Designing Augmented Reality Services for Enhanced Customer Experiences in Retail

Vaidyanathan, Nageswaran; Henningsson, Stefan

Document Version
Accepted author manuscript

Published in:
Journal of Service Management

DOI:
10.1108/JOSM-01-2022-0004

Publication date:
2023

License
Unspecified

Citation for published version (APA):
Vaidyanathan, N., & Henningsson, S. (2023). Designing Augmented Reality Services for Enhanced Customer Experiences in Retail. *Journal of Service Management*, *34*(1), 78-99. https://doi.org/10.1108/JOSM-01-2022-0004

Pre-print version of Vaidyanathan, N., & Henningsson, S. (2023). Designing Augmented Reality Services for Enhanced Customer Experiences in Retail. *Journal of Service Management*, *34*(1), 78-99. https://doi.org/10.1108/JOSM-01-2022-0004

Designing Augmented Reality Services for Enhanced Customer Experiences in Retail

Nageswaran Vaidyanathan
Department of Digitalization, Copenhagen Business School,Copenhagen, Denmark and
Duck Creek Technologies, Boston, Massachusetts, USA

Stefan Henningsson
Department of Digitalization, Copenhagen Business School, Copenhagen, Denmark

Abstract

Purpose

To deliver superior customer experiences, retailers are increasingly turning to augmented reality (AR) technologies for new digital services that can enhance their customer interactions. The potential of AR has been validated in lab experiments, but when implemented in real-world contexts, its commercial impact has been limited. Therefore, this paper investigates how to design AR-based services (AR services) that enhance customer experiences in retail.

Design/methodology/approach

The paper uses a conceptual research approach to integrate research on AR in the context of retail, combining customer, retailer, and technical perspectives with the design thinking method to demonstrate how the challenge of AR service design can be addressed through design thinking.

Findings

The paper develops propositions that explain how a design thinking method is useful in the design of effective AR services. The paper also articulates principles for how to implement the design thinking method in the specific context of AR for enhanced customer experiences.

Practical implications

The study documents critical practices for retailers seeking to be competitive with superior customer experiences under the increasing digitalization of retailer-customer interactions.

Originality/value

The study contributes to the service design literature by answering the call to develop moderately abstracted explanations of how different digital technologies can be used to provision new services in different application domains, with the focus here being the design of AR services in the context of retail.

Pre-print version of Vaidyanathan, N., & Henningsson, S. (2023). Designing Augmented Reality Services for Enhanced Customer Experiences in Retail. *Journal of Service Management*, *34*(1), 78-99. https://doi.org/10.1108/JOSM-01-2022-0004

Designing Augmented Reality Services for Enhanced Customer Experiences in Retail

Nageswaran Vaidyanathan
Department of Digitalization, Copenhagen Business School,Copenhagen, Denmark and
Duck Creek Technologies, Boston, Massachusetts, USA

Stefan Henningsson
Department of Digitalization, Copenhagen Business School, Copenhagen, Denmark

1 Introduction

Rapid inventions in digital technologies are creating a growing number of possibilities for novel services that can enhance the interactions between service companies and their customers (Opazo-Basáez et al. 2022). The use of emerging digital technologies as the bases for novel services has become so prominent that the provision of new services today is "essentially all digital, driven or enabled by novel data and technological opportunities" (Kowalkowski et al. 2022, p. 60). For companies operating through a service-dominant logic (Vargo and Lusch 2004), this transition toward services enabled by digital technologies (henceforth *digital services*) presents not only business opportunities but also a range of challenges because the effective incorporation of digital possibilities requires fundamentally different ways of working (Huikkola et al. 2022; Opazo-Basáez et al. 2022).

The need for new ways of working is increasingly being recognized in the literature on service design (Patrício et al. 2019). Service design refers to the activity of planning and organizing people, infrastructure, communication, and material components of a service in order to improve its quality and the interaction between the service provider and customers (Sangiorgi and Prendiville 2017). Within this definition, *digital service design* refers to service design that harnesses enabling capacities in digital technologies as a basis for service design (Efendioglu and Woitsch 2017). Because of the increasing permeation of digital technology, the related literature on service innovation (see Barrett et al. 2015) and servitization (see Kowalkowski et al. 2022) has seen an increased focus on digital technologies as the bases for new services. In comparison, however, relatively little attention has been directed to *digital enablement* in service design. Additionally, the emergent literature on digital service design has highlighted that the impact of digital technologies on service design is not general but rather takes on different forms depending on the specific digital technology investigated and the specific context of the design activities. For example, the consequences for service design are different when comparing a setting with smart sensors and the Internet of Things in manufacturing

(Efendioglu and Woitsch 2017) against a setting with AI-enabled robot advisers in financial services (Lu et al. 2021). Therefore, both in research specifically on service design as well as in the broader service literature, calls have been made to investigate at a domain-specific level how *different digital technologies* can be used to provision new services in *different application domains* (Paschou et al. 2020, p. 278; Sangiorgi and Prendiville 2017; Teixeira et al. 2012).

One context where digital service design is becoming of particular relevance is the retail industry. Over the last decade, the retail industry has witnessed a dramatic shift in competition from a traditional focus on transactions to the creation of complete customer experiences (Jain et al. 2017). In 2010, only 36% of companies competed solely based on customer experience, whereas by 2018, this number had increased to 89% (Gartner 2018).[1] In their efforts to deliver superior customer experiences, retailers have increasingly turned to digital technologies. One of the key digital technologies that is expected to have far-reaching transformative impact on retail is augmented reality (AR; Christ-Brendemühl and Schaarschmidt 2022). In contrast to virtual reality (VR) and other forms of extended reality technologies that remain largely in laboratory use, AR stands to have an immediate transformative impact in retail.

Consequently, the last few years have seen the broad introduction of a range of AR-based services (henceforth *AR services*) in retail. A class of these new services has leveraged novel capacities in smartphones to support apps that allow prospective customers to visualize furniture, design items, apparel, and even makeup in their intended contexts of use (Sun et al. 2022). Others have drawn on special purpose devices, including smart glasses and interactive mirrors, to increase the level of "immersiveness" (Hofma et al. 2018) beyond what a smartphone can provide. Some services have been tailored to an online retail context, while others have been created to enhance in-store experiences (Christ-Brendemühl and Schaarschmidt 2022). Yet others are aimed at fostering hybrid experiences, specifically pushing an omnichannel commerce agenda (Bolton et al. 2018).

Research on AR in the specific context of retail have confirmed the customers' willingness to use AR and the potential of AR to increase sales in retail through lab experiments and surveys (Riar et al. 2021; Tan et al. 2022). However, while there is growing consensus about the *potential* of AR to enable new services in retail, reports suggest that most customers who are exposed to *real-world* AR services in retail are disappointed by the experience (Heller et al. 2021). Overall, while the potential of AR in retail is widely accepted, both practice and academia "struggle to articulate how [AR] delivers experiences that are valuable to customers" (Chylinski et al. 2020, p. 374).

[1] The survey included 97 respondents in Europe, the United States, Canada, and China.

In this paper, the challenge of harnessing the emerging possibilities in AR is regarded as a *service design* challenge. That is, the paper addresses the activities of planning and organizing that are needed to realize the potential of AR in new services that improve interactions between a service provider (retailer) and customers. The formal research question is *how to design AR services that enhance customer experiences in retail?*

To answer this question, a conceptual research approach is used to create a conceptual model (Gilson and Goldberg 2015). The development of the conceptual model is done in two steps. First, the output of AR-based service design is characterized as a specification that transcends and interconnects three basic design components: (a) AR's technological attributes, (b) a retailer's context-specific attributes, and (c) customer experience perceptions. Second, it is argued that this design challenge requires a design approach tailored to the discovery of use cases that match the rapidly evolving technological possibilities. To this end, the applicability of the design thinking method (Brown 2008; Leonard and Rayport 1997; Lockwood 2010) is explored to leverage the emergent possibilities of technologies with "empathy" toward consumers (see 'method theory' in Jaakkola 2020).

This work contributes to the literature on service design by addressing digital service design in the specific setting of AR services in retail. The conceptual model should be seen as a substantive theory—a moderately abstracted theory (Merton 1968) for a specific area of inquiry (Glaser and Strauss 1965)—that explains how to design *AR services* (a specific digital technology) in the context of *retail* (a specific application domain) and articulates principles that help practitioners do so.

The remainder of this paper is structured as follows. The next section explains the approach taken to develop the conceptual model. Then the literature review positions this work in relation to the service design literature and models the design challenge by reviewing previous research on AR in the retail context, including the link between AR and customer experiences. Subsequently, the design thinking method is introduced, and an explanation is provided to cover how it addresses some of the key issues in the design challenge for AR services in retail. Finally, the discussion section addresses the theoretical and practical implications of this work before a short conclusion is presented.

2 Conceptual research approach

The approach to building the conceptual model was informed by advice from the broader management literature (Gilson and Goldberg 2015; Hulland 2020; Jaakkola 2020) about designing conceptual research and is presented in Table 1.

Table 1. Methodological approach taken to construct the conceptual model

Aspect of study	**Methodological consideration**	**Approach taken**
Phenomenon of interest	Inductively identify different conceptualisations of the phenomenon, and figure out how the aspect of interest is best addressed in terms of broad concepts or theories (Jaakkola 2020).	Define customer experiences as the basis for competition in retail, and AR as a rapidly evolving digital technology that provides new possibilities for digital services that can enhance customer experiences.
Domain theory	Domain theory describes the key constructs, theories, and assumptions that characterise the focal area of study (MacInnis 2011).	Review literature on customer experiences and AR to establish the key constructs that needs to be integrated in AR service design.
Method theory	Method theory provides concepts to explain "substantive issue(s) of the domain theory at hand" (Lukka and Vinnari 2014, p. 1309).	Identify and justify design thinking as an approach to explain the qualities of a service design process that configures the attributes of AR to the end of enhanced customer experiences.
Model construction	Develop logical arguments for the association between constructs from the domain and method theories (Gilson and Goldberg 2015), and summarise arguments in the form of a figure (Jaakkola 2020).	Linking the qualities of design thinking to the problem domain of AR services and customer experiences in retail through propositions covering the logical arguments. Demonstrate connections between constructs using illustrative examples (Payne et al. 2017).

Within service research, conceptual articles are considered to provide valuable contributions when they build on extant research to devise conceptual models that further "scientific knowledge by explaining phenomena, and the existing and predicted conceptual relationships between phenomena" (Li et al. 2021, p. 645). The conceptual research approach aims to "identify novel connections between existing constructs" (Jaakkola 2020, p. 22) rather than to develop completely new constructs. This approach follows the example of previous conceptual papers in service research. For example, Edvardsson et al. (2018) develop the relationship between service innovation and context change, Akaka et al. (2015) integrate the two research streams of consumer culture theory and service-dominant logic, and Patrício et al. (2020) conceptually model how health-care challenges can be addressed by service design.

The conceptual model developed in this study belongs to the category of substantive theory (Glaser and Strauss 1965)—theory developed for a specific area of inquiry. As such, the model takes the general concept of design thinking as an approach to service design and specifies it in relation to the

context of AR services in retail. To this end the three propositions serve to capture the essence of this application. As a substantive theory, the conceptual model is a moderately abstracted theory, with a limited scope of application but high practical relevance (Merton 1968). Moderately abstracted theories (also known as midrange theories) are particularly relevant to research domains that remain close to practice, such as service research (Kowalkowski et al. 2022), because they can easily be used to inform practice.

The epistemological assumption framing the model development is derived from the interest in customer experience as the outcome of concern. Following scholars working in the area, customer experiences are recognized as fundamentally subjective (Akaka et al. 2015; Christ-Brendemühl and Schaarschmidt 2022), a view that aligns with an interpretative epistemology in this work. This furthermore resonates with approaching service design through a design thinking approach that centers on empathy and customer perception rather than technical measures of an AR service as the basis to judge the value of the service.

3 Literature review

This section reviews the literature of relevance to this paper in three steps. First, this work is positioned in the service design literature. Second, the customer experience concept is introduced and defined. While AR can be used as the basis for a range of different retail services (Christ-Brendemühl and Schaarschmidt 2022), in light of the retail industry's transition to competition based on superior experiences, the focus here is on the services that will be especially valuable in supporting such a transformation. Third, the section reviews research that has linked the customer, retailer, and technical perspectives of AR to the formation of experiences. Taken together, the three perspectives holistically frame the different parameters to consider in the design of AR services in retail.

3.1 Digital service design

The literature on service design builds on contributions from research in management, marketing, and operations information systems and interaction design (Gummerus et al. 2021). From an initial focus on interface design, the focus of service design in service research has since shifted to the service encounter (Bitner et al. 2008), where the customer interacts with the service provider (Sangiorgi and Prendiville 2017), and furthermore the holistic organization of service encounters (Patrício et al. 2011).

Commonly used definitions of service design refer to design as an activity as opposed to the meaning of design as the "blueprint" for or configuration of services (Gummerus et al. 2021). Specifically, service design refers to the activities of organizing people, infrastructure, communication, and

materials in order to improve service quality and thereby enhance the interactions between a service provider and customers (Sangiorgi and Prendiville 2017).

While there are many different approaches to service design, they rest on some common starting points. One of these is that they typically center around the customer as the focal point (Gummerus et al. 2021; Sangiorgi and Prendiville 2017). Another common starting point is the ambition to regard interactions between service providers and customers holistically (Lim et al. 2019; Prestes Joly et al. 2019). That is, service design is as much concerned with the orchestration of service encounters as the shaping of the individual encounters themselves.

These common starting points are then materialized in different forms as concrete approaches to service design. Some of these approaches are predominantly internally oriented, building on practices of process, operations management, and service blueprinting (Teixeira et al. 2012). Others are more closely oriented to the experiences of the service customers. Such approaches include customer experience modeling (Teixeira et al. 2012) as well as variants of participatory design (Meroni and Sangiorgi 2016).

Reflecting increasing permeation of digital technologies, a stream of service design research has started to investigate how design activities can be adapted to harness emerging possibilities in digital technologies. The key characteristics of digital technologies, that is, the fact that they are easily editable, reprogrammable, modular, and combinable, make new approaches to service design more suitable than some established practices (Barrett et al. 2015; Eaton et al. 2015). Consequently, there is recognition in the literature on service design that the infusion of digital technology in new services needs to be accounted for in the service design activities (Kunz and Walsh 2020; Teixeira et al. 2016). Here service design that specifically aims to leverage new possibilities in digital technology as the bases for new services is referred to as *digital service design*.

Reflecting the view that there is no single best approach to service design, research on digital service design has frequently addressed a unique setting that includes a specific category of technology and/or a specific context of use, such Industry 4.0 (Efendioglu and Woitsch 2017), health care (2021) and hospitality (Tuominen and Ascenção 2016). Continuing along the lines of this research that investigates digital service design within specific settings, this study is specifically directed toward the technological category of AR and the emerging possibilities for new services it warrants in the context of retail. Given this focus, the customer experience concept provides a foundation to articulate what makes services effective in this context.

3.2 Customer experiences in retail

Customer experience is in this paper defined as the *aggregate and cumulative customer perception created while learning about, acquiring, using, maintaining, and disposing of a product or service* (Jain et al. 2017). The interaction between the organization making an offer and the intended customer of that offering is the central tenant of customer experience (Jain et al. 2017). An experience occurs when a company intentionally uses services as the stage, and goods as props, to engage individual customers in a way that creates a memorable event (Pine and Gilmore 1998). Experiences are personal responses occurring only in the mind of an individual who has been engaged on an emotional, physical, intellectual, or even spiritual level (Bolton et al. 2018). Therefore, an "organization needs to create a cohesive, authentic and sensory-stimulating total customer experience that resonates, pleases and differentiates the organization from the competition to build an emotional connection with customers" (Berry and Carbone 2007, p. 26).

As reflected in the extant literature on customer experiences, customer experience as a collection of relational interactions between a retailer and a customer entails two complementary focus points in the retailer's production and customer's perception of experiences. Increasingly, such interactions are taking place in an omnichannel setup with hybridity between physical and digital means of interaction, where customer journeys are often unpredictable and uncontrollable (Bolton et al. 2018; Hilken et al. 2018).

3.3 Augmented reality and customer experiences

The most widely accepted definition of AR, and the one applied in this paper, is that AR is a set of technologies that makes it possible to supplement "the real world with virtual (computer-generated) objects that appear to coexist in the same space as the real world" (Azuma et al. 2001, p. 34). Within the customer experience framing, AR forms a channel that mediates retailer-customer interactions (Poushneh and Vasquez-Parraga 2017). As such, AR is regarded as a technology with high potential to impact the relationship between retailers and their customers (Christ-Brendemühl and Schaarschmidt 2022). For example, Chylinski et al. (2020) argue that AR holds unique capabilities to enable embedded, embodied, shared, and adaptive experiences, resulting in technology-enhanced customer experiences. The interaction through AR is one of several touchpoints in the holistic customer experience.

More specifically, research conducted primarily through controlled experiments and conceptual modeling has linked AR to a series of variables that are associated with enhanced customer experiences. Table 2 presents an overview of select works that have explored the link from customer, retailer, and technical perspectives.

Table 2. Perspectives on AR in retail

Perspective	**Theme**	**Indicative references**
Customer	Information provisioning	(Alimamy et al. 2017; Chylinski et al. 2020)
	Cognitive load	(Lu and Smith 2010; Tarafdar et al. 2019)
	Playfulness and entertainment	(Hilken et al. 2017; Jessen et al. 2020; Smink et al. 2019)
Retailer	Risk reduction	(Sun et al. 2022)
	Loyalty and branding	(Jessen et al. 2020; Rauschnabel et al. 2019)
	Cocreation of experiences	Archibald et al. (2019b
Technical	Interaction possibilities	(de Ruyter et al. 2020; Huang and Liao 2015; Park and Yoo 2020)
	Technical robustness	(Heller et al. 2021; Javornik 2016)
	Privacy and integrity	(Rauschnabel et al. 2018)

3.3.1 The customer perspective

Taking a customer-centric perspective, previous research has extensively investigated the conditions that influence customers' willingness to use AR in the context of retail. Doing so has led to the conclusion that customers' decisions to use AR are formed by utilitarian and hedonic aspects of use (Tan et al. 2022).

One of the core findings about the utility value of AR relates to AR's capacity to provide the right information at the right time. The right information (e.g., inventory levels, shipping times, etc.) may be provided through AR by the retailer but can also come from other customers or a wider group of influencers (Chylinski et al. 2020). By provisioning the right information at the right time, AR contributes to the retail experience by reducing time, performance, psychological, financial, and social risks in retail (Alimamy et al. 2017).

Other explanations about AR use that further build on its utility value are rooted in cognitive theories of use (Riar et al. 2021). This research proposes that AR use is driven by AR's capacity to cognitively unload the user by providing an augmented information overlay. Meanwhile, parallel studies have suggested that AR may instead increase the cognitive burden on users because they have to simultaneously process information from both the real and virtual worlds and that this burden may inhibit adoption in some instances (Lu and Smith 2010).

Yet other explanations of use are more closely rooted in the hedonic value of AR, considering playfulness and joy (Jessen et al. 2020). Here moderating conditions include technology-specific attributes such as aesthetics and the vividness of an interaction as well as use- and user-specific attributes such as the amount of time available and mood (Smink et al. 2019). That is, under certain

conditions and given the design of an AR solution, some customers will be willing to use the solution simply because it is fun. According to Huang and Liao (2015), the visual appeal and the entertainment value of an AR application are important factors that customers consider. Jessen et al. (2020) refer to a "playground effect" to explain how AR increases customer engagement and offers a source of intrinsic satisfaction for customers.

3.3.2 The retailer perspective

Taking a retailer perspective, research has investigated how use impacts a range of variables that ultimately are associated with increased sales. A key theme in this research is that different AR services are suitable based on retailers' distinct profiles.

One such explanation has specific bearing on retailers using AR as part of their entry into online shopping. Among the greatest impediments for customers in online shopping is the distance between them and a physical product. AR's ability to provide additional information about the product at hand helps shoppers overcome the spatial disconnect and increases the purchase conversion ratio (Chen et al. 2002). The value of AR's capacity for telepresence is thus contingent on the retailer's ambition to sell products that are not commodities and not routinely purchased and that therefore involve a high degree of risk (Sun et al. 2022). In other words, the power of telepresence is not applicable to the retail of commodities or for in-store purchases.

Along a similar line of thought, Javornik et al. (2021) argue that luxury brands should apply AR in a way that "convey[s] unique luxury attributes" (p. 284). The link between AR and retailer branding is echoed elsewhere in the literature. For example, Smink et al. (2019) conclude that AR leads to an affective process that enhances a customer's attitude toward the brand (Jessen et al. 2020). Generally, state-of-the-art AR services that present a high degree of novelty have been found to create a positive association with the retailer. However, the long-term impact of this effect has been questioned (Riar et al. 2021).

Finally, Archibald et al. (2019a) argue that AR services need to fit into the retailer's broader service ecosystem to be effective. The AR service they investigated redistributes the customer touchpoints between the different actors in the service ecosystem, ultimately leading to a redistribution of value appropriation among the actors. Naturally, there is pushback from several members of the ecosystem and limited interest to contribute to the success of the service. This example, as well as the other studies presented above, conveys the unifying theme that in addition to the customer's perception, the retailer's business context is a critical dimension to consider in the design of AR services.

3.3.3 The technical perspective

In conclusion, there is strong support for the notion that through utility and hedonic values, AR can in principle enhance customer experiences. However, the findings from previous research also indicate that such effects of AR are highly contingent on its technical design parameters. One group of variables that have been found to moderate the impact of AR include interaction possibilities and the technical robustness of the AR solution (Riar et al. 2021). Technical failures and constrained interaction can lead to lower levels of enjoyment from the interaction (Park and Yoo 2020). If incorrect information is provided through AR, the solution's utility value is challenged. Additionally, cognitive or technical barriers (Javornik 2016), high demands for customer participation (Christ-Brendemühl and Schaarschmidt 2022), and concerns about privacy and data integrity (Rauschnabel et al. 2018) may negatively influence a customer's willingness to use AR in the first place.

Critically, AR represents a class of technology that in the context of retail can be configured to assume many shapes and implemented in a wide range of different use situations (Gäthke 2020). All these potential use situations put different requirements on the technical configuration of an AR solution (de Ruyter et al. 2020). Technically, AR includes four architectural components: (a) a rendering method that connects the virtual and real worlds, (b) an input channel that allows a user to interact with the virtual world, (c) a projection interface that transforms data to real-world stimuli, and (d) a data feed that provisions data for processing and display. For each component, there are multiple implementation options that enable or constrain the use of the specific AR solution (see Table 3).

Table 3. Technical components in AR services

Component	**Design alternatives**
Rendering method	The rendering method deploys virtual images over real-world objects (de Ruyter et al. 2020). This superimposition can be done using different methods. The method of simultaneous localization and mapping localizes sensors with respect to their surroundings while at the same time mapping the structure of the environment. The marker-based method (also known as the recognition method) uses a camera to identify visual markers or objects. The location-based method (also known as the markerless method) uses GPS, a digital compass, a velocity meter, or an accelerometer to provide data about a location.
Input channel	The input channel refers to the passive or active possibilities for the user to manipulate the overlay of data in the real world (Carmigniani et al. 2011; Pham and Stuerzlinger 2019). Passive input includes the provisioning of geographic or position data. Active input can take place through the interaction modes of sight, gesture, and voice.
Projection device	The projection of data to visual stimuli typically uses smartphones, large displays such as TVs, and smart glasses. With head-mounted displays, smart glasses make AR an integral part of the entire field of view. This gives a more lifelike AR experience. The disadvantage of smart glasses is that since they have not been generally adopted, AR implementations on smart glasses require the provision of special purpose devices. Smartphones are, in contrast, generally available, but they deliver a very limited AR experience.
Data stream	Data provisioning in AR brings data to overlay visuals in a 3D space. Two primary forms include static and dynamic data provisioning. Static data is preloaded from product catalogs or databases with 3D models. Dynamic data refers to the provision of real-time-generated data that is produced by sensors in the environment or through social media channels.

Because each of the components of AR is experiencing rapid transformation, the technical possibilities to deliver customer experiences are also under constant transformation. Therefore, the design challenge of AR in retail is one of matching the evolving technical possibilities with the retailer's and customer's attributes to mediate the interaction between these parties in a way that contributes to the holistic formation of customer experiences (Heller et al. 2021). Such a situation lends itself well to a design thinking approach, which rests on fundamentally explorative principles and situational design that recognizes both utility and hedonic use values.

4 AR-based service design through design thinking

Having established the design challenge of AR services in retail as connecting the three domains of customer, retailer, and technical attributes, this section proposes design thinking as a suitable approach to address the challenge. Design thinking has been extensively adopted in digital industries because of its capacity to intersect emergent technical possibilities with subjective perceptions of value (Bason and Austin 2019). The conceptual argument for its suitability in the design of AR services in retail is developed below. First, the design thinking method, including three of its main qualities, is presented. Second, the relevance of each of these qualities in relation to the AR service design challenge is explained, formulating propositions and implementation principles that articulate how the design thinking approach can be implemented in this context to achieve the intended outcome.

The case vignette of IKEA Place (Box 1) illustrates the propositions in practice. IKEA Place, an AR-based smartphone app for displaying furniture and interior design items in their intended use context, was one of the first commercial successes of AR in the retail industry. While the functionality of IKEA Place is now rather standardized, IKEA Place was an early venture that for a time presented a differentiating service. The story behind IKEA Place has been recounted in various forums. Here the case narrative is used to make abstract arguments accessible to the reader.

4.1 Design thinking

The design thinking method is a human-centered process that is used to discover unmet needs and opportunities and convert them to create value through customer experiences (Lockwood 2010). This approach is based on applying designers' methods to solve a problem, including ethnographic and psychological tools to frame the problem-solving (Brown 2008). Understanding users' needs is crucial in this innovation process, especially in the early steps. Many designers therefore develop empathy toward customers through in-depth visual observations and ethnographic research techniques (Leonard and Rayport 1997).

Box 1. IKEA Place: Bridging customer, retailer, and technical perspectives

In pioneering the AR service of displaying furniture and interior design items in their intended use context, IKEA creatively matched the specific challenges and opportunities of its business model with the characteristics of its customer base and evolving technical possibilities. A primary consideration was that IKEA had a traditional self-service concept where the staffing of stores was limited. IKEA customers were expected to take the selection and assessment of IKEA products into their own hands and use any available means to do so.

In this context, the customer value of IKEA Place was identified as a situation where the customer could touch and feel a product in the store but would be uncertain of which model or make would best suit the intended use context. The customer problem emphasized was the effort of going to an IKEA store and organizing friends or family to help with logistics and producing a trailer for product transport just to find out that the color of a piece of furniture was not a perfect match with the carpet given the light in a specific room.

Then, in the ideation of possible solutions to the customer problem, it was recognized that IKEA has a global presence and must tailor catalogs and marketing material to many different cultural contexts. Therefore, instead of using photos in their product catalogs, IKEA had for a long time been using Autodesk 3ds Max software to render photorealistic images. Hence, IKEA's product catalog already existed as photorealistic 3D models as opposed to most other retailers that possessed libraries of 3D models tailored only for construction and production.

Additionally, IKEA was an early partner to the AR start-up Metaio, which was later acquired by Apple. Metaio became an important actor in Apple's release of the ARKit, a set of functions available to third-party app developers to make the development of AR apps easier by providing much of the basic technical functionality needed for AR as a standard functionality in the iPhone. During the ideation of IKEA Place, this technical foundation was identified as a prerequisite for economic feasibility. Without the ARKit, development costs and the threshold for adoption would be too high. Therefore, the release of the app was put on hold until the conditions for its success were in place.

The development cost of IKEA Place has been estimated in the range of US$100,000. This would be a high amount for a small retailer but not for a global retailer such as IKEA. The price tag was conditioned on the existing 3D model catalog and the technical foundation provided by Apple's ARKit release. Thus, the success of IKEA Place was a result of the design process combining IKEA's empathy with the customer base, the company's global self-service retail model, and its awareness of technological developments. The same AR service would not have had the same effect given a different customer base, retail model, or point in the evolution of AR technologies.

Sources: Khan et al. (2018), Lunden (2017), and Ozturkcan (2021)

Figure 1 shows how a design thinking method conceptually connects customer, retailer, and technical attributes in the pursuit of AR-enabled interaction points to provide superior customer experiences. The process goes through five phases, works with stakeholders, and leverages templates and conversations. For an overview, see Table 4.

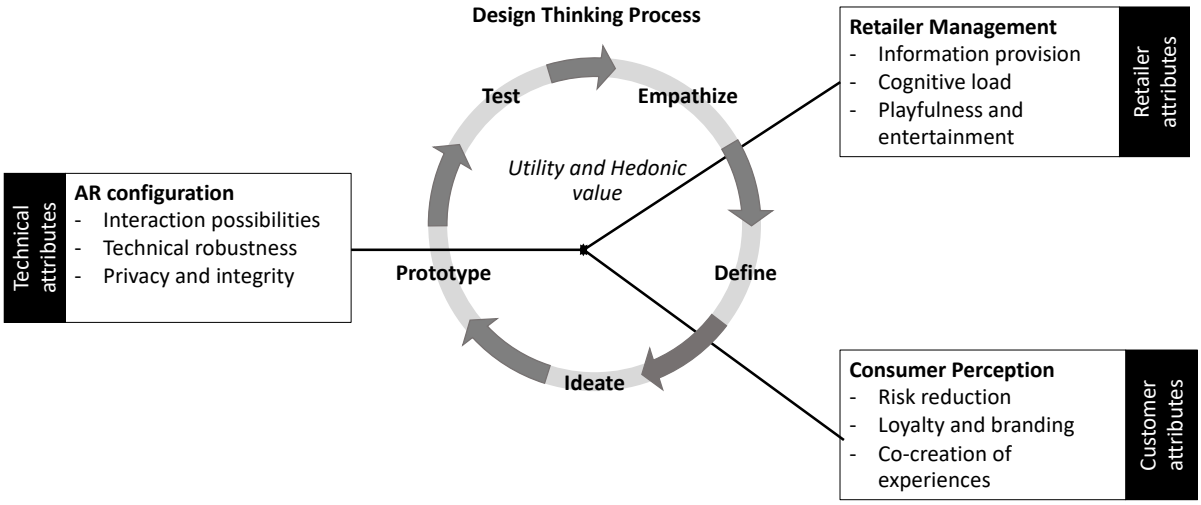

Figure 1. Design thinking process as connecting technical, retailer, and customer attributes in the design of AR for enhanced customer experiences

Table 4. Steps in the design thinking method (based on Brown [2010] and Lockwood [2009])

Phase	**Description**
Empathize	Looking at the needs of the users not only to gather user requirements but also to uncover what users would like to experience is the starting point for design. Creating an empathy map is an outcome of this phase that helps with establishing a clear view of each stage of the experience and related problems where impact could be created. This phase's outcomes will vary based on every customer persona that is considered.
Define	The designer arrives at a meaningful and actionable problem statement. This is likely the most difficult part of the design challenge. It requires the designer to synthesize observations and insights about users and the stated and unstated needs of the users based on the empathy phase. This phase leverages the use of templates to define problems specific to each persona in a way that would not just alleviate the pain from the problem space.
Ideate	Facing the challenges experienced by the users and generating various innovative solutions to the findings from the empathy phase. Ideas come with experience or by sharing. They also come from borrowing from similar situations faced by other industries unrelated from the current context. The focus is on generating many ideas in the first phase of ideation while not considering too closely or pondering over the quality, feasibility, or viability of the ideas. The second phase of ideation encourages designers to consider the feasibility and viability of the ideas generated.
Prototype	The implementation and testing of solutions in an agile manner. It is the phase that allows designers to take the ideas that are in their heads and bring them to reality in the simplest possible way. Prototypes can range from paper prototypes to storyboarding and screen prototypes. It allows the user to experience the solution and helps to prevent the designer from telling instead of showing.
Test	The solution prototype gets tested by users in their real-life settings. The user experiences this ideally without guidance. Testing is crucial in producing an application that is reliable and fulfills user expectations.

Design thinking has seen extensive adoption in digital industries, particularly those that are intimately connected with subjective perceptions. Reflections on such use cases have documented three important qualities that are highly relevant in the context of AR services and customer experiences (see Brown 2008; Cooper et al. 2009). First, *design thinking enables a broad understanding of the root causes* of user problems. Second, the structures of design thinking *reduce the risk of launching* a solution by unearthing perceptions and feasibility early on. Finally, beyond the design itself, design thinking builds a *foundation for continued evolution* and innovation. These qualities make the design thinking method particularly suited to the creation of AR services in retail, if applied with consideration to the specific contexts involved.

4.2 A broad understanding of root causes for problem definition

A design thinking process has two points of convergence with phases of exploration preceding them (Brown 2008). The first phase of exploration is problem-centric and covers the empathize and define steps. The second phase of exploration is solution-centric and covers the steps of ideation, prototyping, and testing.

The problem exploration phase is designed to be loyal to the customer (Cooper et al. 2009). It is structured to bring relevant actors, including technical experts and representatives from the retailer, into a series of workshops that can take different perspectives to understand customer problems. The pivotal element of these workshops is the information collected from socializing with customers of the retailer (Bason and Austin 2019). Importantly, such information gathering has to include the customer base's perception at a general and an emotional level of any technologies involved. Examples include how a specific customer group is bothered by privacy concerns and data integrity or fascinated by exploring new technical features.

The activities leading up to the initial workshops are a form of empathy conversation with the purpose of creating an empathy map specifically catered to AR possibilities (Brown 2008). The empathy map serves as an externalized, shared understanding covering articulated as well as unspoken needs. The empathy map defines the goal, the audience, and the problem to be solved using AR technologies and expectations concerning the service being designed.

This way of working that anchors the "requirements specification" in the subjectivity of the customers is purposeful given that the perception of customer experiences is subjective based on the eyes of the customer. The capacity of AR services to provide the right information at the right time requires a profound understanding of what information is appreciated in a given context (Chylinski et al. 2020). Additionally, empathy conversations also form a foundation for the aesthetic and visual design of an AR solution. Take, for example, the customer perception of time. For one customer group, a good

experience may be characterized by short interaction time. Here, an AR service intended to increase the playfulness of the experience (Jessen et al. 2020) may just be perceived as annoying.

In the IKEA Place app (see Box 1), empathy toward customers was reflected in the recognition that for many customers, getting to an IKEA store is a bit of a logistical challenge. This is particularly true if a customer needs to bring a couch back and forth between locations. For many customers, how a piece of furniture looks in a larger context is something that IKEA traditionally has addressed through its showrooms. The AR app took this experience-enhancing service one step further by showing how a piece of furniture fitted into the specific context of a customer's home. Therefore, for IKEA's customers this service really enhanced the customer experience by answering one of their core needs, standing in contrast to many other retailers that have produced similar AR services. Best Buy, for example, created an AR app that visualized TV screens in a room. While this app was also potentially a useful, TV screens are less varied than furniture and are easier to visualize than novel furnishings. Another example is the Magic Mirror (an interactive smart mirror) by Prada. While technically advanced, it did not solve a customer problem. In contrast, it created new problems with data integrity and privacy. A profound understanding of such subtleties is critical to explain why similar AR services are received very differently by various customer groups.

Proposition 1: A design thinking approach to AR service design fosters a broad, customer-centric understanding of root causes that enables the design of AR services that enhance customer experiences.

It further follows from a customer experience view that an AR service is one of several touchpoints that together form the customer experience (Archibald et al. 2019a). Thus, the AR service exists as part of the holistic customer experience in an omnichannel customer journey (Kranzbühler et al. 2018). What this effectively means is that the service's operational and technical integration with the retailer and the customer must be considered in the design process.

Taking the retailer's position into consideration means that not all customer problems are equally valued. For example, the retailer may consider itself to have a strong customer experience for its established customer base and a weaker experience for younger clientele who are showing interest in the products that the retailer offers. Additionally, some services may be building more naturally on the existing technological landscape. AR services are contingent on data feeds, and whether this data exists could be a deal breaker when trying to realize a service. Moreover, AR services also generate data. Such data, for example, on which garments a customer inspects but ultimately does not purchase may provide value for the retailer beyond the immediate AR service itself.

Therefore, a holistic interpretation of the meaning of customer perceptions from the retailer and technical perspectives is required. For example, can an issue raised by customers be addressed by technology while not being intrusive and introducing privacy concerns? Underlining the holistic interpretation of customer perceptions is therefore a critical implementation principle of design thinking in the retail context (see Table 5).

Implementation principle 1: A holistic interpretation of customer perceptions is required in the convergence on the problem definition for AR services.

Table 5. Implementation principles for design thinking in the context of AR and enhanced customer experiences

Principle	Implementation challenge	Coping practice
1. A holistic interpretation of customer perceptions is required in the convergence on the problem definition.	Although the AR solution is one self-contained touchpoint, it is also an integrated part of a holistic customer experience.	Trial solutions not only as isolated instances but also as an integrated component of a holistic customer experience.
2. Multidisciplinary teams that include deep technical expertise and can iterate rapidly are required to establish feasibility.	From one AR project to the next, technical possibilities in rendering method, input channel, projection device, and data stream evolve.	Bring deep technological knowledge into the multidisciplinary team, and prepare to have all information needed for fast iterations in the design process.
3. The traceability of design choices is required to enable continuous evolution and innovation.	Design thinking downplays the technical considerations that are needed to make the solution not only efficient in the moment but also an effective stepping-stone into the future.	Document rationales and create lists of features not implemented with specified reasons for the decision. Communicate discovered, unexploited potential.

4.3 Creativity and feasibility in solutions

The second explorative phase in design thinking aims at eventual convergence on a solution to the problem defined in the previous explorative phase. The steps and their associated activities in the ideation, prototyping, and testing phases are tailored to situations with complex problems and no standard solution (Brown 2008).

Differentiating AR services leverage emergent possibilities in technology (Heller et al. 2021). Therefore, a key premise for the solution exploration is to revisit what is technically and commercially possible given the rapid progress of digital technologies. The development of technologies impacts the possibilities of creating customer experiences in three different ways. First, the technical robustness of an AR service (Riar et al. 2021) paired with constrained interaction can lead to negative experiences (Park and Yoo 2020). Therefore, technological maturity directly impacts when a known service yields attractive experiences. Second, technological maturity reduces costs. Novel technologies are expensive, but prices are typically falling rapidly. This makes AR services that

previously were not commercially attractive realistic possibilities. Third, novel technological capacities create radically new possibilities. For example, novel ways of capturing and exchanging data may reduce concerns about privacy and data integrity (Rauschnabel et al. 2018).

Recently, new capacities in smartphones that lower the barriers for customers to adopt AR services using a smartphone as a projection device have unleashed a stream of new AR services. Similarly, digitized fitting rooms have been trialed extensively and are seeing ongoing technological progress in associated technical devices (smart mirrors, body scanners, cameras, holograms, etc.) that are experiencing substantial capacity enhancements (Lavoye et al. 2021). Additionally, with in-store networks being set up in most retailers' store networks, the technical infrastructure in stores is now ready to implement personal and dynamic data streams. Outside the store context, however, network capacity is still insufficient to support the dynamic data feeds that would be needed for personalized experiences. Here, the arrival of 5G networks is expected to push the boundaries of what is technically possible.

The design thinking process is particularly suitable for problems where no established solution exists (Bason and Austin 2019). An important aspect of the ideation and prototyping phases is the built-in activities that aim to question previous assumptions of what is and what is not possible. Ideation practices such as bodystorming and "How Might We" (Chilufya and Arvola 2021) aim to give a voice to multiple stakeholders to catalyze the intersection of customer, retailer, and technical perspectives in the service design. Other activities focus on the worst possible solutions to expose feasibility barriers, and yet other activities aim specifically to question the assumptions of impossible designs (Brown 2008). In a fast-moving technological space, such approaches enable the exploration of what is possible and what is still beyond commercial feasibility.

In an interview with TechCrunch (Lunden 2017), Michael Valdsgaard, who at the time headed up digital transformation at IKEA, explained that what really moved the idea of the AR app from a vision to a commercial project was a contact initiated by Apple: "They came in and said, essentially, 'We have mature software, we have a platform.' They sent us the ARKit. That really started things. Plus they have hundreds of millions of devices, and you have the possibility of being in all those overnight. … AR is one of those moments where we have the tech maturing. We really think AR is going to change everything that we know today." So technical maturity was the cue that informed IKEA that AR use was now in reach across "hundreds of millions of devices."

IKEA could have developed its AR service earlier, but then the app would have required more extensive development and would have required customers to install special purpose software on their phones. The now discontinued AR app called Layar is an example of an AR service that was ahead of its time when it launched in 2009. Through Layar, the user could point a smartphone camera to a

surrounding area and Layar would overlay video on the screen with information retrieved from search engines, Wikipedia, and review sites. There were, however, difficulties in obtaining accurate positioning data to correctly display the information, and there were performance issues with real-time data feeds over mobile networks compromising the service.

In the exploration of what is technically possible, it is important that the design thinking process remains loyal to the customer perception (Bason and Austin 2019). Taking the customer perspective, technological capacities are subject to perception. Here design thinking emphasizes rapid prototyping to collect customer insights (Chilufya and Arvola 2021). A profound loyalty to the customer perception is a unique aspect of design thinking that is only possible because of the initial empathy conversations.

Proposition 2: A design thinking approach to AR service design facilitates the exploration of technical possibilities from a subjective customer position and thereby enables the design of AR services that enhance customer experiences.

The challenge of the moving technological frontier means that from one AR project to the next, the technical possibilities are different. In AR, such technological developments pertain to all four elements of the AR design parameters: rendering method, input channel, projection device, and data stream. Functional enhancements are important, but in addition, efficiency improvements can be made to deliver functions at lower cost. Additionally, the moving technological frontier applies complementary technologies that are used in combination with AR. For example, AI and machine learning can be leveraged to produce relevant information to project in an AR service and can be used in combination with the service's input channel.

The key point here is that deep technological knowledge is fundamental to a design process in which AR is leveraged to enhance customer experiences (Heller et al. 2021). Only by weaving such knowledge together with the emerging understanding of customers that the design thinking approach brings can AR solutions that enhance customer experiences be designed. Furthermore, design thinking that remains loyal to customers thrives on rapid prototyping to validate perceptions of technologies. However, such rapid iteration can only be accomplished if the design team works with technological expertise from the beginning (Chilufya and Arvola 2021). An iterative process where designers for each iteration have to further investigate technological options and solicit expert opinions on expected progress, cost, security issues, and so on will lack the necessary momentum in the iteration.

Implementation principle 2: Multidisciplinary teams that include deep technical expertise and can iterate rapidly are required to establish the feasibility of AR services.

4.4 Enabling continuous innovation

As discussed above, design thinking is an appropriate approach to the creation of AR services because the final design reflects a broad and empathic understanding of the customer, retail, and technical possibilities. Meanwhile, in addition to the AR service itself, the understanding formed during the design process is a valuable resource that enables continuous development and innovation.

An AR service can be seen as a technical and organizational stepping-stone in the further evolution of a retailer. In the definition of the problem and the ideation of solutions, a lack of technical capacity will often be brought into consideration for rejecting a problem or solution. While these limitations would typically just lead to a rejection of the idea, here such constraints can instead lead an idea to be parked for further consideration. More specifically, several retailers put their AR ideas on hold until there was an established standard for AR in smartphones and anticipation of customer adoption of smartphone models that could handle such functionality.

Again, IKEA Place provides a good illustration. In the same interview with TechCrunch (Lunden 2017), Valdsgaard reflected: "We are also playing with VR. The only problem is that people are not super comfortable with it. … But as soon as VR is mature we will have a presence in it, too." Continuing to reflect on what is next in terms of digital service innovation for IKEA, Valdsgaard elaborated: "Well, the question really is who solves what and when? Right now Apple has solved the AR question and is bringing it to mass market. … Some companies already do things well, but when you have to buy special equipment—it's not for us."

Ideas can be put on hold because of commercial or organizational readiness. Due to the price tag, or the need for technical support functions, certain AR services may only be appropriate for specific store concepts or specific markets. Just by the relevant technology becoming more mature and cheaper, rollout can potentially proceed to more locations. Therefore, both technically and organizationally, an AR service designed through a design thinking process presents both immediate value and value as a stepping-stone for future developments and thus needs to be treated that way in the design thinking process.

Proposition 3: A design thinking approach to AR service design creates a foundation for continuous improvements of AR services that enhance customer experiences.

A known issue in design thinking is documentation. Applied in its typical fashion, design thinking brings traceability difficulties (Bason and Austin 2019). User engagement inputs are commonly captured on Post-its or via prototypes, mainly in an unstructured manner, to advance team collaboration and process speed (Cooper et al. 2009). However, this makes it difficult to trace back and document why solutions were designed the way they were.

The evolving nature of AR technologies requires that the design process be documented with more rigor than is typical in design thinking. Therefore, the design thinking method moderators need to act differently in the creation of AR-based solutions compared to a typical design thinking process. Besides documenting possibilities, the technical designers need to architect a solution with possible future scenarios in mind (Archibald et al. 2019a). Instead of creating stand-alone solutions that in the end would make the customer experience a range of differently engineered AR experiences, designers need to cater for evolvability.

Implementation principle 3: The traceability of design choices is required to enable continuous evolution and improvement of AR services.

5 Discussion

We have in this paper focused on the meaning of digital technology for service design in the context of retail. In retail, the use of digital technologies as the bases for new services is unfolding as part of the transition to competition based on superior customer experiences as opposed to the traditional transactional models of buying low and selling high. One of the key technologies in this transition is AR, which in laboratory experiments has shown high potential but has frequently been implemented in the real world with disappointing outcomes (El-Shamandi Ahmed et al. 2022). In considering how the potential of AR can be materialized in practice, the question addressed in this paper was *how to design AR services that enhance customer experiences in retail?*

A conceptual research approach (Gilson and Goldberg 2015; Hulland 2020; Jaakkola 2020) was used to answer to the research question. The resulting conceptual model of AR service design through design thinking (graphically represented in Figure 1) is a form of substantive theoretical contribution (Glaser and Strauss 1965) that complements works on digital service design through its focus on a highly relevant but previously not investigated setting for digital service design. The model extends the understanding of this particular area of inquiry in three ways.

First, building further on findings that the practical meaning of digital service design takes different forms depending on the setting of design, AR service design is characterized as a challenge of matching technical, retailer, and customer attributes. The customer experience literature portrays customer experiences as formed in the interaction between a retailer and a customer (Kranzbühler et al. 2018). When such interaction is mediated by AR, the AR design challenge is to find unknown possibilities to cater to technical, retailer, and customer attributes *all* at the same time (Heller et al. 2021).

Characterizing the AR service design challenge requires the unboxing of the technological design parameters of relevance. Past research on AR has typically treated it as one single, homogenous

technological invention (Riar et al. 2021). Here, it is recognized that AR technology represents a heterogenous group of technologies that can be configured differently across four architectural components: rendering method, input channel, projection device, and data stream (Pham and Stuerzlinger 2019).

The recognition of AR service design as a combination of technical, retailer, and customer attributes allows us to make sense of divergent findings in past research. For example, past studies have shown that AR can have both a positive and negative impact on cognitive load (Lu and Smith 2010). The explanation for this is simply that it is the specific combination of attributes in the AR service design that has such an impact—not AR per se.

Second, this work has explained the applicability of the design thinking method in the context of retail. The arguments in favor of the design thinking method's applicability to AR service design were summarized earlier in three propositions. The explanation for why design thinking works in this setting can be linked to the transforming role of digital technology in retail (De Keyser et al. 2019). Digital technology has a long history of enabling retailers to achieve a competitive edge over their rivals. Classic examples include Zara's use of a supply chain management system to enable fast fashion and Dell's strategy of using web shops to sell directly to customers rather than through a reseller network (Christopher and Holweg 2011). One of the characteristics of the last wave of digital technologies, which includes AR and other extended reality technologies, is that they are expanding the domain covered from primarily back-office functions to customer-facing. This new application of digital technology requires new service design approaches focused on the user as the center of the design process rather than on using traditional methods of digitizing business that model processes as flow diagrams and activity maps (Heller et al. 2021). For retailers, the shift in the nature of digital technology therefore implies a need to adjust service design practices.

Adding to this emerging view of what the new digital normal of service design entails, our research provides a unique reference point for digital service design when it comes to differentiating experiences also beyond the retail context. While there are many service design approaches that resemble and share some overlap with design thinking, the nuanced differences are important to emphasize. In a design thinking process, instead of having a marketing specialist organizing the customer base into archetypal personas, you have a service designer who sits down with a prospective customer to have a conversation about privacy, social media behavior, surveillance capitalism, and so on to understand where the technological boundaries can be pushed and where they cannot. This is a line of thought that fits research findings showing that customers may resist new services for a range of different reasons (Claudy et al. 2015). While most service design approaches will give attention to the addressed customer group, design thinking stands comparatively well to navigate the complex mix of drivers of adoption and resistance in digital service design.

Third, recognizing that moderately abstracted (Merton 1968) substantive theory (Glaser and Strauss 1965) is particularly suitable as the basis to guide practice, key principles were articulated as guidelines for the application of design thinking to enhance customer experiences through AR. Design thinking downplays the technical attributes and the integration of a momentary experience into the retailer's operational context. The three implementation principles share the common characteristic of seeking to balance the focus on the customer by bringing deep technical and operational knowledge into the design workshops to enable rapid iteration between problem-solution proposals without breaking the creative momentum. Ultimately, the three principles ensure that accounting for the relevance of an experience is not done at the expense of technological ignorance.

In practice, adhering to the implementation principles requires the formation of a design thinking team that includes deep technical knowledge. Typically, retailers would work with external technology providers in advanced technical projects, such as AR implementations. Because the technical competences are needed *in* the design team, one key to success is to nurture a collaborative partnership rather than a client-supplier relationship between retailer and technology provider. Additionally, working in this mode requires that technical experts embrace the ethnographic ambition of design thinking, and not just see themselves as technical implementers that work towards a set requirement specification.

The limitations of this paper include its conceptual nature. The propositions developed are based on logical reasoning considering the characterization of the problem at hand and the documented merits of the design thinking method. The case data is only illustrative and does not serve to validate the propositions. Future research should seek to empirically validate the propositions and the overall applicability of design thinking for the design of AR services in retail. This includes establishing the boundary conditions for the method by determining when the design thinking method is not useful. Furthermore, the implementation principles were developed by critically reflecting on the implications of the design thinking method. For practice, the implementation principles should be taken as broad guidelines that need to be interpreted in a specific use situation.

6 Conclusion

The essence of a business in the retail industry is to transform itself against its competition based on differentiating customer experiences (Jain et al. 2017). Increasingly, such unique customer experiences are realized through the design of new services that are leveraging emerging capacities in digital technologies. This paper considered the design of digital services based on AR. While AR services have shown great potential in experimental lab settings, their real-world commercial impact remains relatively limited (de Ruyter et al. 2020; Heller et al. 2021).

The main argument of this paper is that AR service design needs to cater to a nexus of technical, retailer, and customer attributes to be effective. This is a problem situation that lends itself well to the qualities of a design thinking process for service design (Bason and Austin 2019; Brown 2008; Cooper et al. 2009) that centers on the customers as the end users. Such a design thinking process must, however, be infused with deep technological knowledge to correctly explore the technical possibilities and limitations in the rapidly evolving AR technologies. For retailers mastering this complex act of discovery, this capability presents a differentiating opportunity for digital services that contribute to creating superior customer experiences.

7 References

Akaka, M. A., Vargo, S. L., and Schau, H. J. 2015. "The Context of Experience," *Journal of Service Management* (26:2), pp. 206-223.

Alimamy, S., Deans, K. R., and Gnoth, J. 2017. "Augmented Reality: Uses and Future Considerations in Marketing," in *Leadership, Innovation and Entrepreneurship as Driving Forces of the Global Economy*. Springer, pp. 705-712.

Archibald, P., Lohse, M., Vaidyanathan, N., and Henningsson, S. 2019a. "Augmented Reality and Customer Experience in Retail: A Case Study," in: *OASIS 2019: Organizations and Society in Information Systems Workshop, December 14 2019*. Munich Germany.

Archibald, P., Lohse, M., Vaidyanathan, N., and Henningsson, S. 2019b. "Augmented Reality and Customer Experience in Retail: A Case Study," in: *OASIS 2019: 2019 Organizations and Society in Information Systems Workshop*. Munich Germany.

Azuma, R., Baillot, Y., Behringer, R., Feiner, S., Julier, S., and MacIntyre, B. 2001. "Recent Advances in Augmented Reality," *IEEE computer graphics and applications* (21:6), pp. 34-47.

Barrett, M., Davidson, E., Prabhu, J., and Vargo, S. L. 2015. "Service Innovation in the Digital Age," *MIS quarterly* (39:1), pp. 135-154.

Bason, C., and Austin, R. D. 2019. "The Right Way to Lead Design Thinking," *Harvard Business Review* (97:2), pp. 82-91.

Berry, L. L., and Carbone, L. P. 2007. "Build Loyalty through Experience Management," *Quality progress* (40:9), p. 26.

Bitner, M. J., Ostrom, A. L., and Morgan, F. N. 2008. "Service Blueprinting: A Practical Technique for Service Innovation," *California management review* (50:3), pp. 66-94.

Bolton, R. N., McColl-Kennedy, J. R., Cheung, L., Gallan, A., Orsingher, C., Witell, L., and Zaki, M. 2018. "Customer Experience Challenges: Bringing Together Digital, Physical and Social Realms," *Journal of Service Management* (29:5), pp. 776-808.

Brown, T. 2008. "Design Thinking," *Harvard business review* (86:6), p. 84.

Carmigniani, J., Furht, B., Anisetti, M., Ceravolo, P., Damiani, E., and Ivkovic, M. 2011. "Augmented Reality Technologies, Systems and Applications," *Multimedia tools and applications* (51:1), pp. 341-377.

Chen, L.-d., Gillenson, M. L., and Sherrell, D. 2002. "Enticing Online Consumers: An Extended Technology Acceptance Perspective," *Information & Management* (39:8), pp. 705-719.

Chilufya, E. M., and Arvola, M. 2021. "Conceptual Designing of a Virtual Receptionist: Remote Desktop Walkthrough and Bodystorming in Vr," *Proceedings of the 9th International Conference on Human-Agent Interaction*, pp. 112-120.

Christ-Brendemühl, S., and Schaarschmidt, M. 2022. "Customer Fairness Perceptions in Augmented Reality-Based Online Services," *Journal of Service Management* (33:1), pp. 9-32.

Christopher, M., and Holweg, M. 2011. "“Supply Chain 2.0”: Managing Supply Chains in the Era of Turbulence," *International journal of physical distribution & logistics management* (41:1), pp. 63-82.

Chylinski, M., Heller, J., Hilken, T., Keeling, D. I., Mahr, D., and de Ruyter, K. 2020. "Augmented Reality Marketing: A Technology-Enabled Approach to Situated Customer Experience," *Australasian Marketing Journal (AMJ)* (28:4), pp. 374-384.

Claudy, M. C., Garcia, R., and O'Driscoll, A. 2015. "Consumer Resistance to Innovation—a Behavioral Reasoning Perspective," *Journal of the Academy of Marketing Science* (43:4), pp. 528-544.

Cooper, R., Junginger, S., and Lockwood, T. 2009. "Design Thinking and Design Management: A Research and Practice Perspective," *Design Management Review* (20:2), pp. 46-55.

De Keyser, A., Köcher, S., Alkire, L., Verbeeck, C., and Kandampully, J. 2019. "Frontline Service Technology Infusion: Conceptual Archetypes and Future Research Directions," *Journal of Service Management* (30:1), pp. 156-183.

de Ruyter, K., Heller, J., Hilken, T., Chylinski, M., Keeling, D. I., and Mahr, D. 2020. "Seeing with the Customer's Eye: Exploring the Challenges and Opportunities of Ar Advertising," *Journal of Advertising* (49:2), pp. 109-124.

Eaton, B., Elaluf-Calderwood, S., Sørensen, C., and Yoo, Y. 2015. "Distributed Tuning of Boundary Resources," *MIS quarterly* (39:1), pp. 217-244.

Edvardsson, B., Frow, P., Jaakkola, E., Keiningham, T. L., Koskela-Huotari, K., Mele, C., and Tombs, A. 2018. "Examining How Context Change Foster Service Innovation," *Journal of Service Management* (29:5), pp. 932-955.

Efendioglu, N., and Woitsch, R. 2017. "A Modelling Method for Digital Service Design and Intellectual Property Management Towards Industry 4.0: Caxman Case," *International Conference on Serviceology*: Springer, pp. 153-163.

El-Shamandi Ahmed, K., Ambika, A., and Belk, R. 2022. "Augmented Reality Magic Mirror In the Service Sector: Experiential Consumption and the Self," *Journal of Service Management* (ahead-of-print:ahead-of-print).

Gartner. 2018. "Key Findings from the Gartner Customer Experience Survey." Gartner.

Gäthke, J. 2020. "The Impact of Augmented Reality on Overall Service Satisfaction in Elaborate Servicescapes," *Journal of Service Management* (31:2), pp. 227-246.

Gilson, L. L., and Goldberg, C. B. 2015. "Editors' Comment: So, What Is a Conceptual Paper?," *Group & Organization Management* (40:2), pp. 127-130.

Glaser, B. G., and Strauss, A. L. 1965. "Discovery of Substantive Theory: A Basic Strategy Underlying Qualitative Research," *American behavioral scientist* (8:6), pp. 5-12.

Gummerus, J., Mickelsson, J., Trischler, J., Härkönen, T., and Grönroos, C. 2021. "Acts – Service Design Based on Human Activity Sets," *Journal of Service Management* (32:6), pp. 28-54.

Heller, J., Chylinski, M., de Ruyter, K., Keeling, D. I., Hilken, T., and Mahr, D. 2021. "Tangible Service Automation: Decomposing the Technology-Enabled Engagement Process (Teep) for Augmented Reality," *Journal of Service Research* (24:1), pp. 84-103.

Hilken, T., de Ruyter, K., Chylinski, M., Mahr, D., and Keeling, D. I. 2017. "Augmenting the Eye of the Beholder: Exploring the Strategic Potential of Augmented Reality to Enhance Online Service Experiences," *Journal of the Academy of Marketing Science* (45:6), pp. 884-905.

Hilken, T., Heller, J., Chylinski, M., Keeling, D. I., Mahr, D., and de Ruyter, K. 2018. "Making Omnichannel an Augmented Reality: The Current and Future State of the Art," *Journal of Research in Interactive Marketing* (12:4), pp. 509-523.

Hofma, C. C., Henningsson, S., and Vaidyanathan, N. 2018. "Immersive Virtual Environments in Information Systems Research: A Review of Objects and Approaches," *Academy of Management Proceedings*, Annaheim, CA: Academy of Management

Huang, T.-L., and Liao, S. 2015. "A Model of Acceptance of Augmented-Reality Interactive Technology: The Moderating Role of Cognitive Innovativeness," *Electronic Commerce Research* (15:2), pp. 269-295.

Huikkola, T., Kohtamäki, M., Rabetino, R., Makkonen, H., and Holtkamp, P. 2022. "Unfolding the Simple Heuristics of Smart Solution Development," *Journal of Service Management* (33:1), pp. 121-142.

Hulland, J. 2020. "Conceptual Review Papers: Revisiting Existing Research to Develop and Refine Theory," *AMS Review* (10:1), pp. 27-35.

Jaakkola, E. 2020. "Designing Conceptual Articles: Four Approaches," *AMS review* (10:1), pp. 18-26.

Jain, R., Aagja, J., and Bagdare, S. 2017. "Customer Experience–a Review and Research Agenda," *Journal of Service Theory and Practice* (27:3), pp. 642-662.

Javornik, A. 2016. "'It's an Illusion, but It Looks Real!'Consumer Affective, Cognitive and Behavioural Responses to Augmented Reality Applications," *Journal of Marketing Management* (32:9-10), pp. 987-1011.

Jessen, A., Hilken, T., Chylinski, M., Mahr, D., Heller, J., Keeling, D. I., and de Ruyter, K. 2020. "The Playground Effect: How Augmented Reality Drives Creative Customer Engagement," *Journal of Business Research* (116), pp. 85-98.

Khan, R. H., Darvishi, S., Rezaeinia, M., and Rizwan, Z. 2018. "Smart Store: The Convergence of Ikea Department Store, Augmented Reality and Rfid Technology." Växjö, Sweden: Linnaeus University.

Kowalkowski, C., Bigdeli, A. Z., and Baines, T. 2022. "Guest Editorial: The Future of Servitization in a Digital Era," *Journal of Service Management* (33:1), pp. 59-69.

Kranzbühler, A. M., Kleijnen, M. H., Morgan, R. E., and Teerling, M. 2018. "The Multilevel Nature of Customer Experience Research: An Integrative Review and Research Agenda," *International Journal of Management Reviews* (20:2), pp. 433-456.

Kunz, W. H., and Walsh, G. 2020. "After the Revolution – New Chances for Service Research in a Digital World," *Journal of Service Management* (31:3), pp. 597-607.

Lavoye, V., Mero, J., and Tarkiainen, A. 2021. "Consumer Behavior with Augmented Reality in Retail: A Review and Research Agenda," *The International Review of Retail, Distribution and Consumer Research* (31:3), pp. 299-329.

Leonard, D., and Rayport, J. F. 1997. "Spark Innovation through Empathic Design," *Harvard business review* (75), pp. 102-115.

Li, L. P., Fehrer, J. A., Brodie, R. J., and Juric, B. 2021. "Trajectories of Influential Conceptual Articles in Service Research," *Journal of Service Management* (32:5), pp. 645-672.

Lim, C., Kim, M.-J., Kim, K.-H., Kim, K.-J., and Maglio, P. 2019. "Customer Process Management," *Journal of Service Management* (30:1), pp. 105-131.

Lockwood, T. 2010. "Design Thinking in Business: An Interview with Gianfranco Zaccai," *Design Management Review* (21:3), pp. 16-24.

Lu, B., Hao, S., Pinedo, M., and Xu, Y. 2021. "Frontiers in Service Science: Fintech Operations—an Overview of Recent Developments and Future Research Directions," *Service Science* (13:1), pp. 19-35.

Lu, Y., and Smith, S. 2010. "Augmented Reality E-Commerce System: A Case Study," *Journal of computing and information science in engineering* (10:2).

Lukka, K., and Vinnari, E. 2014. "Domain Theory and Method Theory in Management Accounting Research," *Accounting, Auditing & Accountability Journal* (27:8), pp. 1308-1338.

Lunden, I. 2017. "Ikea Place, the Retailer's First Arkit App, Creates Lifelike Pictures of Furniture in Your Home," in: *TechCrunch*.

MacInnis, D. J. 2011. "A Framework for Conceptual Contributions in Marketing," *Journal of Marketing* (75:4), pp. 136-154.

Meroni, A., and Sangiorgi, D. 2016. *Design for Services*. London, UK: Routledge.

Merton, R. K. 1968. *Social Theory and Social Structure*. New York, NY: Simon and Schuster.

Opazo-Basáez, M., Vendrell-Herrero, F., and Bustinza, O. F. 2022. "Digital Service Innovation: A paradigm Shift in Technological Innovation," *Journal of Service Management* (33:1), pp. 97-120.

Ozturkcan, S. 2021. "Service Innovation: Using Augmented Reality in the Ikea Place App," *Journal of Information Technology Teaching Cases* (11:1), pp. 8-13.

Park, M., and Yoo, J. 2020. "Effects of Perceived Interactivity of Augmented Reality on Consumer Responses: A Mental Imagery Perspective," *Journal of Retailing and Consumer Services* (52), p. 101912.

Paschou, T., Rapaccini, M., Adrodegari, F., and Saccani, N. 2020. "Digital Servitization in Manufacturing: A Systematic Literature Review and Research Agenda," *Industrial Marketing Management* (89), pp. 278-292.

Patrício, L., Fisk, R. P., Falcão e Cunha, J., and Constantine, L. 2011. "Multilevel Service Design: From Customer Value Constellation to Service Experience Blueprinting," *Journal of service Research* (14:2), pp. 180-200.

Patrício, L., Grenha Teixeira, J., and Vink, J. 2019. "A Service Design Approach to Healthcare Innovation: From Decision-Making to Sense-Making and Institutional Change," *AMS Review* (9:1), pp. 115-120.

Patrício, L., Sangiorgi, D., Mahr, D., Čaić, M., Kalantari, S., and Sundar, S. 2020. "Leveraging Service Design for Healthcare Transformation: Toward People-Centered, Integrated, and Technology-Enabled Healthcare Systems," *Journal of Service Management* (31:5), pp. 889-909.

Payne, A., Frow, P., and Eggert, A. 2017. "The Customer Value Proposition: Evolution, Development, and Application in Marketing," *Journal of the Academy of Marketing Science* (45:4), pp. 467-489.

Pham, D.-M., and Stuerzlinger, W. 2019. "Is the Pen Mightier Than the Controller? A Comparison of Input Devices for Selection in Virtual and Augmented Reality," *25th ACM Symposium on Virtual Reality Software and Technology*, pp. 1-11.

Pine, B. J., and Gilmore, J. H. 1998. "Welcome to the Experience Economy," *Harvard business review* (76), pp. 97-105.

Poushneh, A., and Vasquez-Parraga, A. Z. 2017. "Discernible Impact of Augmented Reality on Retail Customer's Experience, Satisfaction and Willingness to Buy," *Journal of Retailing and Consumer Services* (34), pp. 229-234.

Prestes Joly, M., Teixeira, J. G., Patrício, L., and Sangiorgi, D. 2019. "Leveraging Service Design as a Multidisciplinary Approach to Service Innovation," *Journal of Service Management* (30:6), pp. 681-715.

Rauschnabel, P. A., Felix, R., and Hinsch, C. 2019. "Augmented Reality Marketing: How Mobile Ar-Apps Can Improve Brands through Inspiration," *Journal of Retailing and Consumer Services* (49), pp. 43-53.

Rauschnabel, P. A., He, J., and Ro, Y. K. 2018. "Antecedents to the Adoption of Augmented Reality Smart Glasses: A Closer Look at Privacy Risks," *Journal of Business Research* (92), pp. 374-384.

Riar, M., Korbel, J., Xi, N., Zarnekow, R., and Hamari, J. 2021. "The Use of Augmented Reality in Retail: A Review of Literature," *54th Hawaii International Conference on System Sciences.,* T.X. Bui (ed.), Kauai, Hawaii, USA: IEEE Computer Society.

Ryynänen, S., and Uusisalmi, R. 2021. "Technological Innovations through Digital Service Design in Hospital Districts," *International Journal of Innovation in the Digital Economy (IJIDE)* (12:2), pp. 48-62.

Sangiorgi, D., and Prendiville, A. 2017. *Designing for Service: Key Issues and New Directions*. Bloomsbury Publishing.

Smink, A. R., Frowijn, S., van Reijmersdal, E. A., van Noort, G., and Neijens, P. C. 2019. "Try Online before You Buy: How Does Shopping with Augmented Reality Affect Brand Responses and Personal Data Disclosure," *Electronic Commerce Research and Applications* (35), p. 100854.

Sun, C., Fang, Y., Kong, M., Chen, X., and Liu, Y. 2022. "Influence of Augmented Reality Product Display on Consumers' Product Attitudes: A Product Uncertainty Reduction Perspective," *Journal of Retailing and Consumer Services* (64), p. 102828.

Tan, Y.-C., Chandukala, S. R., and Reddy, S. K. 2022. "Augmented Reality in Retail and Its Impact on Sales," *Journal of Marketing* (86:1), pp. 48-66.

Tarafdar, P., Leung, A., Yue, W. T., and Bose, I. 2019. "Impact of Immersive Interface Design on Consumer Perceptions During Online Product Presentation," *40th International Conference on Information Systems (ICIS 2019)*: Association for Information Systems.

Teixeira, J., Patrício, L., Nunes, N. J., Nóbrega, L., Fisk, R. P., and Constantine, L. 2012. "Customer Experience Modeling: From Customer Experience to Service Design," *Journal of Service management* (23:3), pp. 362-376.

Teixeira, J. G., Patrício, L., Huang, K.-H., Fisk, R. P., Nóbrega, L., and Constantine, L. 2016. "The Minds Method: Integrating Management and Interaction Design Perspectives for Service Design," *Journal of Service Research* (20:3), pp. 240-258.

Tuominen, P. P., and Ascenção, M. P. 2016. "The Hotel of Tomorrow: A Service Design Approach," *Journal of Vacation Marketing* (22:3), pp. 279-292.

Vargo, S. L., and Lusch, R. F. 2004. "Evolving to a New Dominant Logic for Marketing," *Journal of Marketing* (68:1), pp. 1-17.