To automate or not to automate? A contingency approach to service automation

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Abstract

Purpose – Following a contingency approach, this paper aims to understand *when* service automation can enhance or destroy value for customers in the frontline by (1) providing a comprehensive overview of factors that influence the value co-creation/co-destruction potential of service automation; (2) zooming in on the combination of service contexts and service tasks to develop research propositions.

Design/methodology/approach – This paper uses a grounded theory approach based on qualitative data from multiple methods (i.e., a diary study with follow-up interviews, a consultation of academic experts, and a storyboard study) as well as a systematic literature review to develop (1) a Framework of Automated Service Interactions (FASI) and (2) a contingency model for service tasks/contexts.

Findings – This paper presents a framework which gives an overview of factors influencing the value co-creation/co-destruction potential of service automation. The framework discerns between three types of factors: service design (i.e., controllable and manageable by the organization); static contingency (i.e., uncontrollable and fixed); and dynamic contingency (i.e., uncontrollable and flexible). Furthermore, the paper presents a contingency model based on the combination of service contexts and service tasks which results in seven research propositions.

Originality – This paper brings structure in the fragmented field of service automation. It integrates and summarizes insights regarding service automation and sheds more light on *when* service automation has the potential to create or destroy value in the organizational frontline.

Keywords – Service automation, value co-creation, value co-destruction, service robot, self-service technology, frontline service technology

Introduction

The emergence of frontline service technologies - 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) - has a profound impact on how services are delivered and perceived (De Keyser *et al.,* 2019). While the service encounter used to be 'a game of people' including human-to-human interactions between customers and employees, frontline service technologies are fundamentally reshaping the service landscape (Larivière *et al.,* 2017). This is especially the case for 'service automation' which implies that a technology replaces a human employee in the frontline (cf. Van Doorn *et al.,* 2017). For instance, fast food restaurants such as McDonalds are increasingly using self-service kiosks instead of frontline service employees to take orders from customers (Huang and Rust, 2018).

Prior research shows that 50 percent of tasks currently performed by human employees can be automated by using currently available technologies (Manyika *et al.*, 2017). Such technologies can replace frontline service employees based on promises of reduced costs and/or increased productivity (Huang and Rust, 2018; Andriole, 2021). The rise of service automation in the organizational frontline has been accelerated by the Great Resignation (Andriole, 2021). Specifically, a record number of frontline employees are quitting or thinking about quitting their jobs in light of the COVID-19 pandemic (Fuller *et al.*, 2022) which makes 'hiring' frontline service technologies even more beneficial for service providers. For instance, a Belgian restaurant recently hired a robot to serve customers because "it is impossible to find the necessary staff" (TV Limburg, 2022).

As implied by its definition, a frontline service technology is intended to support value co-creation which means that the customer is better off because the benefits of service automation exceed its costs (Grönroos and Voima, 2013; Leroi-Werelds, 2019). For instance,

previous studies (e.g., Blut *et al.,* 2016; Čaić *et al.,* 2018) have demonstrated that service automation can increase efficiency and/or perceived control during the service visit. However, prior research (e.g., Leroi-Werelds, 2019; Čaić *et al.,* 2018) also indicates that service automation can lead to value co-destruction which implies that the customer is worse off because the costs of service automation exceed its benefits (Grönroos and Voima, 2013; Leroi-Werelds, 2019). For instance, automated service interactions lack the authentic human touch which can reduce the social value of service interactions (Wirtz *et al.,* 2018). In terms of strategic decision making, value co-creation needs to be fostered, whereas value co-destruction needs to be avoided (Čaić *et al.,* 2018). Hence, managers need to think strategically about service automation and its value co-creation/co-destruction potential from a customer perspective. They need urgent and actionable guidance on *when* to adopt service automation in their organizational frontline (Larivière *et al.,* 2017).

This question is particularly relevant for physical service interactions because of the following reasons. First, in physical service interactions, service employees are a highly visible element of the service provision (Wirtz and Jerger, 2017) and represent the service brand towards its customers (Berry, 2008). Hence, replacing these human employees by technologies can make or break the service brand. Second, physical human-to-human interactions between employees and customers play a critical role in connecting customers to companies (Gremler and Gwinner, 2000; Rafaelli *et al*., 2017). When automating such interactions, it will be difficult to develop lasting bonds with customers and "without a strong connection, customers are more likely to switch providers" (Dwayne Gremler in Rafaelli *et al.*, 2017, p. 93). Third, examples from business practice show that service automation is rising in the physical organizational frontline, which is accelerated by COVID-19 and the Great Resignation (Andriole, 2021; Fuller *et al.*, 2022). As mentioned by Andriole (2021, para. 16): "Why wouldn't all companies want to deploy 'workers' that work 24/7, never need

vacations, never join unions and never get sick (from viruses, at least)? Checkout clerks? Postal workers? Gas station attendants (almost gone now)? And many more."

Although extant research already provides relevant insights regarding service automation of physical service interactions, the existing literature is fragmented (Lu *et al.,* 2020; Odekerken-Schröder *et al*., 2022; Xiao and Kumar, 2021). As a result, a clear and comprehensive overview of factors influencing the value co-creation/co-destruction potential of service automation is lacking and it is currently unclear *when* automation can enhance or destroy value for customers in the frontline (Grewal *et al.,* 2020; Xiao and Kumar, 2021). For instance, should a restaurant use service automation for greeting customers, ordering, and/or serving food? And does this depend on the type of restaurant? These are managerially relevant questions that can not (easily) be answered based on prior research. Hence, "considering the prevalence of technology in service encounters and the conflicting viewpoints about its merits, it seems that clarity is needed with respect to *when* technology functions as a barrier or benefit to service exchanges" (Giebelhausen *et al.,* 2014, p. 113; emphasis added). Various authors (Lu *et al.,* 2020; Xiao and Kumar, 2021) have recently called for more academic research to fill this research gap.

This paper aims to fill this gap by taking a contingency approach - which emphasizes the importance of contextual influences on the management of organizations (Zeithaml et al., 1988) - by discerning two types of factors: design factors (i.e., actions taken by the organization to design the service) and contingency factors (i.e., contextual factors that are uncontrollable for the organization but influence the value co-creation/co-destruction potential of service automation). To accomplish this, this paper uses a grounded theory approach based on qualitative data from multiple methods (i.e., a diary study with follow-up interviews, a consultation of academic experts, and a storyboard study) as well as a systematic literature review. This paper contributes to service research in two key ways. First, this paper makes a

clear conceptual contribution by integrating and summarizing insights regarding service automation (see MacInnis, 2011). Specifically, our Framework of Automated Service Interactions (FASI) provides an overview of design and contingency factors that should be considered when studying and implementing service automation. Prior research providing such a comprehensive and structured overview is currently lacking. A notable exception is the work of Belanche *et al.* (2020) on the implementation of robots. Based on a conceptual study, they provide an overview of robot design, customer and service encounter characteristics that could impact robot performance in the frontline. The current paper does not only focus on robots and uses a systematic literature review as well as consumer insights based on multiple methods (i.e., a diary study with follow-up interviews, a consultation of academic experts, and a storyboard study). This brings new insights to the table, such as the relevance of service contexts as well as service tasks. As such, it provides a more complete understanding of when service automation can create or destroy value in the frontline and answers a recent call by Huang and Rust (2021) to better understand customers' preferences for service automation.

Second, by zooming in on service contexts and service tasks, we shed even more light on *when* service automation has the potential to create or destroy value in the organizational frontline. Overall, our findings show that the value co-creation/co-destruction potential of service automation is contingent on the combination of service tasks and service contexts. While automation is valuable for all service tasks in low-risk transactional (e.g., supermarket) as well as low-equity hedonic (e.g., fast-food restaurant) service contexts, it is only valuable for functional tasks in high-risk transactional (e.g., hospital) and low-risk relational (e.g., local bakery) service contexts. Furthermore, automation is not suitable for high-risk relational (e.g., general practitioner) and high-equity hedonic (e.g., luxury restaurant) service contexts. In mid-equity hedonic contexts (e.g., mid-range restaurant), automation of functional and information provision tasks is only valuable when the firm targets tech-savvy customers.

This paper is structured as follows. In the next section, we define service automation and provide the key findings from a systematic literature review. Next, we describe the research approach which is based on a contingency approach and grounded theory approach. Subsequently, we explain the methodology which includes four different phases of data collection (i.e., diary study, consultation of experts, storyboard study, systematic literature review). Next, the findings are discussed which result in a Framework of Automated Service Interactions (FASI) as well as a contingency model including seven research propositions. Finally, we conclude with theoretical and managerial implications as well as limitations and directions for further research.

Literature review

Service automation implies that a frontline service employee is replaced by a technology (Van Doorn *et al.*, 2017). Prior research (Huang and Rust, 2018; Wirtz *et al*., 2018) and business practice (Andriole, 2021) show that self-service technologies (SSTs) and service robots (SRs) are the most often used technologies for service automation in the physical organizational frontline. SSTs are interfaces that allow customers to deliver the service themselves without employee support, while SRs are autonomous interfaces that interact with and deliver services to customers (Wirtz *et al.,* 2018).

It is important to note that service automation (mainly) happens at the task-level, which means that a specific task - and not the whole service process - is automated (Manyika *et al*., 2017). For instance, when visiting a restaurant, an employee can greet you and take your orders, while a robot delivers your food and drinks to the table. In this case, only the order delivery is automated. This implies that service automation can range from no automation (i.e., no service tasks are automated) to full automation (i.e., all service tasks are automated).

Although prior research already provides relevant insights regarding service automation, the existing literature is fragmented (Lu *et al.,* 2020; Odekerken-Schröder *et al*., 2022; Xiao and Kumar, 2021). To illustrate this fragmentation and gather existing insights into when service automation can create or destroy value for customers in the frontline, we conducted a Web of Science Core Collection search at the topic level (i.e., title, abstract, and keywords) for "robot*" or "self-service technolog*" in combination with "acceptance", "adoption", "value", "benefit", "cost", "*creation", "*destruction", or "sacrific*" as well as "customer*" or "consumer*" and "service*". Our selection covered all work published before 2022. We screened the results for English academic articles with a Social Sciences Citation Index and published in the fields of business or management, which returned 252 results. Within these 252 articles, we screened the titles and abstracts to delete papers that did not focus on the following aspects: business-to-consumer context, customer perspective, frontline, substitution of employees, human-technology interaction, physical/offline service environment, and technologies with an actual physical appearance/shape. This yielded 159 articles. Finally, we screened the articles' content and deleted papers that did not focus on the above-mentioned aspects; involved a viewpoint or editorial; or had no relevant key variables or outcome(s) regarding value co-creation/co-destruction or technology acceptance. The Web Appendix provides an overview of the remaining 100 articles.

Four main insights arise from this systematic literature review. First, prior studies include three key types of value for customers: functional value (e.g., usefulness, ease-of-use), social-relational value (e.g., warmth, social presence), and hedonic value (e.g., enjoyment). However, the latter has only been considered from a value co-creation perspective (i.e., the focus is on technology creating enjoyment while the destruction of enjoyment as a result of automation has been neglected).

Second, with regard to contingency factors, a considerable amount of research incorporates customer characteristics, such as technology readiness (e.g., Lin and Chang, 2011); technology anxiety (e.g., Wang, 2017); need for interaction (e.g., Kaushik and Rahman, 2017); and demographics (e.g., Lee *et al.,* 2021). Furthermore, various studies include situational characteristics, such as relative waiting time (e.g., Demoulin and Djelassi, 2016); consumption goal (e.g., Koller and Königsecker, 2012); time pressure (e.g., Demoulin and Djelassi, 2016); and perceived crowding (e.g., Gelbrich and Sattler, 2014).

Third, although several studies indicate that the value co-creation/co-destruction potential of service automation depends on the service context, most of these studies are conceptual in nature (e.g., Huang and Rust, 2021; Wirtz *et al.,* 2018; Xiao and Kumar, 2021). Nevertheless, existing empirical studies, for instance, reveal differences between full-service versus limited-service hotels (e.g., Lin *et al.,* 2020) and fine-dining versus quick-service restaurants (e.g., Xu *et al.,* 2020). However, a clear overview of service characteristics explaining these differences is currently lacking.

Fourth, prior work does not account for the service task that has been automated. Previous studies focus on various tasks such as self-check-in (e.g., Fan *et al*., 2016), self-check-out (Sharma *et al.,* 2021), ordering food (e.g., Xu *et al*., 2020), delivering food (e.g., Mende *et al.,* 2019), greeting customers (e.g., Van Pinxteren *et al.,* 2019), or providing information (e.g., Koller and Königsecker, 2012). Furthermore, various studies mix multiple service tasks in the same study (e.g., Lee *et al.,* 2021) or are based on customers' perceptions about prior experiences with the automated interface in general (e.g., Lin and Chang, 2011). This makes it really difficult to discern for which tasks service automation results in value co-creation or co-destruction. A notable exception is the recent qualitative work by Boudkouss and Djelassi (2021) showing the difference in customers' value perceptions between an interactive kiosk and a self-check-out. Although they do not discuss their results in light of specific tasks, this

study already demonstrates the relevance of taking different types of SSTs - and thus the service tasks that have been automated - into account.

Overall, our systematic literature review indicates that the current literature is fragmented and a clear understanding of *when* service automation is valuable from a customer perspective is lacking. Furthermore, this review also demonstrates that to answer the 'when' question more research is needed related to service contexts and service tasks. Against this backdrop, this paper uses a contingency approach:

- to build a framework that gives a comprehensive overview of factors influencing the value co-creation/co-destruction potential of service automation in the frontline;
- to build a contingency model that uncovers for which combinations of service contexts and service tasks service automation can be valuable.

Research approach

Our research combines a contingency approach with a grounded theory approach. We explain each of them in the following sections.

Contingency approach

In the 1960s, management theory began to adopt a new orientation - called 'a contingency approach' - which emphasizes the importance of contextual influences on the management of organizations. A contingency approach is positioned between two extreme views: (1) the view that universal principles of management exist; (2) the view that each organization is unique and each situation must be evaluated separately (Zeithaml *et al.*, 1988). Specifically, a contingency approach assumes that not all organizational actions are effective under all conditions, but that some actions are more effective than others, depending on the context (Zeithaml *et al.*, 1988). Such a contingency approach is useful to examine when service

automation is valuable from a customer perspective since its value co-creation/co-destruction potential is contingent on contextual factors.

A contingency approach involves three types of factors: contingency factors, response factors, and performance factors (Zeithaml *et al.*, 1988). Contingency factors are contextual characteristics usually exogenous to and uncontrollable for the organization. Response factors - which we refer to as design factors in this study - involve actions taken by the organization in light of contingency factors and, in case of service automation, relate to service design decisions (e.g., interface design, task design). Performance factors are the dependent measures and "represent specific aspects of effectiveness that are appropriate to evaluate the fit between contingency variables and response variables for the situation under consideration" (Zeithaml *et al.*, 1988, p. 40). In this study, the performance factor involves the value co-creation/co-destruction potential of service automation.

Grounded theory approach

We applied a grounded theory approach that was based on a paradigm of interpretivism (Gehman *et al*., 2018; Gioia *et al*., 2013). Our approach involved the collection and analysis of different types of field data as well as literature "to develop a theory that is 'grounded' in these data" (Homburg *et al.*, 2017, p. 379). There are three key reasons why a grounded theory approach is suitable for our research. First, grounded theory is the most appropriate approach for studying phenomena that are not well understood (Homburg *et al.,* 2017). As mentioned before, research on service automation is fragmented and there is a need to better understand customers' preferences for service automation (Huang and Rust, 2021). Second, a grounded theory approach aims "to capture and reduce the complexity of concepts that are socially constructed in the organizational reality of participants" (Homburg *et al.,* 2017, p. 379). This makes it valuable to obtain a comprehensible and complexity-reducing

understanding of the design and contingency factors that should be considered when making service automation decisions. Third, grounded theory stimulates the integration of qualitative research data and existing literature to develop a theoretical framework (Homburg *et al.,* 2017). Given that there are abundant studies on SRs and SSTs (see Web Appendix), but a comprehensive understanding of the design and contingency factors that determine the value co-creation/co-destruction potential of service automation is lacking, a grounded theory approach allows us to synthesize consumer-based insights and prior literature to develop an integrated and comprehensive framework of service automation.

Methodology

We used three methods to gather qualitative data: a diary study with follow-up interviews; consultation of academic experts; and interviews based on storyboards. Finally, the systematic literature review (see Webappendix) was used as an additional source of data to validate and complete our findings. "Using multiple methods to study a phenomenon is proposed to produce results that are more robust and compelling than single method studies" (Davis *et al.*, 2011, p. 467). In our multiple method research design (see Table I), the data from the diary study with follow-up interviews received the largest weight since it acted as the foundation for the other methods (see also Davis *et al.*, 2011). In the following sections, the different phases of data collection and analyses are described followed by an explanation of how we moved from data to theory.

[INSERT TABLE I HERE]

Phase 1. Diary study and follow-up interviews

We started by generating in-depth consumer insights based on a diary study and follow-up interviews. A diary study is valuable for understanding individual daily experiences related to service interactions (Bolger *et al.*, 2003). In fact, "in diary studies, people provide frequent reports on the events and experiences of their daily lives […] in a way that is not possible using traditional designs" (Bolger *et al.*, 2003, p. 579). Furthermore, diaries permit a reduction in the possibility of retrospection because of the minimized time between experiencing the event and recalling it (Bolger *et al.,* 2003; Burton and Nesbit, 2015).

Procedure. We used event-based diaries (Bolger *et al.,* 2003) based on a period of three weeks. We asked participants to answer eight open-ended questions (see Appendix 1) in their diary each time they had a physical service experience. Participants had the choice between a hard-copy diary and an online diary. In line with the general notion of service design - "service should be visualized as a sequence of interrelated actions" (Stickdorn and Schneider, 2010, p. 26) - we incorporated a process-based approach in the diary design. To guide participants and make them aware of all relevant service interactions, we provided them with a non-exhaustive list of different services (see Appendix 1) based on previously used examples of the widely adopted and empirically validated SEC framework, which detects three service types: search, experience, and credence (Ostrom and Iacobucci, 1995).

Sample. Calls to participate were sent via email to students and employees of our university (which is located in Belgium) and via the lead author's personal social media channels. In addition, posters with a research call were distributed throughout the university's building. Data were collected until no additional insights were gathered. In total, 30 respondents participated (M_{age} = 45 years [23–78 years], 9 men) and 281 diary inputs were collected. Subsequently, 27 out of 30 participants were willing to participate in the follow-up interviews. The interviews lasted between 25 and 87 minutes, for an average of 48 minutes.

We audiotaped all interviews and transcribed the data verbatim, resulting in 386 single-spaced pages of text. Based on the diaries, we created service blueprints to visualize the service process which acted as a guiding tool during the follow-up interviews (Bitner *et al.,* 2008).

Follow-up interviews. Semi-structured follow-up interviews were conducted with 27 participants. These interviews included two parts. The first part of the interview focused on the respondent's diaries and service blueprints and was meant to collect clarifications, more details, and additional service experiences (Burton and Nesbit, 2015). Consistent with the process-based view of services, this first part of the interview was based on the sequential incidents technique which asks respondents to describe and reflect upon all steps experienced in the service process of "critical" (i.e., very positive or very negative) as well as "normal" incidents (Stauss and Weinlich, 1997). The second part of the interview focused on the respondent's opinions about, experiences with, and preferences for service automation. We were particularly interested in services and tasks that could or could not be automated from the respondent's point-of-view. Probing questions were based on the particular services and tasks mentioned in the diary studies. We encouraged elaboration by repeating or paraphrasing responses back to the respondent and asked follow-up questions to get complete responses.

Data analysis. After familiarizing with the data, the Gioia methodology (Gioia *et al*., 2013) was used to code the data. The Gioia methodology is able to capture concepts relevant to the customer experience "in terms that are meaningful for the participants and fosters a level of scientific theorizing about that experience" (Sharma and Conduit, 2016, p. 440). By means of thematic analysis, we followed the four-step Gioia procedure (Gioia *et al*., 2013). First, we coded the data, which resulted in first-order terms presented in the respondent's own words. Second, these first-order terms were organized into second-order concepts reflecting existing theory and research terminology. Third, second-order concepts were organized into overarching theoretical dimensions, called "aggregate dimensions." Fourth, we constructed a

data structure based on the aforementioned ingredients that allowed us to visualize the progress from raw data to concepts and dimensions. The data structure was reviewed and discussed by the first two authors. Based on the findings of this first round of coding, we drafted a first version of the FASI. This initial framework can be considered an artifact during the coding process (Locke *et al.,* 2022).

Phase 2. Consultation of academic experts

We asked twelve prominent academic experts with publications in the field of frontline service technologies to evaluate the initial version of the FASI. Nine of them accepted our request.

Procedure. To make the evaluation process as efficient as possible for the experts, we assigned specific evaluation criteria to each of them. Specifically, we asked each expert to evaluate (1) the overall framework and one dimension of the framework or (2) two dimensions of the framework. We thus listed specific questions for each expert to gather feedback on whether the concepts and/or dimensions of the framework were relevant and complete. Each expert could choose how to answer these questions: via email, a physical meeting, or a digital meeting.

Data analysis. The data were used to validate and refine the initial FASI by checking if all elements were relevant and adding or adapting elements whenever deemed necessary. Hence, we used a hybrid process of inductive and deductive thematic analysis to interpret the data.

Phase 3. Storyboard study

To gather additional insights for the FASI and to particularly zoom in on service contexts and service tasks, we used a storyboard study. Considering the importance of visualization for

service design (Teixeira *et al*., 2017) and the process-based nature of service experiences (Bitner *et al.*, 2008), storyboards offer an excellent research method to gather additional insights. Based on our initial FASI in combination with the SEC framework, three storyboards (i.e., a store, a restaurant, and a bank) were designed (see Appendix 2). These storyboards visualized the various service tasks and were complemented by a narrative to create different scenarios (Teixeira *et al*., 2017). In accordance with our initial results, we manipulated service and situational characteristics by adapting the narrative.

Procedure. We used a context disruption interview protocol that combined in-depth exploratory interviews with generative card activities (i.e., storyboards) (Čaić *et al*., 2018). The storyboards aided the respondents to induce their knowledge regarding a service interaction, whereas the interviews captured respondents' experiences, perceptions, and opinions concerning service interactions before and after introducing technology (Čaić *et al*., 2018).

Sample. Participants were recruited via their email account from our university as well as through the personal social media channels of the lead author. The sample included 31 respondents (Mage = 35 years [18–74 years], 14 men) each assessing two storyboards. Procedural details and study materials are presented in Appendix 2.

Data analysis. The data were used to validate and refine the initial FASI by checking if all elements were relevant and adding or adapting elements whenever deemed necessary. Next, we zoomed in on the service tasks and service contexts of the storyboards to identify relevant codes based on the actual language of the respondents. These codes were summarized in broader themes which were reviewed and discussed by the first two authors.

Phase 4. Systematic literature review

The systematic literature review was used in two key ways. First of all, it was used to further validate and complete the FASI (see Web Appendix). The literature was used as a direct source of coding (Locke *et al*., 2022). Based on the literature review, we added country characteristics and interface design characteristics, which were not explicitly mentioned during the interviews, but can be considered relevant when answering the 'when' question (Belanche *et al*., 2020). Given the large diversity of customer characteristics mentioned in the literature, we only included the ones that were mentioned at least twice in our systematic literature review. Characteristics that were specifically related to a specific context (e.g., basket size in supermarkets) were not included in the FASI.

Second, we used the literature when zooming in on service contexts and service tasks "to help make sense of and theorize from categorization schemes" thereby "feeding observations and theory into each other in a process of double fitting" (Locke *et al.,* 2022, p. 272).

Moving from data to theory

Although data were gathered in subsequent phases, it is important to note that we used an iterative coding process which means that we cycled between data sources when analyzing the data (Locke *et al*., 2022). We identified and analyzed common patterns of meaning within and across data sources, carefully comparing our emergent theoretical patterns against the data, and vice versa (Locke *et al*., 2022).

In line with the recommendations of Grodal *et al.* (2021) to achieve rigor in qualitative analysis, we combined multiple analytical moves when moving from data to theory. We first approached the data with a specific question in mind: "When does service automation enhance or destroy value for customers in the frontline?" to generate initial categories of contingency and design factors, which is in line with the contingency approach. Next, the

process of data analysis shifted toward refining these categories by adding, dropping, merging, and splitting categories whenever deemed necessary. This ultimately resulted in the FASI. In a next step, we approached the data with a more specific question in mind: "For which combinations of service tasks and service contexts does service automation enhance or destroy value for customers in the frontline?". We again used multiple moves (adding, dropping, merging, splitting, relating, contrasting) to tease out the mechanism that resulted in our contingency model and research propositions.

Findings

Framework of Automated Service Interactions

The first objective of this paper is to provide a comprehensive overview of design and contingency factors influencing the value co-creation/co-destruction potential of service automation. Figure 1 presents the FASI which gives an overview of all factors that are deemed relevant based on the grounded theory approach used in this paper. This framework shows that whether service automation results in value co-creation or value co-destruction for the customer depends on three types of factors: service design factors; static contingency factors; and dynamic contingency factors.

[INSERT FIGURE 1 HERE]

Service design factors are under the control of the organization and relate to the configuration and orchestration of service interfaces used during the service encounter. Static contingency factors are contingencies that are fixed and stable for the organization. They are based on prior strategic decisions of the organization (i.e., what do we do and where do we do it?). The organization can not (easily) change these factors. For instance, the country where

the organization operates is fixed, unless it decides to move to another country, but even then, country characteristics can be considered 'a given' or known in advance. The same holds for service characteristics: These can be considered as fixed or known when making tech-touch decisions. The organization should take these static contingency factors into account when automating service interactions.

Dynamic contingency factors are contingencies that are flexible and thus not fixed. These factors are not known in advance. For instance, when a customer visits the service provider, he has his own individual characteristics (such as demographics, technology readiness, self-efficacy, and need for interaction) and is influenced by the situation in terms of consumption goal, time pressure or crowding. The organization can and should acknowledge these factors when automating service interactions, but - given the dynamic and unpredictable nature of these factors - it is more difficult to take them into account when answering tech-touch questions. Table II gives a definition of each factor and includes illustrative quotes and references.

[INSERT TABLE II HERE]

A contingency model of service contexts and service tasks

As illustrated by our systematic literature review, a clear understanding of the impact of service contexts and service tasks on the value co-creation/co-destruction potential of service automation is currently lacking. However, several - especially conceptual - studies (e.g., Huang and Rust, 2021; Wirtz *et al.*, 2018; Xiao and Kumar, 2021) highlight the relevance of these factors when making service automation decisions. Consequently, the second research objective of this paper is to uncover when service automation creates/destroys value in the frontline by zooming in on the combination of service contexts and service tasks. In

particular, we want to answer managerial questions such as 'should I use service automation in my luxury restaurant and should I do this for greeting, ordering, serving, and/or billing?'. In line with a contingency approach, we thus combine a design factor (i.e., service task) with contingency factors (i.e., the service characteristics which determine the service context) to evaluate the value co-creation/co-destruction potential of service automation (i.e., performance factor).

Before we start with the explanation of our contingency model, it is important to emphasize the role of customer needs. Specifically, our data indicate that customer needs explain *why* customers value a human versus automated interface for a specific service task in a specific service context. In this regard, the data reveal that 'need for interaction' should not only be considered as a consumer trait, i.e., a stable disposition or quality of a person. Specifically, while prior studies (e.g., Blut *et al.*, 2016; Lee, 2017) consider need for interaction as a consumer trait, our findings clearly indicate that need for interaction also depends on the circumstances. Although some consumers seem to have a general desire to retain personal contacts with human employees during a service encounter ("Once in a while, I need to have my little chat."), our data reveal that this need for interaction depends on the combination of the service context and task. This can explain why prior research found mixed results related to the role of need for interaction (e.g., Lee, 2017; Kaushik and Rahman, 2015). The following quotes clearly show the relevance of a context-task-specific need for interaction:

> You go to a store to buy something. You go in and out. You are gone. But in a café. You can make a café with all kinds of machines. I'm curious how many people will come. Just because of the [lack of] interaction with other people. (Henry, 72)

> If I go to the swimming pool it is not necessary to have a human being at the cash register. You can pay with your card, pass through the gate and you are inside. [...] You do not have personal contact anymore. If we go to the cinema, we also use the self-scan. (Anne, 47)

> I believe this [automation] is really positive because everything will become more efficient. There will be less mistakes. It will go faster. A computer is smarter than a human being nowadays. Maybe there will be less human interaction. But the tasks that can be kept personal, should be kept personal. Repetitive tasks can be done by a computer. (Marie, 23)

When analyzing the data, we found three other needs that are relevant to explain for which service tasks and service contexts service automation creates/destroys value in the frontline: need for speed, need to be served, and need for advice.

> I think a lot of things are technically possible. From a pharmacy to everything you can buy. But I believe it should be about functional products like a supermarket or a pharmacy. Things that do not need to be explained. (Charlotte, 38 years)

> I know a lot about wine, so I can use it [the tablet]. That is technical support for people who know something about wine. But if you do not know anything about wine, it is better to have a human person who can give you advice. It is important that someone can give you good advice. (Peter, 52 years)

> If I go to the hospital. In the past, you had to register via a person. There was someone sitting at the desk. Now I go to a terminal. I enter my ID, click, click, click. And you are registered. The terminal says where to go. This is more pleasant than telling everything to a person. [...] This [telling everything to a person] has no value. And the terminal is much faster. (Rose, 52 years)

> A robot is not needed in a supermarket. I prefer to do it myself [with an SST]. I do not need to be served. (Alice, 57 years)

> You go to a restaurant to be served. Because it is different from dining at home. […] You want to have the feeling that they are 'working' for you. (Elina, 20 years)

> I really like to be served in a fashion store. Someone in front of me who folds my clothes and puts them in a nice bag. And gives a bit of information. I will give an example: Someone who says that I have to think about the cleaning products for my new shoes or reminds me that I can use a water-repellent spray. [...] These kinds of things provide additional value. (Isaac, 51 years)

As mentioned before, our contingency model is based on a combination of service contexts and service tasks. The FASI already indicated the existence of four service characteristics: hedonic versus utilitarian; transactional versus relational; low equity versus high equity; low versus high risk. Utilitarian services focus on task completion, efficiency, usefulness, and functionality; while hedonic services focus on enjoyment, escapism, and sensation (Hellén and Sääksjärvi, 2011). Transactional services focus on transactions with customers, while relational services focus on building long-term relationships with customers (Huang and Rust,

2021). Low equity implies that little value is added to products/services in terms of brand name associations. The focus is on efficiency and delivering the expected service quality. High equity implies that a lot of value is added to products/services with brand name associations as well as exclusivity, uniqueness, and social empathy (Netemeyer *et al.,* 2004; Xiao and Kumar, 2021). Risk is defined as the perceived uncertainty and negative consequences of buying a product or receiving a service (Swaminathan, 2003). There are several aspects that can be linked to 'high versus low risk'. In particular, the price of the product or service (i.e., higher unit prices imply a higher financial risk; Swaminathan, 2003), complexity of the product or service (i.e., challenging tasks as well as high levels of decision-making latitude are related to performance risk; Gong and Choi, 2016); private versus public setting (i.e., the presence of other customers can induce socio-psychological and privacy risk; Blut *et al.,* 2016), and services for yourself versus your possessions (i.e., if customers themselves are the service recipient there is an increased physical risk).

Starting from these four service characteristics, we uncovered seven service contexts when analyzing the data. For each service context, we present a research proposition related to the service tasks that can potentially be automated. These propositions are formulated so that testable hypotheses can be derived to guide future research efforts. The propositions are summarized in a contingency model presented in Table III.

[INSERT TABLE III HERE]

Low-risk utilitarian service contexts. In low-risk utilitarian contexts, the focus of customers is mainly on task completion, efficiency, usefulness, and functionality. Automation is valuable in these service contexts to fulfill the need for speed. Because of the low risk, customers do not need advice and do not need to be served.

> I do not know why a human employee should explain to me how to open a checking account. This is not difficult. So this can easily be done by robots. (Max, 26 years)

> You can completely automate a supermarket because I do not need human contact there. I prefer as little human contact as possible. These are things that you want to go quickly. You do not need advice about what to buy or not buy in a supermarket. (Marie, 23 years)

> Suppose that I enter [a DIY store] and I click on the screen "I need a product to glue tiles" and it says you have a choice between A, B, and C and I make a choice. I would find it awesome if the robot would get it from the store racks and bring it to me. (Isaac, 51 years)

> Suppose I'm at the airport. Or at an international train station. And I have to wait for my train. And there is a shop and there is a robot in the shop. I believe, because you are in a rather impersonal setting, I would use the robot. (Peter, 53 years)

As already apparent in the last quote, the need for interaction depends on the positioning of the service organization: in case of transactional services (e.g., a supermarket or DIY store), the customer does not need interaction. However, in case of relational services (e.g., a local bakery or a local grocery store), customers often choose this specific service provider because of a high need for interaction. In the latter case, they like and prefer human-to-human interactions to build and enjoy the relationship with the service provider.

> Most people go to the butcher shop to have a little chat. I do not believe this is possible with a robot. [...] I would miss this [little chat]. (Sofie, 36 years)

> It would be fine to enter my order [via a tablet in the butcher shop] so they can start preparing everything. But in the end, I want to see someone who says "Here is your order, thank you". (Steven, 36 years)

> [At the bakery and butcher shop] I prefer human interaction, because here in the countryside… You can have a little chat with these people. This is different than in a large store. (Thomas, 54 years)

Summarizing the above, we propose:

> **Proposition 1:** When an organization has a transactional positioning in a low-risk utilitarian service context, service automation results in value co-creation for all service tasks.
>
> **Proposition 2:** When an organization has a relational positioning in a low-risk utilitarian service context, service automation results in value co-creation for functional tasks, but it results in value co-destruction for other service tasks.

High-risk utilitarian service contexts. In case of high-risk services, people have a high need for advice and a high need for interaction. They prefer human employees instead of technologies because the personal connection with employees reduces risk perceptions (Selnes and Hansen, 2001). Similarly, Wirtz *et al.* (2018) argue that for services requiring complex cognitive and social skills - which is often the case for high-risk services - human interfaces are still a necessity.

> If I go to the bank to order foreign money, I can do this via a screen or robot. But if I go to discuss a loan, this is something else. I need to have a real person before me. [...] I would like to have information from real experts. (Charlotte, 38 years)

This preference for human employees is also mentioned by Caroline when discussing automated service interactions when going to the bank for a loan. She wants advice from a human employee, but automation can be useful for functional tasks.

> Technologies are pre-programmed and cannot think out of the box like a human person. So they are only useful for the registration at the entrance. (Caroline, 36 years)

In a similar vein, Charlotte prefers human service provision when talking about choosing and purchasing furniture (which she refers to as expensive purchases). She prefers human employees for the advice, but automation can be used for functional tasks.

> I prefer a human person since he can talk about his own experiences or opinions. [...] He can adapt to your personal wishes and needs. And also adapt more easily than a screen or robot that just provides information. Maybe it can be useful for taking orders. Maybe this can be automated. (Charlotte, 38 years)

Consumers' preferences also depend on the positioning of the service provider. In case of relational and more personal services, people prefer only human interactions:

> Also at the doctor or physiotherapist. I like to be personally welcomed and greeted compared to a code or whatever. (Charlotte, 38 years)

> The general practitioner? This is a human and you pay for the service of this human person, not for something automated. This has to be personal. (Emma, 25 years)

Even for more functional tasks, automation is not welcomed in this service context.

> I do not like this [entering medical information via an SST in the waiting room]. I want to explain my symptoms to the doctor. [...] I want to say what I feel and what kind of symptoms I have. (Emma, 25 years)

Based on the above, we propose:

> **Proposition 3:** When an organization has a transactional positioning in a high-risk utilitarian service context, service automation results in value co-creation for functional tasks, but it results in value co-destruction for other service tasks.
>
> **Proposition 4:** When an organization has a relational positioning in a high-risk utilitarian service context, service automation results in value co-destruction for all service tasks.

Hedonic service contexts. Hedonic services focus on enjoyment, escapism, and sensation (Hellén and Sääksjärvi, 2011). Some respondents do not want to interact with automated service interfaces at all in a hedonic service context.

> It [service automation] is more useful in this context [a bank] than in a restaurant, because a restaurant is more a social experience. (Caroline, 36 years)

> This [automation in a restaurant] does not feel right. Dining is a social experience. (Lily, 54 years)

> This [automation by means of a tablet] does not fit with why someone goes to a restaurant. You want to have social interactions with people. (Caroline, 36 years)

Others see the benefits of using automation for functional tasks.

> In case of a purchase, like furniture, a cinema ticket, … okay. But if it is about a service or an experience, like a visit to a restaurant, I would not like screens or automation, except for the payment. (Charlotte, 38)

However, consumers' preferences depend to a large extent on the positioning of the service provider. In high-equity hedonic service contexts, customers have a higher need for interaction, need for advice, and need to be served; while in low-equity service contexts, they have a higher need for speed and even full automation is a valuable option.

> In large fashion chains, this [automation] is possible, like Decathlon or H&M or Zara. [...] It would be much quicker. But in small boutiques.... These are specialty stores. You go there for advice and personal interaction. These are the strengths of these stores so it would not fit in such a store. (Marie, 23 years)

> I would prefer a human employee when really going out for dinner. Then you want to take the time. I believe the aim of automation is to save time. In case of a romantic dinner, I would not use the tablet, but in the case of McDonalds or Quick or Burger King. Fast food. I would definitely use it. (Max, 26 years)

> In a gastronomic restaurant, I expect that I am personally welcomed. A digital menu card is okay. But ordering… I do not like paprika, I want to discuss the method of preparation, I want wine and feedback from the sommelier. This is expensive wine so I need an expert's opinion. [...] You are not at a Burger King. (Peter, 53 years)

Hence, we propose:

> **Proposition 5:** When an organization has a low-equity positioning in a hedonic service context, service automation results in value co-creation for all service tasks.
>
> **Proposition 6:** When an organization has a high-equity positioning in a hedonic service context, service automation results in value co-destruction for all service tasks.

As can be expected, we also see a middle ground between these two extremes, which we refer to as 'a mid-equity positioning'. Examples include mid-range hotels and restaurants, but also public wellness facilities. In these cases, the use of automation largely depends on the target segment. When the service provider targets tech-savvy customers (i.e., high level of technology readiness), service automation can be used for functional and information provision tasks. Louisa and John have a low level of technology readiness and prefer human-to-human interactions for all tasks in a restaurant:

> I would prefer the current way of working. Someone comes to the table to get your order. [...] You are going for dinner to have a nice evening. I like how it is. [...] Just personal. (Louisa, 67 years)

> I prefer humans. This [automation] is another atmosphere if you enter the restaurant. (John, 74 years)

Max and Liliana have a high level of technology readiness and see the benefits in terms of efficiency.

> I would use a tablet to order. You can decide for yourself. It is quicker and easier. (Max, 26 years)

> If I enter the restaurant, I would prefer that someone personally greets me, but for the payment I do not mind. […] Because if you ask for the check, you often have to wait a long time. If it can be faster with a tablet, I prefer the tablet. Also for the menu card and ordering. [...] When I enter and leave the restaurant, the human interaction is more pleasant. (Liliana, 25 years)

For tech-ready people, functional (e.g., payment; ordering) and information provision tasks (e.g., information about assortment; the menu card in a restaurant) can be automated. However, for other tasks, humans are (still) the preferred interface. Marie and Alice, for instance, have a high level of technology readiness and see the benefits of using technology for ordering and paying in a restaurant. However, for certain service tasks, human-to-human interactions are needed:

> This [greeting by a technology in a restaurant] would not really bother me, but I believe I would have a better feeling if there was a person at the entrance. Everything that has to do with efficiency, can be done by a computer, but everything that has to do with emotions and feelings, has to be done by people, I believe (Marie, 23 years)

> You could check whether you have a table and where you can sit. And maybe you can order. But some people like it if there is someone coming to the table. Also if you want to order something else than what is on the menu card. (Alice, 57 years)

Summarizing the above, we propose:

> **Proposition 7:** When an organization has a mid-equity positioning in a hedonic service context and targets technology ready customer segments, service automation results in value co-creation for functional and information provision tasks. However, it results in value co-destruction when customers have a low level of technology readiness and for other service tasks.

Finally, it is important to note that, although customers accept full automation in some service contexts, offering human assistance is advisable in case the customer has a specific question or when technology fails. Hence, the organization should consider service recovery options when opting for service automation.

> A robot can malfunction or it does not answer my question. I cannot operate it. (Lea, 73 years)

> I would never go somewhere where there are only robots or only technologies. I prefer that there is someone there to supervise. (Charlotte, 38 years)

Conclusion

Service automation is becoming part of the organizational frontline (van Doorn *et al*., 2017). Prior research provides some relevant insights regarding service automation, but the literature is fragmented. As a result, it is currently unclear *when* technologies can enhance or destroy value for customers in the frontline (Grewal *et al*., 2020; Xiao and Kumar, 2021). The present paper uses a contingency approach to help answer this 'when' question.

Theoretical implications

This paper proposes a framework (see Figure 1) as well as a contingency model (see Table III) which contribute to the existing literature in several ways. First, this paper addresses gaps in the extant literature by answering calls for more research focusing on *when* service automation creates or destroys value in the frontline (Grewal *et al.,* 2020; Xiao and Kumar, 2021). This is the first study - to the best of our knowledge - that takes a contingency approach and explicitly discerns between several contingency and design factors to explore service automation. Such a contingency approach is necessary to unravel contextual factors that impact customers' perceptions about service automation. We encourage researchers to take design and contingency factors mentioned in the FASI into account in their own research, especially when comparing technologies or contexts. For instance, Chiu and Hofer (2015) investigated the influence of the market context on customers' perceptions and usage intentions of SSTs by comparing Taiwanese and Austrian customers. However, in the Taiwanese context they investigated multimedia kiosks in convenience stores, while in the Austrian context they investigated self-check-out in supermarkets. Given the differences in

service contexts and service tasks, their findings are potentially biased. A thorough consideration of various design and contingency factors is thus needed when investigating service automation.

Second, the FASI brings structure in the fragmented field of service automation. Service automation is not new, but the introduction of SRs has increased academic attention to this topic. A variety of conceptual as well as empirical studies on automated service interactions explain parts of the picture, but a comprehensive and structured overview is currently lacking. Such an overarching framework allows researchers to gain a more holistic understanding of service automation from a customer perspective (see also Lu *et al.,* 2020). Given the combination of various qualitative data collection methods as well as a systematic literature review, the FASI is well-grounded in the existing literature as well as in-depth consumer insights.

Third, our findings clearly show the relevance of service tasks and service contexts when investigating service automation. Prior research refers to "automating the front end of a service" (Andreassen *et al.,* 2018, p. 173) or "the adoption of robotics in customer service" (Xiao and Kumar, 2021, p. 21) while our findings clearly show that 'the service' does not exist. It is a combination of service tasks within a particular service context. Researchers have to take this into account when setting up their study. For instance, various empirical studies include multiple SSTs or SRs in the same study (see Web Appendix), while not taking into account potential differences between service tasks. Kaushik and Rahman (2017) and Lee *et al.* (2021), for example, investigated customers' usage intentions of respectively SSTs and SRs in hotels. Although frontline service technologies deployed in the hotel context can perform several types of service tasks such as functional (e.g., carry luggage), core service delivery (e.g., check-in/out, deliver room service), provision of information (e.g., give information about popular attractions), and social-emotional (e.g., greet and entertain guests)

tasks, both studies did not take these different tasks into account. This could potentially bias research findings.

Managerial implications

Like it or not, service automation is a trend that service providers cannot afford to ignore due to increasing human labor costs; enhanced technological capabilities; and declining costs of technologies (Xiao and Kumar, 2021). Technically, technologies such as SSTs and SRs have the potential to replace human employees in the frontline, but when it comes to service interactions, it is never purely a technical issue (Xiao and Kumar, 2021). Hence, service providers should not rush into service automation but they have to consider the value co-creation/co-destruction potential of service automation from a customer perspective. In this light, our paper provides some relevant insights.

First of all, as indicated by our FASI, the value co-creation/co-destruction potential of service automation depends on multiple factors. While some of these factors are under control of the organization, others are not. This makes the decision to automate rather complex and organizations should think carefully about the design of their organizational frontline. For example, in 2014 Starwood Hotels & Resorts Worldwide was the first hotel group that introduced Botlr, a robotic butler offering guest services. However, it was only used in Aloft hotels, since Aloft's customers are typically more tech-savvy than the average hotel guest and are more likely to value cutting-edge technology (Xiao and Kumar, 2021).

Second, our findings show that human employees are still the preferred interface in some service contexts. In high-equity hedonic service contexts, such as luxury hotels or gastronomic restaurants, customers desire the human touch. They want to be served and they prefer human-to-human interactions because it is part of the whole experience. This is in line with the notion of employees as differentiators: "authentic human touch can help differentiate

offerings in the marketplace and display unique brand-building behaviors" (Larivière *et al*., 2017, p. 241). In a similar vein, when an organization has a relational positioning in a high-risk utilitarian context (e.g., general practitioner; physiotherapist) automation is out of the question since people prefer the human touch, personal recognition, and attention. In this case, automation would devaluate the relationship between service provider and customer.

Third, organizations with a transactional positioning in a low-risk utilitarian service context (e.g., supermarket) as well as organizations with a low-equity positioning in a hedonic service context (e.g., fast-food restaurant) can opt for full automation. However, even in case of full automation, human employees should be available to assist customers. Specifically, human employees act as a safety net for solving technology failures and for answering complex customer questions. This also implies that service providers should think carefully about service recovery options when opting for service automation.

Finally, it is advisable to offer customers a choice between an automated and human interface. Offering choice is the most customer-centric solution since customers can opt for the interface of their choice based on their customer characteristics (e.g., technology readiness, self-efficacy, previous experience) as well as situational characteristics (e.g., consumption goal, time pressure). Furthermore, customers do not like to be trapped or forced into interacting with a technology (Bitner *et al*., 2002).

Limitations and future research suggestions

Although this research contributes to our understanding of service automation, several limitations and further research suggestions deserve to be mentioned. First, our qualitative data were collected in Belgium. Since the FASI suggests that country characteristics (i.e., market context, culture, technology infusion) can influence the value co-creation/co-destruction potential of service automation, the generalizability of our results to other

countries cannot be taken for granted. We therefore stimulate future research on service automation to investigate other countries as well. For instance, it could be interesting to examine whether service automation is already accepted for other service tasks and contexts in countries where technology infusion is much higher (e.g., Japan, Singapore).

Second, this research did not compare automation by means of SSTs versus SRs. For instance, ordering in a restaurant can be automated by means of a self-service-kiosk but also by means of a robotic waiter. Given the fundamental differences between these two technologies (see Wirtz *et al*., 2018), we encourage further research to compare customers' perceptions related to SSTs and SRs in order to give more fine-grained advice to managers. Furthermore, future research can investigate the impact of the service context on the means of service automation as well as the degree of automation. For instance, Amazon Go is an example of full automation in grocery shopping which is based on a combination of technologies. Hence, further research can zoom in on various aspects of service automation.

Third, this research investigated service automation in terms of physical service interactions and focused on SRs and SSTs. Given the rise of chatbots, we encourage researchers to investigate the value co-creation/co-destruction potential of automation in terms of online interactions. Furthermore, it could be interesting to investigate the value co-creation/co-destruction potential of service augmentation, which implies that a technology does not substitute a human employee but rather complements or assists the employee (De Keyser *et al.*, 2019).

Fourth, the FASI did not include the role of emotions which are a key aspect of many service encounters (Mattila and Enz, 2002). For instance, further research can include the role of emotional contagion (Hennig-Thurau *et al*., 2006) and emotional competence (Delcourt *et al*., 2016) when investigating service automation. Another fruitful avenue for further research

is to examine service automation in relation to employee behaviors such as service improvisation (Secchi *et al.,* 2019) and service customization (Gwinner *et al*., 2005).

Fifth, this study as well as the majority of empirical work (see Web Appendix) mainly focus on customers' acceptance of service automation in terms of SST and/or SR adoption. However, this is just part of the puzzle, since it only considers a rather short-term perspective. Further research is needed to gain a better understanding of customers' changing expectations, barriers, and concerns over time and their long-term use of these technologies (De Keyser and Kunz, 2022).

Sixth, this paper clearly shows the value of a multimethod qualitative approach for the investigation of technologies in service contexts. Each of the methods used in this study has its own merits and by combining them we could unravel new and important insights about service automation. Specifically, our findings reveal the relevance of combining service tasks and contexts when examining service automation. In line with recent recommendations by De Keyser and Kunz (2022), we encourage researchers to adopt a qualitative approach to further examine the potential of service technologies for service practice.

Finally, the FASI as well as our propositions can guide and stimulate further research on service automation. Each of the seven propositions can be empirically tested in quantitative studies. Furthermore, the components of the FASI spark various research questions and researchers can continue this research stream by investigating each component in great depth. We also encourage further research on the combinations of components. Specifically, future research should investigate various combinations of the FASI elements in order to help managers decide whether service automation is suitable for their organization. Hence, future research should acknowledge that customers' acceptance of service automation depends on a multitude of factors and is thus more complex than previously described. Furthermore, further

research can investigate the role of customer engagement in the FASI framework (Hollebeek *et al.,* 2019).

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Figure 1. Framework of Automated Service Interactions

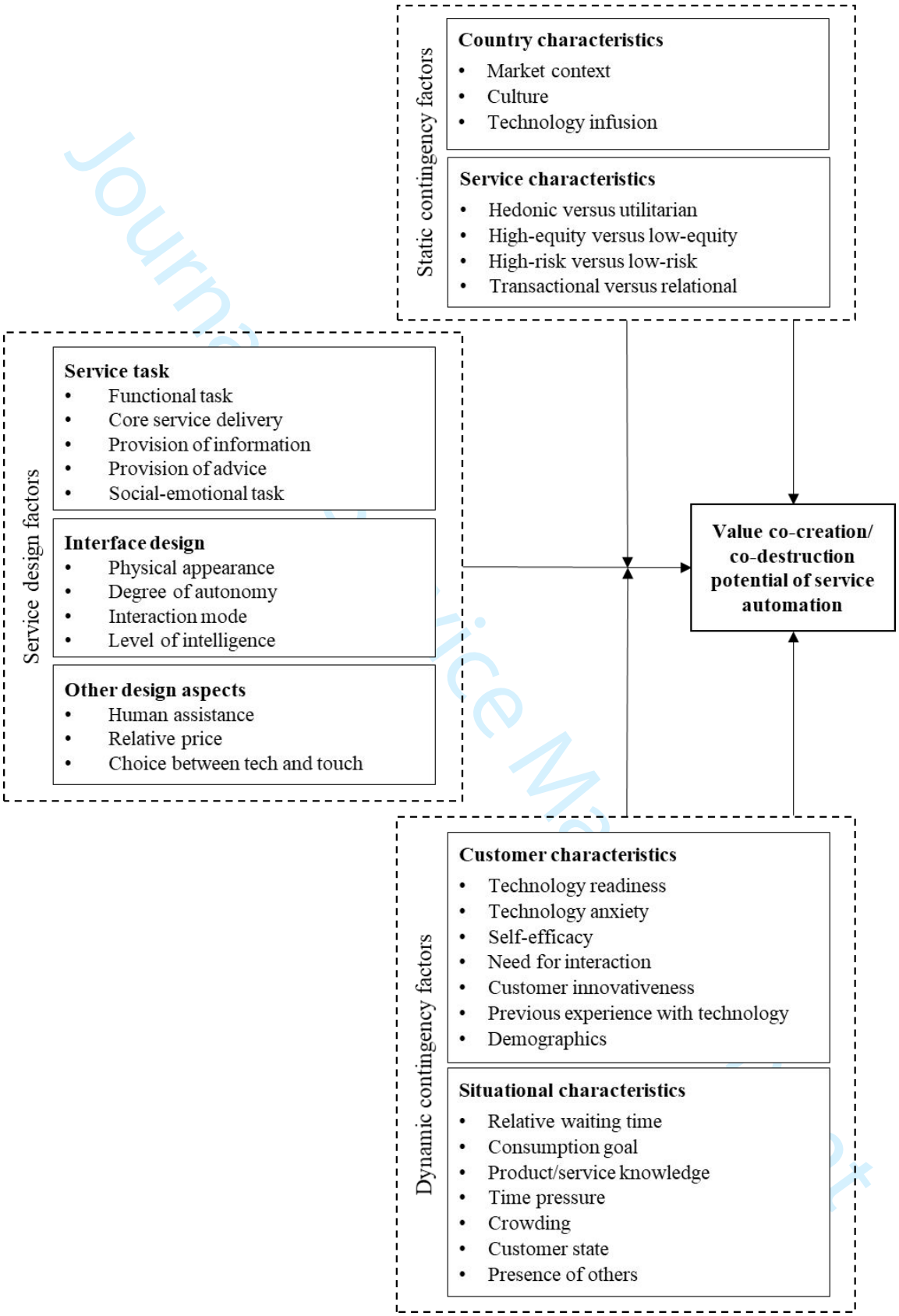


Table I. Multiple method research design

Phase	Method	Purpose	Sample
1	Diary study and follow-up interviews	• To gain an in-depth understanding of individual daily experiences related to service interactions • To understand consumers' opinions about, experiences with, and preferences for service automation • To develop an initial version of the FASI	30 dairies including 281 diary inputs 27 follow-up interviews with consumers
2	Consultation of academic experts	• To evaluate and refine the initial version of the FASI	9 experts
3	Storyboard study	• To generate additional insights to further develop the FASI • To understand consumers' opinions about, experiences with and preferences for service automation for specific tasks and contexts	31 interviews with consumers
4	Systematic literature review	• To validate and complete the FASI • To make sense of our insights related to service tasks and service contexts	100 academic articles

Table II. Overview of factors included in the FASI

	Illustrative quotes	Illustrative references
SERVICE DESIGN: SERVICE TASK		
Functional task: Delivering functional parts of the service, such as ordering a product or receiving payment.	This [ordering and paying with a tablet in a restaurant] can be useful because you have a lot of apps nowadays to pay very quickly. (Elise, 27 years)	/
Core service delivery: Delivering the core service, such as serving food or performing a medical examination.	You could check whether you have table and where you can sit. And maybe you can order. But some people like it if there is someone coming to the table. (Alice, 57 years)	/
Provision of information: Providing facts, figures, and other types of objective data to customers.	The tablet can be useful to show me where I can find a particular wine. (Peter, 53 years)	/
Provision of advice: Giving guidance and assistance to customers.	If you focus on something that is more personal or has more value […] like clothes or jewelries, or interior stuff like draperies and you need advice, than there should be a human person in the store (Isabel, 24 years)	/
Social-emotional task: Developing a personal bond with a customer. Examples include greeting, welcoming, using humor, recognizing a customer or expressing a personal interest.	I do not need a machine that nods [to greet me]. I mean, that's worthless. […] There I want someone who is really empathic. (Zoë, 45 years)	Zhang et al. (2021)
SERVICE DESIGN: INTERFACE DESIGN		
Physical appearance: The aesthetic design of the service interface (e.g., human-likeness, touch screen versus tablet, size; Belanche et al., 2020).	I think that [a humanoid SR] would be weird, then I think "what's the added value that it [an SR] has a human-like form?" (Hanne, 31 years)	Mende et al. (2019); Pitardi et al. (2021)
Degree of autonomy: The degree to which the technology can serve customers without human involvement (Wirtz et al., 2018).	A robot is more appealing than a tablet because it needs less effort from you. (Lisa, 25 years)	Li and Wang (2021); Xiao and Kumar (2021)
Interaction mode: The way a customer can interact with the technology (e.g., voice, touch; Wirtz et al., 2018).	It is strange to talk to a robot. (Peter, 52 years)	Henkel et al. (2020); Pitardi et al. (2021)
Level of intelligence: The degree of intelligence of the technology in terms of options and AI.	Suppose that you order a hamburger. But you don't like pickles. I'm not sure if this is possible with the tablet. (Max, 26 years)	/
SERVICE DESIGN: OTHER DESIGN ASPECTS		
Human assistance: The availability of a human employee to support the customer in case of technology failure or complex questions.	When you do not want to ask a question to the robot or when the robot is not working, there need to be people around that can still help you. (Zoë, 45 years)	Hilton et al. (2013); Koller and Königsecker (2012)
Relative price: The price a customer has to pay to use the automated interface compared to the human interface.	If I get a discount with one [interface], I will choose that one. (Henry, 72 years)	Andreassen et al. (2018)
Choice between tech and touch: The possibility to choose between a human and automated service interface.	I would leave the choice to the customer: do you want to interact with a person or tablet in a restaurant? (Alice, 57 years)	Cserdi and Kenesei (2021); Hilton et al. (2013)
STATIC: COUNTRY CHARACTERISTICS		

Market context: Countries can be classified into one of three broad categories: developed economies, economies in transition and developing economies (World Economic Situation and Prospects, 2020).	/	Chiu and Hofer (2015)
Culture: Countries can be categorized based on various cultural dimensions such as power distance, individualism, masculinity, uncertainty avoidance, long term orientation, and indulgence (Hofstede, 2011).	/	Blut et al. (2016); McCartney and McCartney (2020); Trappey et al. (2016)
Technology infusion: The degree to which technology is applied and embedded in a particular country.	[When seeing the robot] This is like in Japan. (Sophie, 36 years)	Fuentes-Moraleda et al. (2020)
STATIC: SERVICE CHARACTERISTICS		
Hedonic versus utilitarian: Hedonic services focus on enjoyment, arousal, escapism, freedom, and sensation. Utilitarian services focus on task completion, efficiency, rationality, usefulness, and functionality (Hellén and Sääksjärvi, 2011).	In this context [wine specialty store], I believe automation fits better than in a visit to a restaurant. In a restaurant I have a higher need for human interaction than in this store. (Liliana, 25 years)	Xiao and Kumar (2021)
High-equity versus low-equity: Low-equity services are service settings where little value is added by brand name associations and are characterized by a focus on efficiency and delivering the expected service quality. High-equity services are service settings where high value is added by brand name associations and an emphasis is put on exclusivity, uniqueness, and social empathy (Netemeyer et al., 2004; Xiao and Kumar, 2021).	In such a small restaurant this [automation] is strange, because it is all about Italian hospitality. However, in a large restaurant chain or where everything should go fast, it is possible. (Hanne, 31)	Xiao and Kumar (2021); Xu et al. (2020)
High-risk versus low-risk: Risk is defined as the perceived uncertainty and negative consequences of buying a product or receiving a service (Swaminathan, 2003).	In the sporting goods store I work they give running advice and it is—from a medical perspective—important to have the right running shoes to prevent injuries. These are important things. And this could be done with a computer, but there are so many exceptions.… So personal interaction is required. This is similar to a visit to the doctor. I do not want to interact with a robot either in that case. For these things I believe it is important that there are humans involved. (Marie, 23)	Akdim et al. (2021); Amelia et al. (2021); Simon and Usunier (2007); Wirtz et al. (2018)
Transactional versus relational: Transactional services focus on a transactional relationship with customers, while relational services focus on building long-term relationships with customers (Huang and Rust, 2021).	If you go to a small bank - with only a few employees - this [registration via a tablet] is not necessary, because they know you when you enter. But in a large bank, it is indeed useful that you register and that it [the tablet] says that you have to go to desk 3 for instance. (Caroline, 36 years)	Akdim et al. (2021)
DYNAMIC: CUSTOMER CHARACTERISTICS		

Technology readiness: An individual's tendency to accept/use new technologies to realize private and/or work-related goals (Parasuraman and Colby, 2015).	I saw at Starbucks something mentioned about an app. […] I find these things interesting and therefore wanted to try this app. (Alexander, 32 years)	Lin and Chang (2011); Lin and Hsieh (2006; 2012)
Technology anxiety: An individual's apprehension, or even fear, when faced with the possibility of using technology (Blut et al., 2016).	I personally find it [automation] a bit frightening. (Louisa, 67 years)	Amelia et al. (2021); Blut et al. (2016)
Self-efficacy: An individual's confidence in his/her ability to perform a specific task using the technology (Blut et al., 2016).	For people who are computer-minded, okay, they might be able to work with it [a tablet for ordering a meal]. (Daniel, 64)	Blut et al. (2016); Xiao and Kumar (2021)
Need for interaction: An individual's desire to retain personal contacts with human employees during a service encounter (Blut et al., 2016).	I prefer humans for all interactions. To have a little chat. (John, 74 years)	Amelia et al. (2021); Belanche et al. (2021); Blut et al. (2016)
Customer innovativeness: An individual's tendency to search, evaluate and try novel products, services, and innovations (Adapa et al., 2020).	I would like to try it [self-scanning in the supermarket]. Just to see how it works. (Louise, 67 years)	Jeon et al. (2020); Kim et al. (2021a)
Previous experience with (a specific) technology: An individual's previous experience with technology in general or with a specific automated service interface (Blut et al., 2016).	I would like that even better [ordering via a tablet instead of a waiter in a bar] because it is comparable to the kiosk at McDonald's and I always use that kiosk. (Marie, 23 years)	Amelia et al. (2021); Blut et al. (2016); Hilton et al. (2013)
Age	However, as an elderly person, I'm not in favor of working with a tablet. […] It does not apply for older people. They are going to have difficulties with it [a tablet], so they will usually need the regular menu. (Daniel, 64)	Fernandes and Pedroso (2017); McCartney and McCartney (2020); Xiao and Kumar (2021)
Gender	/	McCartney and McCartney (2020); Xiao and Kumar (2021)
Education/Occupation	I work in the IT sector and I see the importance of automation. (Max, 26 years)	Ivanov and Webster (2021); Xue et al. (2007)
DYNAMIC: SITUATIONAL CHARACTERISTICS		
Relative waiting time: The time a customer has to wait in line to use the automated interface compared to the human interface.	So if I notice that the waiting time is twenty minutes there [for the human cash register] and here [with the SR] it is only five minutes, I will choose the robot. (Steven, 36)	Demoulin and Djelassi (2016); Wang et al. (2012)
Consumption goal: Customers can be task-focused and view shopping as a task they want to complete as efficiently as possible. Or they can be experiential-focused and view shopping as an enjoyable experience in which they seek arousal (Büttner et al., 2013).	I was specifically looking for a white singlet and I searched for all white singlets in the store. […]. That [a robot or tablet to help search items in the store] would be very useful. Especially because it had to go quick. […] But this is a different kind of shopping. At that point I did not have time and I needed something. Sometimes I go shopping as a leisure activity […] (Astrid, 23)	Koller and Königsecker (2012); Liu et al. (2020); Rosenbaum and Wong (2015)

Product/service knowledge: The customer's subjective knowledge about the product or service category (Flynn and Goldsmith, 1999).	Most of the time I know what I need [in a DIY store] and I'm already convinced about what I want and then they do not need to show me something else. (Thomas, 54)	Reinders et al. (2015)
Time pressure: The customer's perception of lacking time in a particular situation (Collier et al., 2015).	If you have to go for a quick lunch, you can choose the automated [restaurant]. (Elle, 23)	Demoulin and Djelassi (2016); Gelbrich and Sattler (2014)
Crowding: The customer's feeling that occurs when an environment is considered to be dysfunctionally dense (Gelbrich and Sattler, 2014).	/	Gelbrich and Sattler (2014); Hou et al. (2021); Vakulenko et al. (2019)
Customer state: The customer's situational emotional characteristics such as mood, feelings of joy, attentional fatigue, or stress at the moment (De Keyser et al., 2020).	Sometimes when you have a bad day […], it is nicer to have a human [instead of a technology] in front of you to talk to. (Louisa, 67)	
Presence of others: The fact that other people are present when using the technology.	It's a different feeling, saying it out loud or typing it. Nobody sees what you are typing. (Marissa, 35 years)	Blut et al. (2016); Collier et al. (2015); Fan et al. (2016)

Note. Complete reference list available upon request from the authors.

Table III. Contingency model of service tasks and contexts

Service context	**Utilitarian**				**Hedonic**		
	Low-risk		**High-risk**		**Low-equity**	**Mid-equity**	**High-equity**
	Transactional	**Relational**	**Transactional**	**Relational**			
	e.g. supermarket; DIY store	e.g. local bakery; local butcher store	e.g. hospital; furniture store	e.g. general practitioner; physiotherapist	e.g. fast-food restaurant; limited-service hotel; swimming pool	e.g. mid-range hotel; mid-range restaurant; public wellness	e.g. luxury hotel; gastronomic restaurant; private wellness
Automation of service task	Full automation (with human assistance)	Automation of functional tasks	Automation of functional tasks	No automation	Full automation (with human assistance)	Automation of functional and information provisions tasks in case of tech-ready target segments. No automation for other segments.	No automation
Key customer needs	Need for speed	Need for interaction	Need for advice Need for interaction	Need for advice Need for interaction	Need for speed	Need for interaction	Need to be served Need for advice Need for interaction
Proposition	1	2	3	4	5	7	6

Appendix 1. Diary study

Questions diary study

- When did the service experience take place?
- Where did the service experience take place?
- Why did you visit this organization?
- Which service(s) did you use or which product(s) did you purchase?
- Describe chronologically your service visit from entering the building to leaving the building.
- What did you think of the activities you had to perform?
- What did you think of each of the interactions with employees/technology?
- Did you perform any activity and/or have contact with employees/technology before vising the organization (e.g. search for information, make a reservation)?

Examples of service categories

- Bank
- Clothing: clothing store, shoe store …
- Furniture store
- Care: hairdresser, beautician
- Entertainment: concert, cinema, amusement park…
- Food and drinks: restaurant, café, bar…
- Hotel
- Consultancy: technical, organizational, legal or financial advice
- Healthcare service: doctor, physiotherapist…
- Supermarkets, department stores, night shops ...

Follow-up questions

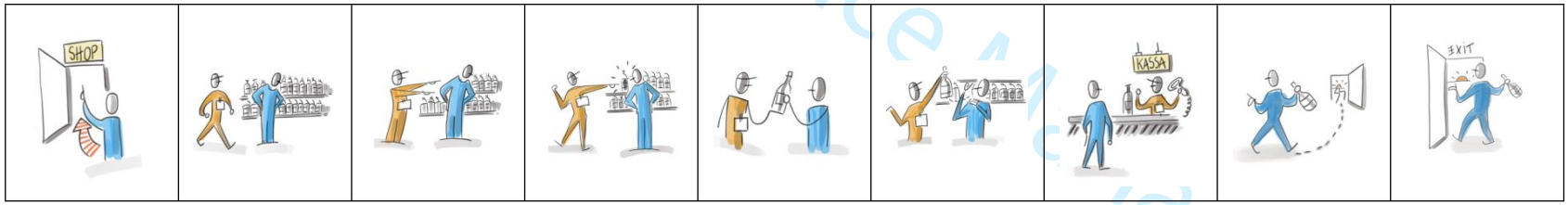
- How do you define automation?
- What comes to mind when you hear the word 'automation'?
- What is your opinion about automation?
- Do you have experience with automated service interactions? If yes, can you describe them?
- What is your opinion about automating one of the following behaviors or tasks: taking an order, welcoming,…?
- Which behaviors/activities can or cannot be automated in this setting or situation?
- Does your opinion differ depending on the setting or situation?
- Does the type of technology matter?
- Which technology (e.g. tablet, self-scanning, robot,…) do you prefer for each of the behaviors/activities?
- Which behaviors/activities do you definitely want to be performed by a human employee?
- Would it matter if everything is replaced by technology or just certain behaviors/activities?
- Would it make any difference whether there are still employees around (e.g. to intervene when something goes wrong or to answer questions) if everything is replaced by technology?

Appendix 2. Storyboard study

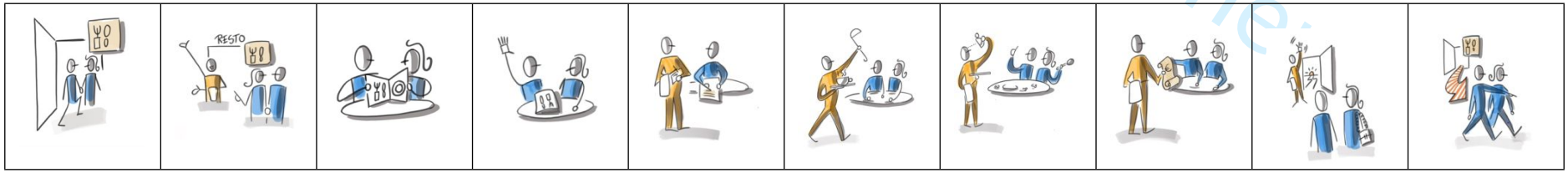
Step 1. Map current situation

Each respondent received cartoon-like cards related to a storyboard in combination with a narrative. The storyboards described either service delivery in a store, restaurant, or bank. The narrative described the different steps of the service experience and specified the specific service context. Specifically, the narrative related to the store described buying wine in a supermarket or a specialty store; the narrative related to the restaurant described going to a bistro or a gastronomic restaurant; and the narrative related to the bank described going to the bank for opening a checking account or discussing a loan. Subsequently, the respondent was asked to put the cards in the correct order to build the story.

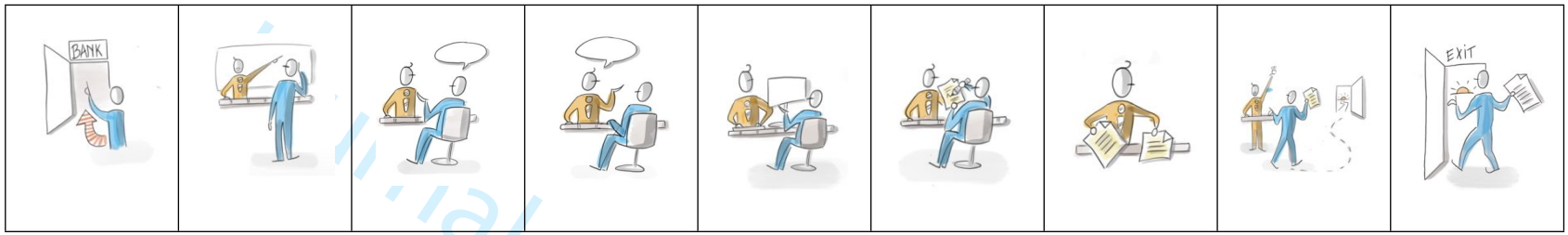
Cards about the store:



Cards about the restaurant:



Cards about the bank:

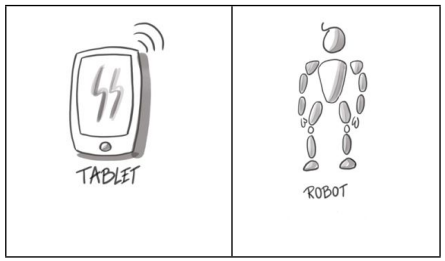


Step 2: Immersion

The concept 'service automation' was introduced and the respondent was asked to recall prior experiences with automated service interactions.

Step 3: Introduce disruption

Two technology cards were introduced (see below): one with an SR and one with an SST (i.e. tablet). The respondent was asked to give his/her opinion about each technology and to describe its features, potential use in service interactions, and value co-creation/co-destruction possibilities.



Step 4: Map future situation

The respondent was asked to indicate where the SR and the SST card could fit in the storyboard and why. Finally, in accordance with the initial version of the FASI, additional questions regarding customer and situational characteristics were asked.

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Web Appendix. Systematic literature review

Article	Nature of main study	Service context	Service task	Interface		Comparison with human interface	Value co-creation			Value co-destruction		Key outcomes	Design and contingency factors
				SST	SR		Functional	Hedonic	Social-relational	Functional	Social-relational		
Bitner et al. (2002)	Overview	Various settings	Various tasks	x			x	x		x	x	Satisfaction, trial	SST adoption depends on consumer readiness (ability, role clarity, motivation).
Lin and Hsieh (2006)	Cross-sectional survey	Various settings	Various tasks	x			x					Quality, satisfaction, Usage intention	The perceived quality of the SST and behavioral intentions related to the SST depend on technology readiness.
Oyedele and Simpson (2007)	Scenario-based survey	Shopping, library, hotel	SST-checkout	x								Usage intention	The impact of consumer characteristics (i.e., locus of control, autonomy, technology anxiety, self-efficacy) on SST usage intention depends on the service context (i.e., shopping, library, hotel).
Simon and Usunier (2007)	Cross-sectional survey	Post office, financial services, railway services, gas station	Send mail/parcel; refuel car; withdraw cash; buy rail ticket; financial transactions	x		x						Preference for SST over human employee	Persons with a rational thinking style have a higher preference for SST, while persons with an experiential thinking style prefer human employees. These relationships depend on the type of service (high versus low complexity). Customer age also influences SST preferences, as well as the differential waiting time between the SST and human employee option.
Weijters et al. (2007)	Longitudinal survey	Supermarket	Self-scanning	x			x	x				Attitude, usage, satisfaction	Customers' gender and education influence the relative impact of perceived SST benefits on SST usage. Furthermore, the number of items purchased (indirectly) influences SST satisfaction.

Xue et al. (2007)	Secondary data	Bank	ATM, voice response unit, automatic clearance house, internet banking	x		x	x				Usage	Factors associated with customer efficiency (age, tenure, education, skill) are positively correlated with SST usage and negatively correlated with employee-service channel usage. Customers use SSTs more often than employee-service channels to meet routine and standard service needs.
Zhao et al. (2008)	Experiment	Library	Self-checkout	x			x				Satisfaction, usage intention	Customers' self-efficacy positively influences customer satisfaction.
Lin and Chang (2011)	Cross-sectional survey	Various settings	Various tasks	x			x				Attitude, usage intention	Technology readiness enhances customers' perceived benefits of SSTs, attitude, and behavioral intentions.
Proença and Rodrigues (2011)	Cross-sectional survey	Bank	ATM, telephone, internet	x							Usage	Demographic variables (age, level of education, occupation, region of residence) influence SST usage.
Jia et al. (2012)	Scenario-based survey	Supermarket	Self-scanning check-out	x			x	x	x	x	Value dimensions, trial intention	Customers' regulatory focus (promotion/prevention focus) impacts technology anxiety as well as value perceptions which influence SST trial intention.
Koller and Königsecker (2012)	Focus groups	Fashion retail	In-store information kiosk	x			x			x	Customer evaluations	The use of the in-store kiosk depends on human assistance. This is especially critical for elderly shoppers. Customer evaluations of SSTs depend on the situation (i.e., waiting time) and the customer goal (i.e., searching a specific item versus just browsing).
Lin and Hsieh (2012)	Cross-sectional survey	Transportation; financial	integrated SSTs	x							Satisfaction, usage intention	Technology readiness is positively related to satisfaction and behavioral intentions.
Wang (2012)	Cross-sectional survey	Convenience stores	Multimedia kiosk	x			x	x			Satisfaction, usage intention	/

Wang et al. (2012)	Observations and interviews	Supermarket	Self-checkout	x	x	x	x	x	Attitude, usage	Situational factors (perceived waiting time, perceived task complexity, companion influence) influence the relationship between attitude and behavior. Past experiences with SST influence attitude and behavior. Individual differences (technology anxiety, technology readiness, behavioral inertia and need for interaction) influence SST attitude.
Hilton et al. (2013)	Interviews	Various settings	Various tasks	x		x		x	Value of SST	Customers want to have a choice between SST and human service as well as human assistance in case of questions or SST failure. Prior experience with technology and self-efficacy also play a role in using an SST.
Lee et al. (2013)	Cross-sectional survey	Retail store	Self-check-out	x		x	x		Service quality of the SST	The study revealed gender differences. Ease of use has a larger impact on service quality for females than for males, while need for interaction significantly influenced service quality for females but not for males.
Oh et al. (2013)	Scenario-based experiment	Resort hotels	Self-check-in	x		x			Usage intention	Customers' desires (desire for privacy, effectiveness, autonomy, and interaction) directly or indirectly influence their intention to use SSTs.
Wang et al. (2013)	Longitudinal survey	Supermarket	Self-check-out	x		x	x	x	Satisfaction, usage intention, continued use	Self-efficacy directly influences intention to use SSTs and indirectly influences continued use of SSTs.
Åkesson et al. (2014)	Interviews	Ikea	Website, kiosk, self-checkout, app	x		x		x	Customer experience	Besides SST value perceptions (e.g., convenience, ease of use, reliability, control), the perceived waiting time regarding the human employee and customers' relationship with the organization (i.e., trust) influence the SST experience.
Collier et al. (2014)	Cross-sectional survey	Private (movies, sports, music at home) versus public (theater)	SST offering movies, sports and music at home; Ticketing kiosk movie theater	x		x	x		Attitude, usage intention	There are differences between public and private SSTs with regard to the impact of value perceptions (i.e., hedonic and utilitarian value) on attitude and intention as well as the impact of technological anxiety on value perceptions.

Gelbrich and Sattler (2014)	Cross-sectional survey	Supermarket	Self-check-out	x		x		Usage intention	Self-efficacy influences value perceptions (i.e., perceived ease of use) and technology anxiety. Technology anxiety influences value perceptions and intention to use. Perceived crowding and time pressure impact the relationships between technology anxiety and intention to use as well as between perceived ease of use and intention to use.
Chiu and Hofer (2015)	Cross-sectional survey	Convenience stores; supermarkets	Multimedia kiosks in Taiwanese convenience stores; self-checkouts in Austrian supermarkets	x		x		Usage intention	Differences arise across market contexts that shape usage intentions. In a collectivistic, emerging market context (Taiwan), performance expectancy, effort expectancy, social influence, facilitating conditions, and personal innovativeness significantly influence usage intention. In an individualistic, advanced market context (Austria), only performance expectancy and social influence have significant impacts on usage intention. Personal innovativeness moderates the relationship between performance expectancy and usage intention.
Collier et al. (2015)	Cross-sectional survey	Grocery store	Self-check-out	x		x		x	Attitude	Location convenience, employee presence, tolerance to wait, and order size indirectly impact attitude toward the SST via perceived time pressure and shopping effectiveness.
Evanschitzky et al. (2015)	Cross-sectional survey	Supermarket	Personal shopping assistant	x		x			Initial trial; Continued use	Technological anxiety, novelty seeking, market-maven and trust impact initial trial, while need for interaction and ease of use influence continued use. Perceived waiting time and trust had no impact on continued use.
Kaushik and Rahman (2015a)	Cross-sectional survey	Retail stores	POS systems, self-scanning and self-checkout	x		x	x		Attitude, Usage intention	/
Kaushik and Rahman (2015b)	Cross-sectional survey	Bank	ATM; self-service kiosk; phone banking	x		x		x	Attitude, Usage intention	The impact of perceived usefulness, ease of use and perceived risk on attitude depends on the type of SST. Need for interaction has no significant effect on attitude toward the SST.

Kaushik et al. (2015)	Cross-sectional survey	Hotels	SSTs in hotels (in general)	x		x		x	x	Attitude; Usage intention	Attitude is influenced by perceived usefulness, perceived ease of use, perceived performance risk and trust; but need for interaction had no significant impact on attitude. Intention is influenced by attitude, perceived usefulness, trust and subjective norm.
Kokkinou and Cranage (2015)	Scenario-based survey	Hotel	Self-check-in	x	x	x	x		x	Usage intention	Customers are increasingly motivated to use SST as the waiting line for the service employee grows longer. SST usage intention is influenced by perceived usefulness, anticipated quality of the self-service technology, need for interaction and technology anxiety. Fun, risk, control and effort had no significant effect on usage intention.
Lin et al. (2015)	Cross-sectional survey	Fashion retail	Display	x		x				Satisfaction SST; loyalty retailer	/
Reinders et al. (2015)	Cross-sectional survey	Public transport	Payment chip card	x						Attitude; Word-of-mouth intention	Customer expertise affects individuals' assessments of an SST. Technology experts reported less positive evaluations of the SST than technology novices, and showed lower intentions to engage in positive word-of-mouth. The evaluation of the SST by technology novices is more positive for those that are service experts as compared to service novices, while the evaluation by technology experts is more negative for those that are service experts as compared to service novices.
Rosenbaum and Wong (2015)	Cross-sectional survey; interviews	Luxury hotel/casino	SST kiosk	x		x	x		x	x	Perceived importance of the SST	Customers avoid using SST while on vacation to engage in a so-called 'technological pause'. The importance of the SST depends on the SST options (e.g., wireless internet action, online reservation, obtain discounts, check-in, check-out, ...).
Blut et al. (2016)	Meta-analysis	/	/	x		x	x		x		Attitude, intention, usage	Prior experience, need for interaction, self-efficacy, technology anxiety, and computer playfulness play a role in determining customers' value perceptions, attitudes, intention, and behavior. Cultural aspects as well as the type of SST (i.e., hedonic versus utilitarian SST; transaction versus self-help; public versus private) play a moderating role in these relationships.

Demoulin and Djelassi (2016)	Cross-sectional survey	Grocery store	Self-check-out	x		x	x			Usage	In addition to previous experience with the SST, situational factors (time pressure, basket size, coupons and queue length at the SSTs and staffed check-outs) influence customers' decisions to use SSTs.
Fan et al. (2016)	Scenario-based experiment	Airport	Self-check-in	x	x					Switching intention (from SST to human)	This study demonstrates the joint impact of SST machine voice type, customers' sense of power and the presence of other customers on customers' switching intentions from SSTs to the human service mode.
Kaushik and Rahman (2016)	Cross-sectional survey	Banking; Supermarket; Hotels	Various SSTs	x						Usage	Consumer innovativeness correlates with SST usage.
Nijssen et al. (2016)	Cross-sectional survey	Supermarket	Self-scanning	x		x	x	x	x	Relational value	Attributions mediate the impact of SST performance on relational value. This value is highest for customers with high-benefit and low-cost attributions; customers with low-benefit and low-cost attributions exhibit detrimental effects on the exchange relationship with the firm. Characterized by low self-efficacy, low education, and low spending, these latter customers appear ambivalent and possibly confused about the provider's motives for introducing SST. Furthermore, level of SST adoption impacts cost and benefit attributions.
Susskind and Curry (2016)	Cross-sectional survey	Full-service restaurant	Table-top SST including multiple options	x		x	x		x	x	Likeability (open question); Return intentions	/
Trappey et al. (2016)	Cross-sectional survey	Retail	Personal shopping	x						SST acceptance	Cultural dimensions such as collectivistic/individualist and high/low uncertainty avoidance influence SST acceptance through

			assistant; self-check-out							moderating factors such as social pressure, self-efficacy and technology anxiety.
Fernandes and Pedroso (2017)	Cross-sectional survey	Supermarket	Self-check-out	x		x	x		Perceived quality of SST; Satisfaction with store; repatronage intention	The importance given to some attributes was different according to the customer's age and frequency of use. Younger customers perceive a higher sense of control over the technology, while more regular users find it more fun and easier to use.
Kaushik and Rahman (2017)	Scenario-based survey	Hotels	SSTs in hotels (in general)	x		x		x	Usage intention	Need for interaction plays a significant role when customers choose to use an SST. Waiting line has an impact on SST usage intention. The type of accommodation (resort versus hotel) and the star category (three, four or five stars) have no impact on SST usage intention.
Lee (2017)	Cross-sectional survey	Grocery store	Self-check-out	x		x			SST adoption	Customer personality traits (locus of control, sociability, thinking style, and interpersonal-hedonic values) influence need for interaction which ultimately influences SST adoption. Furthermore, time convenience moderates these relationships.
Wang (2017)	Cross-sectional survey	Supermarket	Self-check-out	x		x	x		Usage intention	The customer's ability to use the SST influences SST usage intention. Ability is negatively impacted by technology anxiety and need for interaction.
Wang et al. (2017)	Longitudinal survey	Supermarket	Self-check-out	x					Satisfaction, habit	Prior habit, satisfaction, self-efficacy, and past behavior (both recency and frequency) have significant positive effects on habit. The strength of these effects depends on gender. For men personal dispositions play a role: general technology experience enhances habit, whereas need for human interaction negatively affects habit.
Wei et al. (2017)	Cross-sectional survey	Hotels; restaurants	Various tasks	x		x	x		Satisfaction	Extrinsic and intrinsic attributes determine SST satisfaction in the restaurant setting. In the hotel setting, only extrinsic attributes had a significant impact on satisfaction.

Andreassen et al. (2018)	Conceptual	/	/	x	x		x			x		Demand	A lower selling price can be used to compensate for automation-induced inconvenience.
Barua et al. (2018)	Cross-sectional survey	Banking	ATM; kiosks; mobile banking; e-banking	x			x			x		Satisfaction	/
Kaushik and Kumar (2018)	Cross-sectional survey	Hotel; Resort	Self-check-in	x		x	x		x	x		Behavioral intentions	Need for interaction performs a vital role in choosing SSTs over employees in trial and adoption stages. Type of accommodation (hotel vs. resort) did not significantly affect the variables considered. Perceived performance risk depends on the star category: it was higher for three-star accommodation as compared to five-star accommodation. Waiting line length at the employee service desk is positively related to SST adoption.
Tung and Au (2018)	Online reviews (Tripadvisor)	Hotel	Various tasks		x		x	x	x	x	x	Experience	The findings highlight the influence of robotic embodiment and human-oriented perceptions on consumer experiences. The findings also suggest that users and robots can co-create novel experiences, with some customers even proactively seeking opportunities to interact and communicate with robots to develop a certain level of "relationship" with them. Other customers refer to fear and insecurity when being in the same environment with a robot. Hence, customer characteristics play a role.
Wirtz et al. (2018)	Conceptual	/	/		x	x	x		x			Customer acceptance of SRs	From a customer perspective, SRs are useful for simple cognitive-analytical and simple emotional/social tasks. Furthermore, the study refers to design characteristics such as humanness and social interactivity.
Čaić et al. (2019)	Conceptual	Elderly care	/		x		x		x	x	x	value co-creation/destruction potential of SRs	/
Mende et al. (2019)	Scenario-based experiments	Routine medical service; Lab service;	Information provision; Food preparation;		x	x						Compensatory consumption behavior/intention	Consumers display compensatory responses when they interact with an SR rather than a human employee. SRs elicit greater discomfort (i.e., eeriness and a threat to human identity), which

		Kitchen; Restaurant;	Food delivery; Greeting									results in tan increase of compensatory consumption. The compensatory responses that SRs elicit 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 machinized (rather than anthropomorphized).
Morosan and DeFranco (2019)	Cross-sectional survey	Hotel	Various hotel interactive technologies	x			x	x				Behavioral intention	Customers' information system habit and hedonic motivations influenced their participation in customer–firm interactions when using hotel interactive technologies. In turn, participation and innovativeness influenced conversion behavior, while innovativeness and perceived benefit of using interactive technologies influenced intentions to use such technologies.
Vakulenko et al. (2019)	Systematic literature review	/	/	x			x	x	x	x	x	Customer value	In this systematic literature review, the authors include various customer (technology anxiety; technology readiness; demographics; innovativeness; need for interaction; novelty seeking; waiting tolerance; familiarity); situational (crowdedness; time pressure); and design (employee presence) characteristics to investigate the value of SSTs.
Van Pinxteren et al. (2019)	Field experiment	Business campus	Greeting; offering directions at the reception		x			x	x			Usage intention	Interaction comfort moderates the effect of gaze cues on anthropomorphism: gaze cues increase anthropomorphism when comfort is low and decrease it when comfort is high. Anthropomorphism drives trust, intention to use and enjoyment.
Adapa et al. (2020)	Cross-sectional survey	Retail stores	Various tasks	x			x			x		Usage intention	Perceived shopping value is determined by perceived complexity, advantages, novelty, and risk. The former two relationships are moderated by consumer innovativeness. Shopping value increases usage intention.

Belanche et al. (2020a)	Scenario-based experiment	Hotel; Restaurant	Check-in hotel; Taking and delivering orders restaurant	x	x	x					Responsibility and stability	Respondents make stronger attributions of responsibility for the service performance toward humans than toward robots, especially when a service failure occurs. Mechanical robots, but not analytical robots, increase customer's perceptions of firm responsibility compared to human agents.
Belanche et al. (2020b)	Scenario-based survey	Restaurant	Greeting; taking orders; delivering orders to the table	x		x	x	x			Usage intention; Recommendation intention	Human-likeness has a positive influence on affinity toward the SR. Affinity positively affects service improvement attribution, which in turn has a positive influence on customer behavioral intentions. In contrast, affinity negatively affects cost reduction attribution, which in turn has a negative effect on behavioral intentions.
Belanche et al. (2020c)	Conceptual	/	/	x							Acceptance, satisfaction, loyalty	SR acceptance, satisfaction, and loyalty depend on three factors (1) robot design: aesthetics, robot notification, manipulability, proactivity, affect, formality; (2) customer features: technology readiness, age, gender, culture, personality traits, customer tier; (3) service encounter characteristics: information provision, involvement level, failure and complain, product or service, transactional or relational, employee replacement or collaboration.
Cha (2020)	Scenario-based survey	Restaurant	Taking and delivering orders	x		x	x	x	x		Attitude, Usage intention	Hedonically motivated consumer innovativeness and socially motivated consumer innovativeness have positive effects on attitude and are enhanced by attractiveness, utility, subcultural appeal and originality. However, the relationship between consumer innovativeness and attitude depends on age.
Fuentes-Moraleda et al. (2020)	Online reviews	Hotels	Various tasks	x		x		x	x	x	Acceptance of SRs in hotels	Customers from countries where robots are often used (e.g., Japan or Singapore) require the SRs to be more flawless in its functions and are less surprised. Furthermore, the dimensions of the sRAM depend on traveler type.
Henkel et al. (2020)	Conceptual	/	/	x		x	x	x			Well-being	The typology of robotic transformative service (i.e., entertainer, social enabler, mentor, and friend) includes robot design aspects such as the type of task, intelligence level, embodiment, object manipulation, and navigation.

Jeon et al. (2020)	Cross-sectional survey	Fast-food restaurant	Food ordering kiosk	x		x			x		Usage intention	Customer innovativeness moderates the impact of social influence and perceived risk on usage intention.
Lin et al. (2020)	Scenario-based survey	Full-service hotel; limited-service hotel	Various tasks		x	x	x	x	x	x	Usage intention; Objection to use	Full-service hotel customers are not likely to fully embrace the use of SRs in service delivery and value social interactions with hotel employees. Limited-service hotel customers are more likely to embrace the SR and are willing to sacrifice the low level of social interactions in order to receive more accurate and efficient service from SRs.
Liu et al. (2020)	Focus group discussions with practitioners	Hotels	Various types	x		x			x	x	Customer acceptance from hotel practitioners' perspective	According to practitioners, SST acceptance depends on SST design characteristics (type of SST, physical design), customer characteristics (i.e., age, gender, travel purpose, need for interaction, technology love), service characteristic (i.e., hotel grade).
Lu et al. (2020)	Systematic literature review	/	/		x	x		x	x	x	Acceptance and usage of SRs	This study points to the need for further research on robot design, service context, individual characteristics as determinants of robot adoption and long-term use.
McCartney and McCartney (2020)	Conceptual	/	/		x	x	x	x	x		Consumer acceptance and experiences	Consumer acceptance and experiences depend on age, gender, culture, robot design, robot interface, robot aesthetics, and service setting (full versus limited service).
Neuhofer et al. (2020)	Focus group discussions	Events	Various tasks	x	x	x			x	x	Value co-creation and co-destruction during event experiences	/
Odekerken-Schröder et al. (2020)	Netnographic analysis of online visual and textual descriptions	Companion robot at home	Various tasks		x	x	x	x			Loneliness	The findings reveal that users' posts about robots include various robot design aspects such as look, shape, cuteness, voice, human-likeness or animal-likeness. These aspects may or may not affect users' well-being.

Othman et al. (2020)	Cross-sectional survey	Banking	ATM	x			x			Satisfaction	Reliability, convenience, and functionality are critical factors that affect customer satisfaction in using ATMs. Technological optimism was found to weaken the relationship between reliability and customer satisfaction.
Wu et al. (2020)	Scenario-based experiment	Fast-food restaurant; Sit-down restaurant	Self-ordering kiosk; self-ordering touchpad on table	x		x	x			Visit likelihood	Older customers find SSTs equally convenient and comfortable as younger customers when self-ordering is the only option. The age effect emerges because age positively affects perceptions of human services: as age increases, customers perceive human services as more convenient and comfortable.
Xu et al. (2020)	Cross-sectional survey	Quick-service versus fine-dining restaurant	Order food	x			x	x		Usage intention	Customers' value perceptions toward SST use in restaurants influences SST usage intention via both hedonic and utilitarian expectations. The mediation effect of hedonic expectation between perceived value and usage intention was stronger in fine-dining than in quick-service restaurants.
Zhu and Chang (2020)	Scenario-based survey	Restaurant	Food preparation		x		x		x	Food quality prediction	Robotic chef anthropomorphism affects food quality prediction through the sequential mediators of warmth and competence.
Boudkouss and Djelassi (2021)	Interviews	Retail	Interactive kiosk; self-check-out	x			x	x	x	Benefits sought when using SST	Gratifications sought by customers differ between types of SSTs. Specifically, when using interactive kiosks, customers seek control, time-saving, information, hedonic and social interaction and when using a self-check-out, they seek control and time-saving.
Hou et al. (2021)	Scenario-based surveys; lab experiment	Hotel	Information provision		x					Usage intention	A destination which is more (vs. less) crowded motivates customers to opt for SRs instead of human employees, because more (vs. less) social crowding decreases customers' motivation to interact with others, which is explained by social withdrawal tendency.

Kim et al. (2021a)	Scenario-based survey	Restaurant	Food preparation: Taking orders and serving food		x					Usage intention, word-of-mouth intentions	Customer innovativeness enhances robotic restaurants' image which enhances behavioral intentions (i.e., usage and word-of-mouth).
Lee et al. (2021)	Cross-sectional survey	Hotel	Various tasks		x		x	x	x	Usage intention	Customers can be segmented based on functional aspects (i.e., facilitating conditions, performance expectancy, innovativeness) and emotional aspects (i.e., social presence, hedonic motivation, perceived importance). Age, gender, and education play a role in profiling the segments.
Lien et al. (2021)	Cross-sectional survey	Airport	Various tasks	x			x			Attitude; Usage intentions	/
Sharma et al. (2021)	Field study and cross-sectional survey	Supermarket	Self-check-out	x		x	x			Store satisfaction; store loyalty	/
Wu et al. (2021)	Online reviews	Restaurant	Various tasks		x		x	x	x	Overall evaluation of service provider	The robot's visibility, competence, performance, co-creativity and prominence influence customers' value perceptions.
Park et al. (2021)	Cross-sectional survey	Fashion retail	Various types	x			x	x		Attitude; Usage intention	Innovativeness and optimism - inherent in technology readiness - enhance customer perceptions of SST, while discomfort and insecurity did not.
Romero and Lado (2021)	Scenario-based experiment	Hotel	Checking in; Serving a drink		x		x			Attitude, Booking intentions	Customers' perceived susceptibility to COVID-19 and robot anthropomorphism is positively associated with the robot's prevention efficacy. Robot anthropomorphism and the context's social presence are also positively associated with attitudes toward being attended by a robot.
AlKheder (2021)	Case study including cross-sectional survey	Airport	Check-in and check-out	x			x			Acceptance, satisfaction	Long waiting times are believed to be the main reason behind customer's dissatisfaction with traditional services.

Cao et al. (2021)	Scenario-based experiments	Subway station; Bank; Cinema	Ticket purchase at a subway station or cinema; Banking services	x		x			x	Attitude toward SST providers	The impact of SST-only mode (versus full-service mode; both personal service booths and self-service kiosks) on powerlessness is weaker when the levels of SST familiarity and SST anthropomorphism are high.
Srivastava et al. (2021)	Literature review and cross-sectional survey	Hotel or leisure spot	Room service; Cleaning; Self-checking; Hosting	x	x		x			Intention to book a room	/
Ivanov and Webster (2021)	Cross-sectional survey	Tourism and hospitality	Various tasks		x					Willingness to pay	Based on customers' willingness-to-pay two clusters were identified which differed in terms of age, household size, perceived economic wellbeing, and travel frequency. Moreover, customers' willingness-to-pay was positively associated with attitudes towards robots, customers' robotic service experience expectations, preferences to be served by more robots than humans (partially supported), customers' jobs and vested interests in the use of robots in tourism and hospitality, male gender (partially supported), economic wellbeing (weakly supported), and household size, whereas it was negatively associated with travel frequency, age and education (partially supported).
Belanche et al. (2021)	Vignette experimental study	Restaurant	Waiter tasks (e.g., taking orders, providing meal advice)		x		x	x	x	Value expectations	Customers' perceptions of robots' humanness (i.e., human-likeness, competence, and warmth) positively influence service value expectations (i.e., functional, social, monetary, and/or emotional service value). In addition, customers' need for social interaction strengthens the influence of robots' human-likeness on functional and emotional value, but weakens the influence of perceived warmth on social as well as emotional value.
Xiao and Kumar (2021)	Conceptual	/	/		x		x			x	Customer acceptance of robots depends on customer characteristics (customer readiness, demographics); robot characteristics (anthropomorphism, autonomy, relative advantage, compatibility, complexity, observability, trialability, risk); and customer-robot interaction characteristics (involvement, intensity, intrusion). The impact of automation on service quality is moderated by nature of the firm (BtoC versus

												BtoB); service characteristics (utilitarian versus hedonic) and brand equity (low equity versus high equity).
Chuah et al. (2021)	Cross-sectional survey	Restaurant	Various tasks		x		x	x	x		Attitude, Willingness to use; Willingness to pay	The need for physical distancing and mysophobia (i.e., irrational fear of contamination or germs) have a positive effect on the value of service robots in times of the COVID-19 pandemic.
Byrd et al. (2021)	Cross-sectional survey; Field observation study	Restaurant	Food delivery		x	x	x			x		Value perceptions	/
Mariani and Borghi (2021)	Online reviews (Trip-advisor)	Hotel	Various tasks		x							Online rating	/
Akdim et al. (2021)	Qualitative study; Experiments	Hotels; restaurants	Various tasks		x	x	x	x			x	Attitude	The use of robots is more suitable in transactional and low-price service settings, rather than relational and high-price services. Highly human-like robots (= robot design) evoke negative explicit and implicit attitudes.
Amelia et al. (2021)	Observations, focus groups and interviews	Retail banking	Greeting; Assisting whit everyday banking transactions		x		x	x			x	Acceptance	Individual and task characteristics have an impact on acceptance: prior experience with an SST; technology anxiety; need for interaction; task complexity (which involves the risk of the financial transaction).
Cserdi and Kenesei (2021)	Cross-sectional survey	Public transportation	Ticket vending machine	x		x	x					Acceptance, satisfaction	There are negative consequences of forcing consumers to use the SST. Need for interaction has a negative effect on acceptance of the SST.
Guan et al. (2021)	Cross-sectional survey	Restaurant	Various tasks		x		x	x				Usage intention	The servicescape of the robot restaurant and the service competence of robots significantly affect behavioral intentions of customers. Customers' openness to change negatively moderates the positive impact of servicescape on utilitarian value; additionally, individual negative attitudes toward robots negatively moderate the positive influence of robot competence on hedonic value.

Kim et al. (2021)	Cross-sectional survey	Coffee shop	Various tasks		x		x	x			Satisfaction; intention	/
Zhang et al. (2021)	Cross-sectional survey	Hotel	Check-in		x		x	x			Acceptance	The robot's humanlike appearance leads to higher performance expectancy, mascot-like appearance generates higher positive emotions and machine-like appearance results in higher effort expectancy. The effects of humanlike and mascot-like appearances on consumer acceptance are moderated by the sense of humor of service robots. However, the sense of humor effect is attenuated with a machine-like appearance owing to the lack of anthropomorphism.
Odekerken-Schroder et al. (2021)	Field study; Scenario-based experiment	Restaurant	Serving drinks/dishes; picking up empty glasses		x		x	x			Customer repatronage	In a fast casual dining restaurant, SRs with a high utilitarian value can make the interaction with employees redundant. When the SR's utilitarian value is low or moderate, the interaction with employees can augment this lower performance of SRs.
Lee and Yi (2021)	Scenario-based experiments	Store	Various tasks	x		x		x		x	Overall brand evaluation	/
Li and Wang (2021)	Cross-sectional survey	Various settings	Various tasks		x		x				Attitude, acceptance	Robot anthropomorphism, robot autonomy and customer ability are positively related to perceived usefulness, while robot autonomy, customer ability, and role clarity are positively related to perceived ease of use. Both perceived usefulness and perceived ease of use are significant antecedents of customer attitude. Customer attitude determines customer acceptance of service robots in service encounters.
Pitardi et al. (2021)	Qualitative study; Scenario-based experiments	Medical services	Gathering information; providing product		x	x			x		Customer embarrassment	Embarrassment was lower when respondents interacted with a robot versus a human employee. Furthermore, humanlike robots lead to more embarrassment than machine-like robots (i.e., physical appearance). Voice-based interactions are perceived as more embarrassing than text-based ones (i.e. mode of interaction).

Note. Complete reference list available upon request from the authors.