Avatar-mediated service encounters: Impacts and research agenda

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Technology has been expanding the service encounter concept. Avatars, including virtual and robotic avatars, have been gaining popularity as an emerging technology to generate more human-like and even enhanced remote interactions in technology-mediated service encounters. However, service researchers have paid lesser attention to human-controlled avatar technologies compared to service robots as autonomous avatars. In response to the emerging business and research interests, the technology-mediated service encounter model needs to be updated by integrating avatar technologies. To address this gap, this study develops a conceptual framework of avatar-mediated service encounters. This concept amalgamates features of traditional technology-mediated service encounters and service robots from the aspects of service flexibility and interaction modality. The applications of avatar technologies are categorized based on two axes—user type and avatar embodiment type—and the impacts and research agenda are outlined for each category. The proposed framework contributes to improving remote service experiences and realizing resilient service workplaces.

Keywords: avatar technology; technology-mediated service encounter; remote service; frontline employee; virtual avatar; robotic avatar; frontline service technology; COVID-19

Avatar（虚拟化身）介导的服务接触：影响和研究议程

不断发展的技术使得服务接触的概念进一步拓展。Avatar，包括虚拟 avatar 和机器人 avatar，作为一种新兴技术越来越受欢迎，在技术介导的服务接触中产生更多的类人甚至增强的远程交互。然而，与作为自主 avatar 的服务机器人相比，服务研究人员对人类控制 avatar 技术的关注较少。为了迎合新兴的业务和研究兴趣，需要通过整合 avatar 技术来更新技术介导的服务接触模式。为解决此问题，本研究开发了 avatar 介导的服务接触的概念框架。这一概念从服务灵活性和交互方式等方面融合了传统技术中介服务接触和服务机器人的特点。Avatar 技术的应用基于双轴进行分

类（用户类型和 avatar 化身类型），并概述了每一类的影响和研究议程。拟议的框架有助于改善远程服务经验和实现弹性服务工作场所。

关键词：avatar 技术；技术介导的服务接触；远程服务；一线员工；虚拟 avatar；机器人 avatar；一线服务技术；COVID-19

1. Introduction

Technology is transforming the nature of service encounters. By replacing traditional face-to-face encounters between customers and frontline employees (FLE), information and communication technologies (ICTs) enable technology-mediated service encounters for remote services such as e-commerce and mobile banking (De Keyser et al., 2019; Hartley & Green, 2017; Schumann et al., 2012). Remote services have become more common during the COVID-19 pandemic (Heinonen & Strandvik, 2020; Ostrom et al., 2021). For example, virtual tourism and hospitality services became popular under the lockdown and social distancing policies, and this phenomenon is even expected to complement and improve service experiences at real sites (Gursoy et al., 2022; Zhang et al., 2022).

New technologies are continuously extending the service encounter concept (De Keyser et al., 2019; Larivière et al., 2017). Avatar technology, a remotely controlled artificial agent, is an emerging technology for technology-mediated service encounters (Gursoy et al., 2022; Heinonen & Strandvik, 2020; Su et al., 2022). Avatar technologies comprise not only the virtual avatar—representation of self in a virtual environment—but also the robotic avatar—a physically embodied robot that works under the control of the user. In response to the emerging trend of metaverse, a number of virtual services adopting avatars such as virtual museums and concerts are emerging (Gursoy et al.,

2022; Park & Kim, 2022). Moreover, robotic avatars are gradually increasing in service fields such as hospitals, libraries, and cafés (Guth & Vander Meer, 2017; Schumann et al., 2012; Su et al., 2022). The evolving 5G/6G network technology, which enables precise real-time avatar controls anywhere, further drives this trend (Alwis et al., 2021; Su et al., 2022).

Interestingly, most service research on frontline service technology (FST) focuses on service robots as automated artificial agents (De Keyser & Kunz, 2022; Li et al., 2021; Robinson et al., 2020; Wirtz et al., 2018) and pays little attention to human-controlled avatar technologies mediating the FLE–customer interaction. Rapidly evolving artificial intelligence (AI) spotlights service robots as a disruptive technology that can replace human employees in service fields (Ameen et al., 2021; Henkel et al., 2020; van Doorn et al., 2017). Social robotics has advanced in terms of modality in communication (i.e., gesture and facial expression), which creates the social presence necessary for customer engagement and satisfaction (Belanche et al., 2020b; van Doorn et al., 2017; Van Pinxteren et al., 2020). Many theoretical and experimental studies have been conducted to clarify the potential of service robots as empathic agents that can accomplish more human-like service encounters (Belanche et al., 2020b; De Keyser & Kunz, 2022).

However, many researchers also acknowledge that the technological capacities of service robots are not yet sufficient for flexible, empathic service interactions like human FLEs (Belanche et al., 2020b; De Keyser & Kunz, 2022; Marinova et al., 2017). Moreover, there is growing concern on technologies substituting human employees (De Keyser & Kunz, 2022; Huang & Rust, 2018; Winfield & Jirotka, 2018). Technological substitution of the human workforce has been anticipated during the COVID-19 pandemic as well, considering the efficiency and health-related aspects (Prentice et al.,

2021; Tang et al., 2022). However, studies also call for the need to maintain humanness, emotional connection, and well-being in the age of automation and robotization (Ostrom et al., 2021), emphasizing the human role in service provision, especially considering the fact that intuitive and empathic behaviors are not easily replaced by current automation technologies (Huang & Rust, 2018; Song et al., 2022).

In contrast, the human-controlled avatar technology maintains ties between customers and FLEs located remotely as a mediating technology. However, the existing research on technology-mediated service encounters mostly focuses on traditional ICTs such as e-mail, web chat, and video conferencing (De Keyser et al., 2019; Hartley & Green, 2017). Although human FLEs behind the ICT tools can flexibly organize the service for customers, the limited modality in communication hinders satisfactory service provision (Pascoe, 2022; Van Pinxteren et al., 2020). Human-controlled avatar technologies owning virtual or physical bodies have a strong potential to fill this gap, and hence, the research interest in avatar technologies for service encounters is gradually increasing (Baba et al., 2021; Gursoy et al., 2022; Heinonen & Strandvik, 2020; Ishiguro, 2021). Gursoy et al. (2022), for example, suggest the need for studying consumer behaviors using avatars in the metaverse and their impacts to future service businesses.

Nevertheless, the existing models of technology-mediated service encounters mention only a few cases of avatar technologies such as a remote surgery robot (De Keyser et al., 2019; Schumann et al., 2012). This necessitates further research to obtain more general implications about technology-mediated service encounters adopting avatar technology. Considering the growing business and research interest in avatar technologies in various service sectors (Gursoy et al., 2022; Su et al., 2022), service

research on these technologies must urgently expand to provide theoretical insights about effective application and research challenges.

Hence, this study aims to develop a conceptual framework of avatar-mediated service encounters (hereafter, AMSEs). We first conceptualize the AMSE and its features based on studies of technology-mediated service encounters and service robot as an embodied agent. Thereafter, we categorize the AMSE applications by the user type as an avatar controller (customer or FLE) and the avatar embodyment type (virtual or robotic) for clarifying more specific characteristics. We also identify impacts and the associated research agenda for each category.

This study theoretically contributes to the research on technology-mediated service encounters by extending its model to human-controlled avatar technologies. Moreover, this study assists service organizations' decision-making on AMSE application by presenting the impacts of each AMSE type and fosters the transformation of service businesses into a more resilient form (Huang & Jahromi, 2021).

The remaining paper is organized as follows. First, we illustrate the existing literature on technology-mediated service encounters and service robots. Based on this theoretical background, we introduce the AMSE concept and its hybrid features. We then categorize the AMSE application types. Thereafter, we illustrate the potential impacts and the agenda to promote research and business implementation of AMSE. Finally, we discuss the theoretical and managerial implications.

2. Theoretical background

2.1. Technology-mediated service encounters

Service encounters contribute to value creation through customer interactions (Bitner, 1990; Larivière et al., 2017; Surprenant & Solomon, 1987). Service encounters were

firstly studied as dyadic interactions between an FLE and a customer (Solomon et al., 1985). An FLE identifies customers' expectations through face-to-face customer interactions and takes actions corresponding to the service context (Arnould & Price, 1993), which in turn leads to customer satisfaction. Given this, customers evaluate a service highly when the service FLE's behavior is characterized by context-oriented reactions and positive emotions (Arnould & Price, 1993; Pugh, 2001).

Apart from FLEs' attitudes and behaviors, technologies also play a critical role in service encounters (De Keyser et al., 2019; Larivière et al., 2017; Wünderlich et al., 2012). The FST, defined as 'any combination of hardware, software, information, and/or networks that supports the co-creation of value between a service provider and customer at the organizational frontline' (De Keyser et al., 2019, p. 158), is a key enabler of service delivery and value co-creation between FLEs and customers (Ameen et al., 2021; De Keyser et al., 2019; Parasuraman, 2000). Among the FSTs, ICTs such as e-mail, web chat, and video conferencing systems can be adopted to conduct technology-mediated service encounters, thereby promoting remote services in a situation where customers and FLEs are not co-located (De Keyser et al., 2019). Through service separation by technologies, remotely-located service providers can interact with customers (Hartley & Green, 2017; Paluch & Blut, 2013). Flexibility in service arrangement is a key feature of technology-mediated service encounters (Schumann et al., 2012). Technology-mediated services are organized by human FLEs; hence, the service can be customized to customer needs (Schumann et al., 2012). Hartley and Green (2017) also highlight that the personalization of delivered remote services is an advantage influencing customer satisfaction.

However, the lack of face-to-face contact affects the evaluations of remote services (Schumann et al., 2012). Hartley and Green (2017) clarified that customers

perceive less stasfaction from remote services especially when communication cues such as verbal and visual information are limited. The existing research on technology-mediated service encounters is mostly limited to the 'face-to-screen' customer contact (Froehle & Roth, 2004; Yoon & Lee, 2019). Although human FLEs interact with customers, communication without non-verbal cues causes difficulty in communicating empathy between FLEs and customers (Pascoe, 2022; Schumann et al., 2012). Technology adoption with higher modality of communication in service encounters could increase empathic behaviors, leading to customer satisfaction (Hartley & Green, 2017; Van Pinxteren et al., 2020).

2.2. Service robots as embodied agents

The application of service robots for customer interaction is a pathbreaking topic in recent service research (Belanche et al., 2020a; van Doorn et al., 2017; Wirtz et al., 2018). In a widely used definition by Wirtz et al. (2018), service robots are defined as 'system-based autonomous and adaptable interfaces that interact, communicate and deliver service to an organization's customers' (p. 909). The service robot literature largely agrees that service robots include both virtual agents and physically embodied robots (De Keyser & Kunz, 2022). Compared to the traditional service automation technology for customers, such as self-service technology (Beatson et al., 2007; Meuter et al., 2000), service robots can proactively communicate and interact with customers (Belanche et al., 2020a).

Service scholars are exploring the potential role and capacity of service robots as service actors that can undertake human-like interactions (Flavián & Casaló, 2021; Huang & Rust, 2021). According to Belanche et al. (2020a), human–human interactions can be distinguished from human–robot interactions by the process of estimating and sharing feelings and thoughts. Nevertheless, customers can socially engage with service

robots with human-like appearance and behaviors, known as anthropomorphism (Blut et al., 2021), which leads to positive evaluations of service encounters (Belanche et al., 2021; Romero & Lado, 2021; Van Pinxteren et al., 2020). The human-like embodiment of service robots enables higher modality of interaction. Non-verbal communication using virtual or physical bodies (e.g., nodding) is an essential part of social interaction skills (Huang & Rust, 2021; Schepers et al., 2022) and promotes the perception of responsiveness and sensitive reactions to customer needs (Van Pinxteren et al., 2020). The human-like appearance also affects customers' affinity toward robots, which improves the impression of their service (Belanche, Casaló, & Flavián, 2020).

However, researchers also acknowledge that the current technology level is not sufficient for fluent communication and interactions (Castillo et al., 2020; De Keyser & Kunz, 2022). While functional, routinized tasks are easily adopted by service robots, it is difficult to implement flexible customized service provision based on customer needs and context (Belanche et al., 2020b; Marinova et al., 2017). Some empirical studies on service robots actually show lower customer expectations regarding robot services than human services (Byrd et al., 2021; Choi, Choi, et al., 2020).

3. Avatar-mediated service encounters (AMSEs): Concept and features

The word 'avatar' has been defined as 'a character or creature that you create to represent yourself in a computer game, on the internet, etc.' (Cambridge Dictionary, n.d.). Avatars have been typically applied in video games and virtual communities such as Second Life (Kaplan & Haenlein, 2009; Kohler et al., 2011). In the service literature, an avatar is generally regarded as a virtually embodied autonomous agent and a type of service robot (De Keyser & Kunz, 2022; Van Pinxteren et al., 2020). However, in this study, we discuss service encounters mediated by human-controlled avatar technologies, which are defined as AMSEs.

In the service context, virtual avatars have been adopted in retail (Chesney et al., 2017) and virtual site visits (Garnier & Poncin, 2013; Gursoy et al., 2022). Recently, its application has been growing in real service environments (e.g., virtual receptionists at a hotel) (Choi, Mehraliyev, et al., 2020). Meanwhile, applications of robotic avatars are increasing in service fields such as healthcare (Schumann et al., 2012; Zoder-Martell et al., 2020), education (Guth & Vander Meer, 2017; Huun, 2018), and hospitality services (Su et al., 2022). Ishiguro (2021), a humanoid researcher, envisions a future society where everyone uses avatars for multiple occasions in work and everyday life.

As Figure 1 shows, AMSE combines the advantages of traditional technology-mediated service encounters and service robots, namely service flexibility and interaction modality respectively, for more human-like and even enhanced remote services.

[Figure 1 near here]

3.1. Service flexibility

Flexibility is generally an important capability of FLEs for responding to different customer needs and situations (Hartline & Ferrell, 1996). Service robots are still limited in their flexibility in customer interactions because of their limited communication capacity to gauge customer needs and contexts (Belanche et al., 2020b; Marinova et al., 2017; Song et al., 2022). In contrast, technology-mediated service encounters utilizing ICTs are conducted by human FLEs with greater flexibility (Schumann et al., 2012). Human FLEs can customize their services, capturing the needs of customers even through technological interfaces. These personalized and context-oriented interactions, utilizing the strength of human FLEs (Wirtz et al., 2018), are applicable to AMSEs and can be enhanced with more advanced interfaces and sensors implemented in robotic avatars or environments.

3.2. Interaction modality

Human-like embodiment affects the level of modality in communication and interaction. Social robots embodied physically or virtually can communicate with customers using rich non-verbal cues including in their behaviors and appearance (Belanche et al., 2020b; Van Pinxteren et al., 2020). They are more advantageous than ordinary ICT tools such as text-chatting and video conferencing systems that show only the face on the screen. AMSEs possess higher modality for remote services to realize nuanced interactions including non-verbal communication. Using AMSEs, customers could feel empathy from FLEs and satisfaction in their interactions (Belanche et al., 2021; Hartley & Green, 2017; Van Pinxteren et al., 2020). Although it requires a huge information transaction, the advancement of high-speed 5G/6G networks makes it possible (Alwis et al., 2021; Su et al., 2022). Moreover, the precise control of robotic avatars has already been used for remote surgeries (Schumann et al., 2012). AMSEs could also support remote handling of products at a store and even provide touch for care, which extends the potential applications of robotic avatars (De Keyser & Kunz, 2022).

4. Categorizing avatar-mediated service encounter (AMSE) applications

We now categorize AMSE applications to highlight more specific features obtained by adopting human-controlled avatar technologies in technology-mediated service encounters, especially focusing on its embodiment feature. Through this process, we intend to extend the technology-mediated service encounter model (De Keyser et al., 2019; Froehle & Roth, 2004; Schumann et al., 2012).

We adopted two axes for the categorization: the user type and the avatar embodiment type. First, human-controlled avatar technology directly represents its user

as an embodied user agent and increases the flexibility of their behaviors (Ishiguro, 2021; Su et al., 2022). The counterpart (a customer or an FLE) interacts with an avatar controlled by its user (a FLE or a customer). This human–avatar interaction asymmetrically influences customer–FLE relationships. Schumann et al. (2012) categorized technology-mediated services into provider- and customer-based services; however, it is based on the location where the service is provided. For grasping the nature of this asymmetric influence through avatar technologies, this study adopts user type—an FLE or a customer—as an axis of categorization. Second, avatar technology in this study consists of virtual and (physically embodied) robotic avatars. The differences in avatar embodiment affect the modality of interactions and communications (De Keyser & Kunz, 2022; Van Pinxteren et al., 2020); hence, the avatar embodiment type should be considered in AMSE categorization. The AMSE application types categorized by these two axes are shown in Figure 2.

[Figure 2 near here]

4.1. Virtual experience type

The virtual experience type of AMSEs realizes service encounters in a virtual service environment where customers interact with FLEs. Virtual exhibitions and event services are typical examples of virtual experience type service encounters (Gursoy et al., 2022; Heinonen & Strandvik, 2020). In such service encounters, a large number of customers join, navigate, and experience the virtual environment. V-commerce or shopping experience in virtual environments is another example (Chesney et al., 2017). Customers can enjoy the virtual experience at home or test the service they are interested in and decide whether they should receive a real service (Gursoy et al., 2022).

Unlike video conferencing systems, customers using virtual avatars can express themselves more freely with visual effects in virtual service environments. By using

body gestures and emoticons, customers can convey their intent and emotions (Wirtz & Jerger, 2017) in a virtual environment. Customers can also personalize their appearances as they wish, which affects their experiences (Gursoy et al., 2022; Yee & Bailenson, 2007).

4.2. Tele-experience type

The tele-experience type supports a service encounter in a physical environment where customers participate through robotic avatars. Customers can navigate the facility or experience activities by controlling robotic avatars. The major targets of tele-experience type applications are facility-based service environments (e.g., libraries, museums, and schools) and tourist sites (Guth & Vander Meer, 2017; Heinonen & Strandvik, 2020; Huun, 2018).

A significant feature of this type in comparison to traditional technology-mediated encounters is that customers can remotely interact with human FLEs and products in a real environment. Customers and avatars controlled by remotely located customers may even co-exist in the same service environment, and FLEs may need to serve both of them. This will be a unique situation that can be realized by AMSEs.

4.3. Virtual serving type

The virtual serving type is represented by FLEs controlling virtual avatars and interacting with customers. FLEs can gain access to and communicate with remote customers through avatars. The shop staff in a virtual service or v-commerce environment are a typical application of this AMSE type (Chesney et al., 2017). More recently, virtual avatars have become available at the front desk or concierge kiosk of a real service facility for providing required information to customers (Choi, Mehraliyev, et al., 2020). Similarly, virtual FLEs provide the product information and recommend

an item to customers at a real shop. This type is also used in medical and healthcare environments for providing services such as virtual counselling (Pedram et al., 2020).

In this type, customer experiences can be enhanced through additional technological support (Belanche et al., 2020b), such as displaying a facility map to guide customers. Such information support is useful for not only customers but also FLEs. For example, FLEs can use augmented reality (AR) to check information required for providing services on their screens (Fiorentino et al., 2014). The projected information in AR eliminates the need to open another computer screen, thereby avoiding workflow interruption (De Keyser et al., 2019). Knowledge management and knowledge-based decision support, which are common in call center operations, (Ravishankar & Pan, 2013) are also applicable to this type. Moreover, FLEs can utilize computational support, such as face recognition and emotion detection, to understand the customer facing the avatar. These functions can help less-skilled FLEs to interact more effectively with customers.

4.4. Tele-serving type

The tele-serving type realizes physical interactions with customers by an FLE-controlled robot. Robotic surgery using a specially equipped robot is a well-known service case (Schumann et al., 2012). A high-tech surgery robot can help doctors operate remotely located patients such as those in rural areas. Another unique example of this type is an avatar café (Su et al., 2022), wherein a robotic avatar is controlled by persons with physical impairments. By controlling the humanoid robots, they can serve food and beverages to customers.

The application of human physical skills is an distinguished feature of this type. For example, robotic surgery involves the use of a doctor's professional expertise through the avatar at a remote site. Another feature is the physical augmentation of

human capabilities. The avatar café case implies that the limited physical functions can be supplemented by using an robotic avatar. This is a significant difference from the traditional technology-mediated services using ordinary ICT tools. Meanwhile, customers are required to interact with robotic avatars with different shapes and functions.

5. Impacts and research agenda of avatar-mediated service encounters (AMSEs)

The aforementioned features of each AMSE application type can benefit customers, FLEs, and service organizations in different ways. We now present the impacts of each AMSE application type and associated research agenda (see Table 1).

[Table 1 near here]

5.1. Virtual experience type

The virtual experience type helps customers have rich experiences in virtual environments. Customers can more freely engage in service interactions relative to video conferencing systems or websites. For example, they can move in a virtual environment and express their intentions with gestures and apperances, which increases the engagement in service experiences (Kaplan & Haenlein, 2009). Customers perceive more trust in a virtual environment than in an ordinary website (Chesney et al., 2017). Meanwhile, customers need to learn how to control avatars and interact with FLEs and other actors in virtual environments. It is effective to shorten and simplify this learning process to involve more people in service encounters in the virtual environment.

Service encounters in the virtual world, where even natural laws can be modified, can go beyond the real service experience (Ho et al., 2022). This difference in interactions may, on the one hand, bring a positive impact as a service experience and,

on the other hand, make it difficult to adapt them. Service organizations need to design service encounters combining aspects of user-friendliness and attractiveness. Moreover, it is essential to establish long-term customer engagement in virtual environments for business continuity (Gursoy et al., 2022). The critical factors for long-term engagement need to be investigated; for example, incentive mechanisms and gamification may be effective (Huotari & Hamari, 2016).

Concerning the virtual experience, it is commonly acknowledged that the avatar appearance affects the behavior of its user, also known as the Proteus effect (Yee & Bailenson, 2007). Yee and Bailenson (2007) clarify that the use of the avatar with an attractive apprearance promotes self-disclosure and reduces interpersonal distance. Huang and Philip (2021) discuss the potential impact of similarity between self and the avatar on customer behaviors. Using this psychological effect, service encounters can better enrich customer experiences relative to conventional remote communication technologies. Service organizations and researchers need to investigate the relationship among avatar appearances, behaviors, and their psychological effects for better service experiences. Meanwhile, the misuse of the psychological effect, such as making services too addictive, could be harmful for customers. The interventions acceptable to customers need to be studied from an ethical viewpoint, in line with the concerns of service robot research (Belanche et al., 2020b; De Keyser & Kunz, 2022; Flavián & Casaló, 2021); the research results contribute to policy making including formulating adequate regulations for applications of this AMSE type.

The other advantage of the virtual experience type is the ease of collecting user data. All behavioral information in the virtual environment can be collected as data. The big data collected from customers is available for retention programs (Rothmeier et al., 2021) or service updates. Meanwhile, the methods to analyze collected user data need to

be further studied for enhancing customer engagement while protecting their privacy (Song et al., 2022). In addition, the service realized by the virtual experience type of AMSE may be provided in the real environment; hence, it is meaningful to explore how the virtual experience affects future purchasing behaviors in real service environments (Gursoy et al., 2022). The difference in user behaviors and experiences also need to be considered for creating better experiences both in real and virtual environments (Cai & Lo, 2020).

5.2. Tele-experience type

The tele-experience type of AMSE allows customers to experience interactions with FLEs to recreate real site visits by customers. This type is especially an understudied topic in the existing research on technology-mediated service encounters and service robots and has the potential to create unique value for customers. The customers who live far away from a site or cannot visit there due to personal or social reasons, can enjoy the experience that is usually available only at the site. This extends the opportunities and values of location-oriented services such as tourism and facility-based services. For example, virtual travel, a real-time travel experience through the Internet, became a trend during the COVID-19 pandemic (Zhang et al., 2022). Zhang et al. (2022) revealed that the quality of experience is a key mediating factor in virtual tourism, and innovation, design, and technology are anticipated to overcome sensory constraints in the existing technologies. The tele-experience type of AMSE could assist in overcoming these constraints.

FLEs need to learn how to serve customer-controlled avatars. For example, FLEs need to perceive the emotional change and intentions of customers using avatars. This requires different skills from the ones for the human-to-human service encounter (Watanabe, in press). As Gaur et al. (2021) proposed a research agenda for hospitality

based on AI and autonomous robot integration after COVID-19, a new hospitality model for the tele-experience type of AMSE and its development process need to be studied. Moreover, in a human-avatar mixed environment, the FLEs' required actions for human and avatar customers may be different in response to the physical characteristics and other interaction factors. Future research needs to address this potential issue.

The new service opportunities created by this type also benefit service organizations. Their business areas can be extended to, for example, those who are reluctant to travel but are interested in the place. In response to the expanding market, the customer segment needs to be updated according to the needs for AMSEs and human-to-human interactions. Based on the updated customer segmentation, the required infrastructure and resources (i.e., robotic avatars) should be arranged.

Service organizations can utilize the existing physical assets such as facilities and products for remote service provision. Although the installation of robotic avatars is required, it is cost-effective for service organizations to make the most use of the existing facilities instead of developing a new service environment for the AMSE application. On the other hand, the servicescape where service encounters occur (Bitner, 1992; Rosenbaum et al., 2011) needs to be reconsidered for attractive interactions at the site. This is especially important for the site where human and avatar customers co-exist.

5.3. Virtual serving type

The virtual serving type, first of all improves customer access to services. Knowledge-intensive services, such as concierge and counseling, can greatly benefit from this type to serve customers at different locations (Heinonen & Strandvik, 2020). Compared to ordinary video conferencing systems in technology-mediated service encounters, this

AMSE type can assist FLEs by providing supportive information for customers in an integrated manner. Service organizations need to consider how to blend data analysis and visualization with AMSEs to increase overall user experience for customer satisfaction (Dodds et al., 2022).

Another feature of the virtual serving type is the high customizability of avatar appearance and behaviors. For example, virtual avatars can conceal moods and sentiments, such as distress and uneasiness, of inexperienced FLEs. The Proteus effect may be utilized to make FLEs' attitudes more confident and reliable by choosing adequate avatars (Yee & Bailenson, 2007). The preferable FLE avatar behavior could also be an interesting research topic. In addition, the differences in preferred appearances and behaviors between AMSEs and service robots need to be examined (Lin et al., 2021). All these features can help realize both standardized services with enhanced quality and customized services in response to customer preferences. It is crucial to explore customization strategies for avatar appearances and behaviors.

The applicability of integrated, real-time knowledge support for the FLEs, especially novice workers, is a strength of the virtual serving type of AMSE. A previous study on knowledge management for service provision contributes to the development of such support (Ravishankar & Pan, 2013). Besides exploring the effective knowledge support method, the negative effects on FLEs' skill development processes should also be considered. Avatar-led interactions with the support of visualized information could shorten the initial training period of FLEs; however, skill development could be delayed without an adequate employee education strategy. Moreover, the hospitality features required for the virtual serving type may be different from those in face-to-face service encounters (Gursoy et al., 2022). These differences need to be analyzed in future studies.

The standardized service encounter utilizing the virtual serving type can assist the human resource management strategy of service organizations. The imbalanced distribution of skilled workers causes a demand-supply mismatch (Chapple, 2006), which can be addressed with this AMSE type. This technology even allows remote workers from foreign countries to join in service encounters (Schumann et al., 2012), thereby extending the capacity of service provision. Concerning virtual service encounters at real sites, multiple service points may be operated by fewer operators if the service encounters are infrequent (Ishiguro, 2021). This could contribute to cost-effective service operation.

Remote participation makes human resource management more flexible; however, it could become difficult to check FLEs' workloads and mental status. An existing study on teleworking has revealed its negative impacts on employee well-being (Allen et al., 2015). The specific challenge caused by the utilization of avatar technologies need to be studied to manage human resources for AMSE. Organizational learning at workplaces could also be an issue in the remote work context using this AMSE type (Watanabe, in press); hence, ICT support for learning processes can be considered (Andreu & Ciborra, 1996).

The control of virtual-serving avatars can be changed from manual to automatic and vice versa. This also contributes to the efficient use of human resources. Virtual-serving avatars may be helpful in situations such as recovery from service failure under automatic control because human employees are considered more responsible (Belanche et al., 2020a). On the other hand, as De Keyser et al. (2022) pointed out, customers may feel tricked when they notice that the avatar control has been changed to automatic. This gap between manual and automatic control of avatars may even accelerate the co-destruction of values (Castillo et al., 2020), which may not necessarily be recognized by

service providers (Huang & Philip, 2021). It would be worth investigating cases when human or automatic control is anticipated.

5.4. Tele-serving type

The tele-serving type helps fulfill remote physical interactions in service encounters. This specifically assists professional services that require specialized skills, such as in the case of robotic surgery (Schumann et al., 2012; Wirtz et al., 2018). This AMSE type extends the productivity of FLEs with specialized skills and knowledge. The services requiring human physical skills have been more difficult to shift toward a virtual mode; hence, the impact of this AMSE type is substantial. Meanwhile, it requires considerable investment to replicate human physical skills. A precise analysis of business opportunities needs to be conducted.

Customer acceptance of this AMSE type needs to be investigated as well. The research on service robots indicates that perceptions of human-likeness and affinity affects service evaluations by customers (Belanche et al., 2021). In the AMSE case, the human presence behind robotic avatars could be included as an important element to promote customer acceptance, if it is sufficiently communicated with the customers (Wünderlich et al., 2012). The consumer culture is another important factor in understanding acceptance of new technologies such as service robots (Belanche et al., 2020b; De Keyser & Kunz, 2022). As the applications of this AMSE type increase, customer acceptance and its factors could also change; this should be analyzed in future research. Furthermore, the impacts of demographic factors (e.g., age and gender) and prior technology experiences need to be explored (Lin et al., 2021; Romero & Lado, 2021; Van Pinxteren et al., 2020). Customers are required to interact with robotic avatars with different shapes and functions compared to that of human FLEs. The customers need to learn the rules and etiquettes to communicate with FLE avatars.

The robotic avatar of the tele-serving type augments the physical capabilities of FLEs and enables people with physical impairments to work as FLEs. This contributes to their well-being and self-efficacy (Su et al., 2022). Some intelligent assists to FLEs, such as stabilization of manipulation, are also effective in promoting AMSE application. This hybrid form of service provision, utilizing physical augmentation technologies, is a unique feature of this type (Dodds et al., 2022). In addition, the work and social participation of vulnerable people at real sites is well suited to the corporate social responsibility strategy (Gould et al., 2020) and diversification of workforces in the society. As a potential research question, the impact of work participation can be analyzed from the individual level focusing on employee well-being and customer perception to the societal level such as job market impacts. In addition, studies must consider the required support for employees (e.g., training). From the service business perspective, the impacts of the tele-serving type and real services on service productivity need to be comparatively analyzed. The equipment and infrastructure required for sustainable operations must be investigated as well.

The teleoperating surgery case highlights the potential of precise control of robotic avatars (Schumann et al., 2012). For example, the family may be able to touch the patient in a hospital through a robotic avatar, which is an understudied topic in service research (De Keyser & Kunz, 2022). The impression of persons touching or being touched in the service contexts and influential factors such as displaying the face of the person touching need to be investigated. It is also crucial to establish the safety management for physical human-avatar contacts (Choi, Choi, et al., 2020).

6. Conclusion

This study proposes a conceptual framework of AMSE applications, their impacts, and research agenda. This study contributes to the theory of technology-mediated service

encounters by extending its model to physically or virtually embodied avatar technologies. We identified the hybrid features of AMSEs—service flexibility and interaction modality—which combine the advantages of both traditional technology-mediated service encounters and service robots. These AMSE features help realize more human-like and even enhanced interactions in remote settings.

The categorization of AMSE applications exemplifies how AMSEs can be adopted depending on its user and embodiment types. Focusing on the user types, customers will be able to obtain higher flexibility in their behaviors in virtual or remote service settings by using avatar technologies. In response to this change, further studies on consumer behaviors using avatar technologies are anticipated. With regard to avatars controlled by FLEs, this study highlights the augmentation of user capabilities. Future studies should capture the potential and risks of such augmentation. With regard to the embodiment type, virtual avatars will broaden the potential of service experiences in virtual worlds beyond the constraints of real, material features. The psychological, economic, and social impacts of this change need to be analyzed in future studies. Robotic avatars, on the contrary, expand customer access to real services and associated environments, thereby overcoming even physical constraints such as physical impairments. Providing a comparative view with human-to-human services will be an important issue for this field. These features and associated impacts and research agenda in turn extend the traditional technology-mediated service encounter model (De Keyser et al., 2019; Schumann et al., 2013). This will create a new research arena for service scholars on service encounters and FSTs including service robots.

In terms of managerial implications, this study proposes the different AMSE application types as design options. Service organizations can use these options when adopting AMSEs to enhance service productivity and capabilities of FLEs, thereby

creating customer values, revamping existing services, or launching new businesses. These AMSEs can also help organizations develop appropriate service responses to infections like COVID-19 (Hazée & Van Vaerenbergh, 2020; Tuzovic & Kabadayi, 2020) and increase the resilience of service businesses (Dodds et al., 2022; Huang & Jahromi, 2021). They can also help service organizations promote productivity, resource efficiency, and inclusiveness of service businesses.

Concerning future research, the impacts of AMSEs should be tested empirically, which is also required in research on service robots (Belanche et al., 2021; Byrd et al. 2021; De Keyser & Kunz, 2022). We hope that this study will trigger further studies on AMSEs, thereby contributing to the development of a more resilient and inclusive service business and society.

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The authors report there are no competing interests to declare.

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Table 1. Impacts and research agenda of avatar-mediated service encounter (AMSE) application types

Type	Impacts	Research questions
Virtual experience	• Diverse interactions in virtual environments (i.e., gestures)	• How can customers learn and get accustomed to the interactions in a virtual environment?
	• Unusual experience beyond reality	• How can firms design an AMSE application to fulfill both user-friendliness and attractiveness? • How can firms develop long term customer engagement in a virtual environment? What are the critical factors?
	• Psychological effects of avatar appearance, which could enrich or deteriorate service experiences	• Which avatar feature and its psychological effects contribute to better service experiences or should not be applied from an ethical viewpoint?

	• Big data of customer behaviors for retention, service update, etc.	• How can user data be analyzed for better experiences in the virtual space? • How does the virtual experience affects the future purchasing behavior in real services? • How different are user behaviors and experiences in virtual and real service environments?
Tele-experience	• Service interactions with customer-controlled robotic avatars at a real site (avatar only or human-avatar mixed environment)	• How do FLEs serve avatar customers at the real site? • How will the hospitality for avatar customers be? How will service organizations and FLEs establish it? • How do FLEs serve both human and avatar customers?
	• Broadened access to location-oriented services	• How can firms manage the infrastructure and resource

	(i.e., tourism), which increases the service productivity	for real and virtual access, considering the customer segment?
	• Utilization of the existing service facility (i.e., store interior) for AMSE applications	• How can firms (re)design a servicescape for both human and avatar customers?
Virtual serving	• Integrated data analysis and visual information presentation for customers	• How can data analysis and visualization be blended in AMSEs to increase the overall user experience for satisfying customers?
	• Standardized or customized appearance and behaviors of FLEs	• What kinds of avatar appearance and behaviors affect the customer's attitude and impression? How different is it from service robots? • How much should service organizations and FLEs standardize or customize avatar appearance and

		behaviors for better customer engagement?
	• Real-time knowledge support for FLEs, especially novice workers	• What kind of knowledge should be provided to FLEs considering their skill development process? • How different are the hospitalities for virtual serving and face-to-face serving?
	• Efficient allocation of human resources (i.e., operating multiple service points)	• How can firms manage human resources, considering potential negative impacts of remote working through avatars? • How does organizational learning work for this AMSE type?
	• Switching the manual and automatic control of avatar technologies	• In which case should the manual or automatic control be used? • How do customers feel when the control of avatars

		changes from manual to automatic or vice versa?
Tele-serving	• Professional physical skills of FLEs accessible at remote sites, which extends their service productivity	• What kinds of physical skills are more applicable to this AMSE type from the service business perspective?
	• Human presence behind robotic avatars, which could improve customer acceptance	• What are the critical factors affecting the customer acceptance to the tele-serving type of AMSE? • How will it change through customer experiences and the cultural shift?
	• Supplementing limited physical capabilities for work participation	• What are the multi-level impacts of work participation (e.g., well-being, workplace diversity, job market)?

		• What kind of support is needed for work participation?
	• Precise control for physical contacts in service encounters (i.e., touch for care)	• What are the impressions of the persons touching or being touched in the service contexts? What are the influential factors? • How can firms establish the safety management for human-avatar physical interactions?

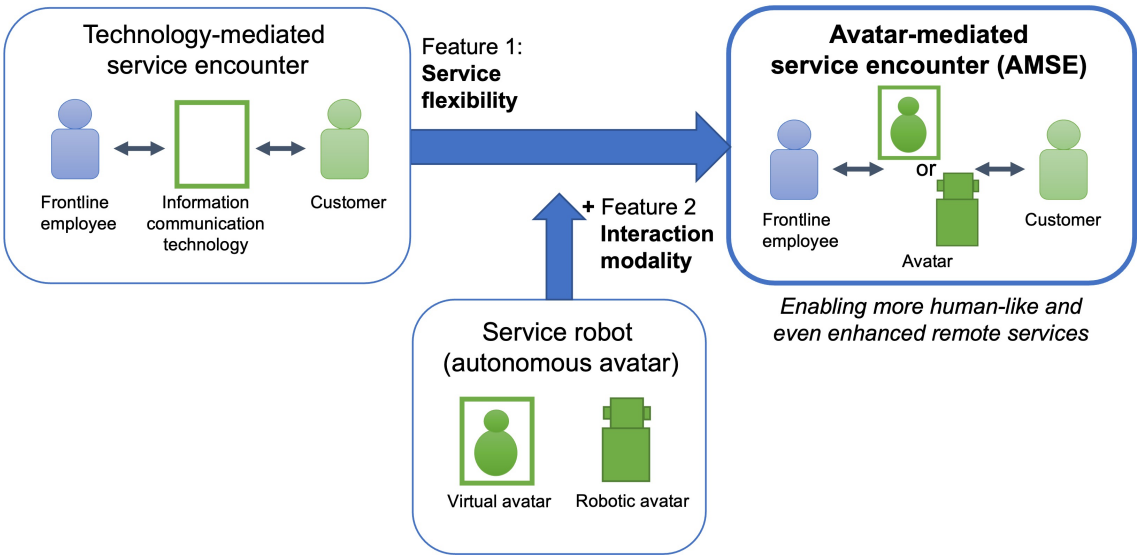

Figure 1. Conceptualization process of avatar-mediated service encounter (AMSE)

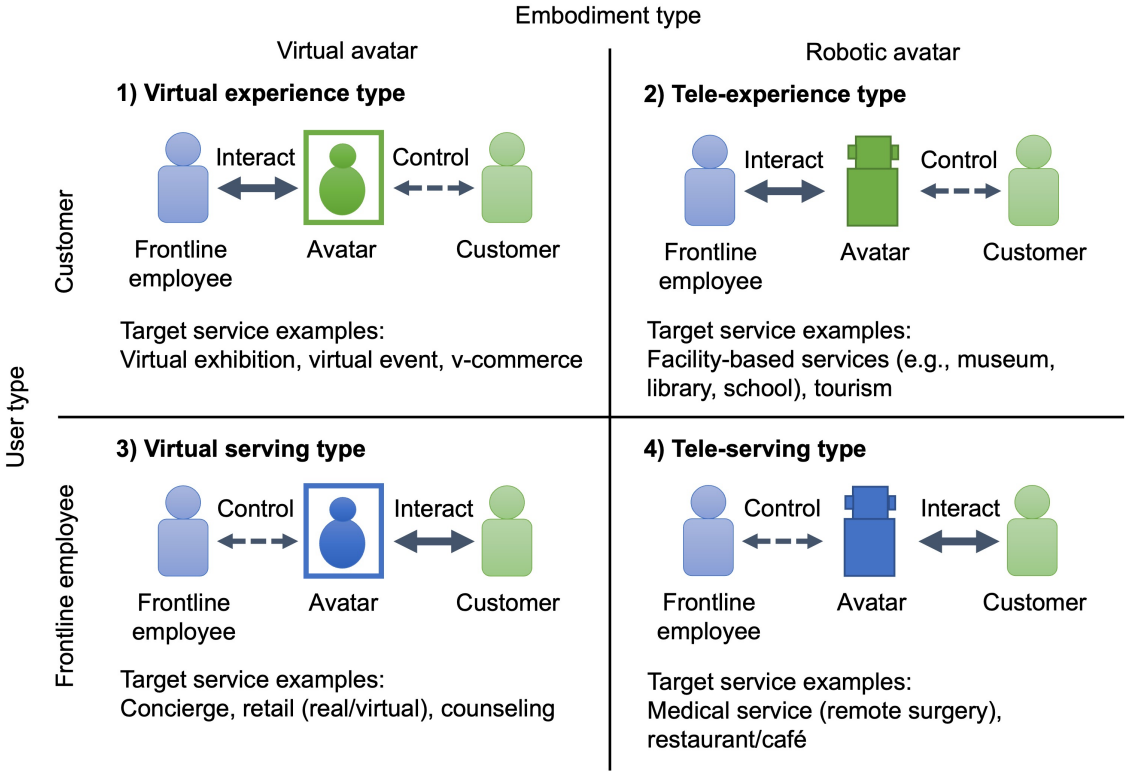

Figure 2. Conceptual framework underlying avatar-mediated service encounter (AMSE) applications