE interaction ($p > 0.1$). The results of these additional analyses are depicted in Figures 6 and 7.

Discussion

The triadic interdependencies between technology (e.g. service robots), human employees (e.g. FLE) and customers (e.g. customers in a restaurant) have been acknowledged in what Larivière *et al.* (2017) label Service Encounter 2.0. De Keyser *et al.* (2019) introduce conceptual archetypes to further capture different constellations of FLE and technology in the service frontline. Our field study and scenario-based experimental design in hospitality services in a fast casual dining restaurant supports the notion that the interplay between service robots and FLE contributes to customers' repatronage intentions.

As hypothesized, our empirical results demonstrate that when customers perceive an anthropomorphized service robot, they are also likely to perceive being with another social entity in the restaurant. Both anthropomorphism and social presence have a strong positive effect on utilitarian and hedonic value of the service robot. These results provide empirical support for the idea that humanoid service robots provide utility and gratification to

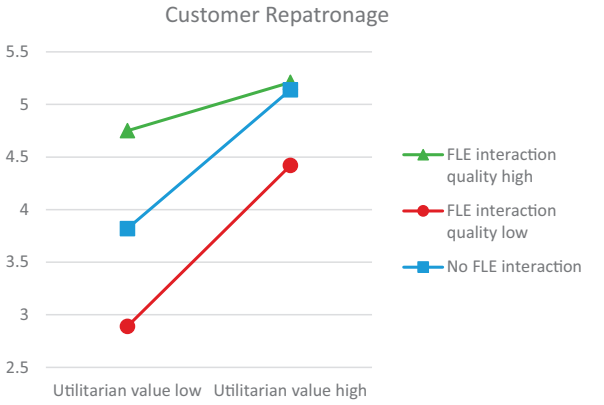

Figure 6.
Additional analysis related to H6 including control condition

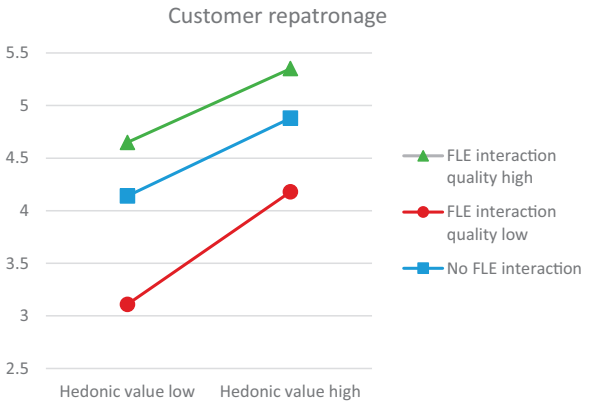

Figure 7.
Additional analysis related to H7 including control condition

customers in hospitality services (Ryan and Deci, 2001). In addition, our findings show that anthropomorphism has a stronger influence on utilitarian value compared to hedonic value. Anthropomorphism seen as a *first degree social response* (Lee *et al.*, 2006), relating to the identification of fundamental human emotions and intentions, affects the provision of the core service (serving drinks and food) more than entertaining guests in the service triad.

Interestingly, only utilitarian value demonstrates a strong, significant, positive effect on customer repatronage in both studies. In the context of our hospitality services, customers seem to value the utilitarian aspects of the encounter (e.g. fast service, affordable prices and consistent/accurate interaction with the service robot). Our empirical findings based on service interactions with service robots in the triadic encounter is a refinement of an earlier study on the relationship between encounter pace and satisfaction, demonstrating that a higher encounter pace positively impacts satisfaction up to a certain tipping point (Noone *et al.*, 2009) as customers also value an enjoyable service encounter (hedonic value). Interestingly, the effect of hedonic value on customer repatronage is insignificant in the field study, yet significant in the scenario-based experimental design. This fascinating result can potentially be explained by the specific empirical context of the fast casual dining restaurant in the field experiment, in which the service robot possesses limited hedonic features. Namely, it communicates unilaterally and does not respond to customers. In the scenario-based experiment design, the service robot exhibits arguably higher hedonic characteristics as it makes jokes and poses for pictures. This finding extends existing retailing studies on the effect of hedonic value on customer repatronage (e.g. Atulkar and Kesari, 2017) to a triadic service encounter with service robots.

Our two studies provide support for our moderation hypothesis which posits that FLE interaction quality augments the effect of utilitarian value on customer repatronage. This finding illustrates the delicate interplay of actors within the customer-FLE-technology triad (De Keyser *et al.*, 2019; Larivière *et al.*, 2017). Namely, in situations where the utilitarian value of service robots is low, high FLE interaction quality leads to higher customer repatronage. In other words, given the triadic interdependencies, FLEs can augment a lower functional performance of service robots, and vice versa (Larivière *et al.*, 2017; Li *et al.*, 2021). To test for a replacement role within the service triad, we tested a scenario in which there is no FLE interaction, implying that the service robots take over the role of the FLEs. The results demonstrate that the same level of customer repatronage can be achieved without FLE interaction if the utilitarian value of the service robot is high. This suggests that in a fast casual dining restaurant, service robots with a high utilitarian value can make the interaction with FLEs redundant. This finding provides initial empirical evidence for a potential "*substitution* role" in Service Encounter 2.0, in which "technology promises to increase service encounter quality and efficiency, omitting inherent human staff variability" (Larivière *et al.*, 2017, p. 240; Li *et al.*, 2021), especially focusing on more consistency and accuracy (utilitarian value) in the service delivery by service robots in contrast to human variability.

Theoretical contributions

Our empirical findings from the field study of the triadic interactions between customers, service robots and FLEs in a fast casual dining restaurant provide three important theoretical insights. First, we provide empirical evidence for the interplay between different actors in the "customer-FLE-technology" triad (De Keyser *et al.*, 2019), resulting in favorable customer outcomes. In the modern-day Service Encounter 2.0, customer-company interactions that take place in service systems are comprised of interrelated technologies, human actors, physical/digital environments and company/customer processes (Lariviere *et al.*, 2017). In these settings, technology can both augment and substitute human FLEs (Marinova *et al.*, 2017; Li *et al.*, 2021). Companies that are able to find the right balance and roles for the

different actors in the customer-FLE-technology triad will be able to attain a competitive advantage (Lariviere *et al.*, 2017). However, so far little is known in the service literature about how companies must strike a balance between the different actors and their roles. To the best of the authors' knowledge, this is the first empirical study to provide insight into how perceived characteristics of different actors within the service triad (i.e. service robots and human employees) work in tandem to affect customer repatronage intentions. This has important implications for the current debate on the augmenting versus substituting role of frontline service technology within the service triad (Larivière *et al.*, 2017; Li *et al.*, 2021; Ostrom *et al.*, 2021). We show that high-quality human FLE interactions in the service triad can augment the low utilitarian value of a service robot. In contrast, as the technology matures and service robots exhibit more utilitarian value to customers, the need for compensation through high-quality FLE interactions decreases and service robots can potentially substitute the human FLEs.

Second, the empirical findings advance service management literature by unraveling the relationship between anthropomorphism and social presence and their effect on perceived value. The study provides evidence for the fact that anthropomorphism – the humanlike emotions and intentions of the service robots – has a positive impact on the perceived social presence of the service robot. Extant research is inconclusive with respect to the effects of anthropomorphism. It posits that humanlike emotions and intentions can either inspire trust and bonding (Lu *et al.*, 2020; van Pinxteren *et al.*, 2019) or following the uncanny valley theory, customers may find a highly humanlike robot creepy and uncanny (Mori, 1970; Mori *et al.*, 2012), creating feelings of eeriness or a threat to (a customer's) human identity (Mende *et al.*, 2019). Our research shows that increasing anthropomorphism directly leads to social presence – a higher "sense of being with another" (Biocca *et al.*, 2003; Heeter, 1992). This is an important finding as it suggests that not only human FLEs (Wirtz *et al.*, 2018) but also service robots could be capable of building rapport with customers through their social presence. Moreover, we provide evidence for the important role that anthropomorphism and social presence play in hospitality services as utilitarian and hedonic value drivers. In particular, we conclude that anthropomorphism as a *first degree social response* (Lee *et al.*, 2006) has a stronger effect on the utilitarian value of the service robot compared to its hedonic value. In other words, anthropomorphism impacts perceived quality of the core services provided such as serving food and drinks, stronger than perceived entertainment of customers.

Third, our studies provide strong empirical evidence for utilitarian value of service robots as a driver of customer repatronage to fast casual dining restaurants. Existing research on robots in hospitality services (see Table 1) is either conceptual in nature or uses laboratory experiments with hypothetical scenarios. Lu *et al.* (2020) indicate that field study research is needed to actually understand the extent to which and how service robots influence customers' outcome variables. Our field study as well as our scenario-based experimental design indicates that in the context of fast casual dining restaurants, service robot's utilitarian value has a pronounced effect on customer repatronage. Understanding the important role of service robot's utilitarian value in fast casual dining restaurants adds to our theoretical knowledge of how service robots can influence customer repatronage in hospitality.

Managerial implications

This study provides service managers of triadic service encounters with valuable insights on the implementation of service robots in frontline services and in particular, in restaurants. First, we find evidence that in hospitality services which used to be a "game of people" (Bowen, 2016), FLEs no longer always need to take an active role in the service encounter as there is a potential for service robots to substitute FLEs. Namely, we find that in fast casual dining restaurants, service robots that achieve high levels of functional performance (i.e. utilitarian value) can replace the need for customers to engage in high-quality interactions

with FLEs. From the restaurant owner's perspective, implementing service robots can lead to cost reductions and productivity gains (Wirtz and Zeithaml, 2018). Especially in the social distancing era of the COVID-19 pandemic, service robots could contribute to minimizing the risk of spreading the virus. Also, services robots can be a solution to ensuring sufficient capacity to deliver consistent service in times of high staff shortages.

Second, our empirical findings have implications for service settings in which service robots should not substitute but rather be augmented by FLEs. We find that FLEs can compensate for lower levels of functional performance (i.e. utilitarian value) of service robots by engaging in high-quality interaction with customers. By demonstrating a high willingness to help and having excellent interactions with customers, FLEs can augment service robots that exhibit lower levels of utility to achieve customer repatronage. This advocates the joint service delivery by FLE – service robot teams in situations where service robot technology is not fully optimized. In this sense, technology and FLE can be used in tandem to provide a better service outcome (Froehle and Roth, 2004; Li *et al.*, 2021).

Third, we provide essential insights for robot engineers and designers, gathered from a real-life setting (Mende *et al.*, 2019) on the human likeness design parameter of service robots. The findings from our field study show that the more service robots in restaurants evoke the perception of having thoughts and emotions, the higher customers evaluate the robots' utilitarian and hedonic value. This indicates that service robots should be designed in a way to display social presence by having the ability to have thoughts and convey emotions in order to create customer value.

Fourth, our results have implications for policy makers as well. Recently, the *Future of Jobs* report published by the World Economic Forum (2020) articulated that the surge in digital technologies and automation largely transforms tasks, jobs and skills within the next five years. In line with these developments, Larivière *et al.* (2017) emphasized the importance of role readiness for employees to acclimate in the new service environment. This demands a completely new set of skills and a proactive attitude from the public sector to support reskilling and upskilling for employees (Huang and Rust, 2020; World Economic Forum, 2020). This study shows that the jobs of FLEs in hospitality will be subject to change, such that they in some cases will be substituted and in other cases augmented by service robots. Policy makers should prepare the workforce in hospitality for this change by providing FLEs with the opportunity to reskill (in case of job substitution) or upskill (in case of job augmentation). We advocate for training specific collaborative skills on how to work with a service robot in a team.

Limitations and future research

This research offers several avenues for future research. First, the empirical context of our field study entails a European, fast casual dining restaurant. Next to this, the sample is skewed since most of the respondents were female (70.8%), between 18 and 34 years old (81.5%), repeat customers (69.4%) and visiting the restaurant with friends (62%). Moreover, we carried out our research during the 2020/2021 COVID-19 pandemic. This warrants caution regarding the generalizability of our findings. Future studies should shed more light on this by conducting similar investigations across different cultural settings, types of restaurants and beyond the pandemic. In particular, it would be interesting to obtain insight into whether service robot's utilitarian and hedonic value play a more or less pronounced role in hospitality settings other than fast casual dining restaurants, and how this potentially affects the interplay between the different actors of the service triad.

Second, the service robots that were employed by the fast casual dining restaurant in our field study were endowed with limited hedonic characteristics. Namely, they communicated unilaterally and could not respond to customers, make jokes or pose for pictures. This may

explain the lack of a significant relationship between the service robots' hedonic value and customer repatronage, contrary to the findings of our scenario-based experiment. Contemporary service scholars postulate that service robots will be able to deliver cognitively complex service tasks and low emotional service tasks (Lu *et al.*, 2020; Paluch and Wirtz, 2020; Wirtz *et al.*, 2018). Building on these insights, we encourage future service scholars to develop field studies to further disentangle the service triad and the link between service robot hedonic value, customer repatronage intentions and FLE interaction quality. Another interesting avenue for future research is the analysis of actual customer behavior demonstrating perceived hedonic value, such as taking a picture or video of the service robot or dancing with the robot, instead of mere customer perceptions.

Third, in our field study, we base our findings on a cross-sectional sample of customers in a triadic service encounter, obtained in the early stages of service robot implementation. This opens up the opportunity for further research to take a longitudinal perspective on the effects of service robot implementation in hospitality as it would be valuable to understand the extent to which our findings hold for revisiting customers over time.

Fourth, future research could further expand our knowledge on factors – beyond FLE interaction quality – that affect the relationship between service robot's utilitarian and hedonic value and customer outcomes. Interesting research questions could be: what is the impact of the utilitarian and hedonic value of the FLE, or to what extent do customers' prior experiences with the robot or the type of party (friends versus family versus business relations) play a role in the interactions with service robots and the effects it has on customer outcomes?

Fifth, it is worthwhile to study how augmentation or substitution by service robots in the service triad for certain tasks affects the employee experience. Do employees feel empowered by their robotic counterpart or rather threatened to become obsolete? While the customer experience has received major academic interest, so far research in the domain of the employee experience has been scarce (Lariviere *et al.*, 2017).

Lastly, we encourage researchers to further expand the service triad by investigating how third parties – such as other employees or other customers – are influenced by and influence the interplay between customers and a team of service robots and frontline employees. Researchers increasingly consider the role of third parties who interact with customers and/or service providers (Abboud *et al.*, 2020), and future research can explore how employees fulfill the third-party roles of bystander, connector, endorser, balancer or partner role in indirect interactions (Abboud *et al.*, 2020). This research direction builds on Bowen's (2016) call for further investigation of employee roles in an evolving service context characterized by growing technologies augmenting employees. In this context, future research can investigate whether and how frontline employees can create value by adopting a third-party role when service robots are directly interacting with customers.

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Appendix 1

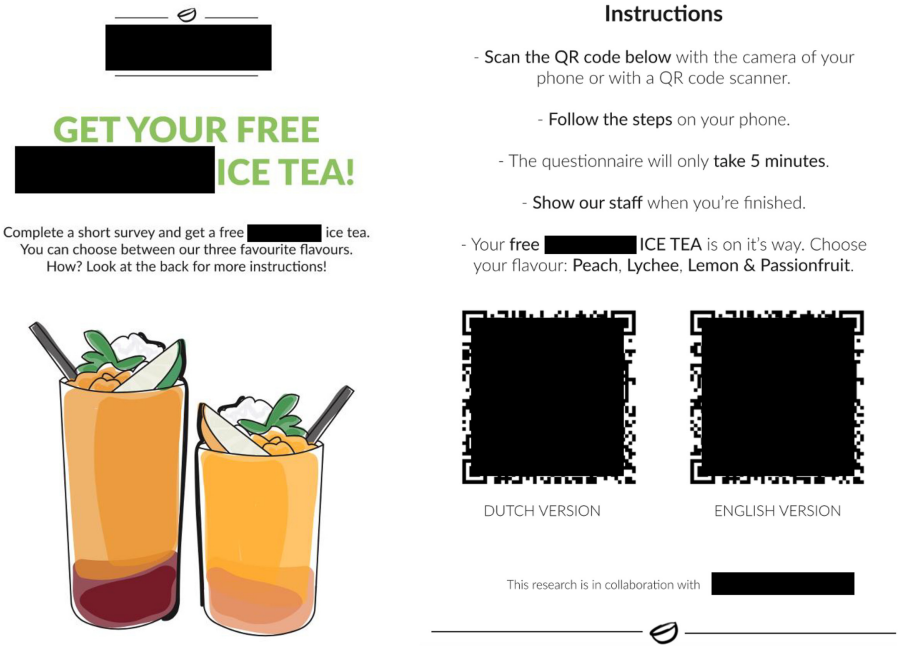

Figure A1. Anonymized flyer containing QR-code

Appendix 2

Hedonic value		High	High	Low	Low
Utilitarian value		High	Low	High	Low
FLE Interaction	High FLE Interaction	While you are sitting at your table, you are being served by the robot Akatar and human employees The robot Akatar takes your orders and serves your drinks and food in a highly consistent and very accurate manner While serving drinks and food, the robot Akatar brings fun, for example, it makes jokes. It is also entertaining, for example, it poses for pictures. It makes the interaction with the robot Akatar very enjoyable The human employees are very helpful, and how they interact with you and your company is excellent	While you are sitting at your table, you are being served by the robot Akatar and human employees The robot Akatar takes your orders and serves your drinks and food in a highly inconsistent and very inaccurate manner While serving drinks and food, the robot Akatar brings fun, for example, it makes jokes. It is also entertaining, for example, it poses for pictures. It makes the interaction with the robot Akatar very enjoyable The human employees are very helpful, and how they interact with you and your company is excellent	While you are sitting at your table, you are being served by the robot Akatar and human employees The robot Akatar takes your orders and serves your drinks and food in a highly consistent and very accurate manner While serving drinks and food, the robot Akatar does not bring fun, for example, it does not make jokes. It is neither entertaining, for example, it does not pose for pictures. It makes the interaction with the robot Akatar very unenjoyable The human employees are very helpful, and how they interact with you and your company is excellent	While you are sitting at your table, you are being served by the robot Akatar and human employees The robot Akatar takes your orders and serves your drinks and food in a highly inconsistent and very inaccurate manner While serving drinks and food, the robot Akatar does not bring fun, for example, it does not make jokes. It is neither entertaining, for example, it does not pose for pictures. It makes the interaction with the robot Akatar very unenjoyable The human employees are very helpful, and how they interact with you and your company is excellent
	Low FLE Interaction	While you are sitting at your table, you are being served by the robot Akatar and human employees The robot Akatar takes your orders and serves your drinks and food in a highly consistent and very accurate manner	While you are sitting at your table, you are being served by the robot Akatar and human employees The robot Akatar takes your orders and serves your drinks and food in a highly inconsistent and very inaccurate manner	While you are sitting at your table, you are being served by the robot Akatar and human employees The robot Akatar takes your orders and serves your drinks and food in a highly consistent and very accurate manner	While you are sitting at your table, you are being served by the robot Akatar and human employees The robot Akatar takes your orders and serves your drinks and food in a highly inconsistent and very inaccurate manner

Table A1.
Scenario descriptions study 2

(*continued*)

Hedonic value Utilitarian value	High High	High Low	Low High	Low Low
	While serving drinks and food, the robot Akatar brings fun, for example, it makes jokes. It is also entertaining, for example, it poses for pictures. It makes the interaction with the robot Akatar very enjoyable	While serving drinks and food, the robot Akatar brings fun, for example, it makes jokes. It is also entertaining, for example, it poses for pictures. It makes the interaction with the robot Akatar very enjoyable	While serving drinks and food, the robot Akatar does not bring fun, for example, it does not make jokes. It is neither entertaining, for example, it does not pose for pictures. It makes the interaction with the robot Akatar very unenjoyable	While serving drinks and food, the robot Akatar does not bring fun, for example, it does not make jokes. It is neither entertaining, for example, it does not pose for pictures. It makes the interaction with the robot Akatar very unenjoyable
	The human employees are not helpful, and how they interact with you and your company is horrible	The human employees are not helpful, and how they interact with you and your company is horrible	The human employees are not helpful, and how they interact with you and your company is horrible	The human employees are not helpful, and how they interact with you and your company is horrible
No FLE interaction	While you are sitting at your table, you are being served by the robot Akatar	While you are sitting at your table, you are being served by the robot Akatar	While you are sitting at your table, you are being served by the robot Akatar	While you are sitting at your table, you are being served by the robot Akatar
	The robot Akatar takes your orders and serves your drinks and food in a highly consistent and very accurate manner	The robot Akatar takes your orders and serves your drinks and food in a highly inconsistent and very inaccurate manner	The robot Akatar takes your orders and serves your drinks and food in a highly consistent and very accurate manner	The robot Akatar takes your orders and serves your drinks and food in a highly inconsistent and very inaccurate manner
	While serving drinks and food, the robot Akatar brings fun, for example, it makes jokes. It is also entertaining, for example, it poses for pictures. It makes the interaction with the robot Akatar very enjoyable	While serving drinks and food, the robot Akatar brings fun, for example, it makes jokes. It is also entertaining, for example, it poses for pictures. It makes the interaction with the robot Akatar very enjoyable	While serving drinks and food, the robot Akatar does not bring fun, for example, it does not make jokes. It is neither entertaining, for example, it does not pose for pictures. It makes the interaction with the robot Akatar very unenjoyable	While serving drinks and food, the robot Akatar does not bring fun, for example, it does not make jokes. It is neither entertaining, for example, it does not pose for pictures. It makes the interaction with the robot Akatar very unenjoyable
	You have not interacted with any of the human employees and were only served by the robot Akatar	You have not interacted with any of the human employees and were only served by the robot Akatar	You have not interacted with any of the human employees and were only served by the robot Akatar	You have not interacted with any of the human employees and were only served by the robot Akatar

Table A1.

About the authors

Prof. Dr. Gaby Odekerken-Schröder is Full Professor in Customer-centric Service Science at Maastricht University, the Netherlands. Her main research interests are service innovation, service robots, healthcare services, relationship management, customer loyalty, and service failure and recovery. She is one of the co-founders of Maastricht University's Service Science Factory, as she loves to bridge theory and practice. Her research has been published in Journal of Marketing, MISQ, Journal of Retailing, Journal of Service Research, International Journal of Social Robotics, Journal of the American Medical Doctors Association, Journal of Service Management, Journal of Services Marketing, Journal of Business Research, and many more. Gaby Odekerken-Schröder is the corresponding author and can be contacted at: g.odekerken@maastrichtuniversity.nl

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