Human-Computer Interaction in Physical Retail Environments and the Impact on Customer Experience: Systematic Literature Review and Research Agenda

Gabriele Obermeier[(✉)] and Andreas Auinger[(✉)]

University of Applied Sciences Upper Austria, Steyr, Austria
{gabriele.obermeier,andreas.auinger}@fh-steyr.at

Abstract. Shopping in the traditional retail environment is increasingly being influenced by technologies enabling human-computer interaction. Scientists, as well as retailers, are interested in examining the effects of interactive in-store technologies on customer behavior. An abundance of researchers have examined customer acceptance of interactive technologies, but little is known about its effects on the customer's experience and its consequences, such as satisfaction, loyalty, and purchase intention. Following the guidelines for a systematic literature review, this article gives an overview of empirical studies conducted on interactive technologies in traditional brick-and-mortar retail stores. Based on that review, this paper provides a research agenda for future work on interactive in-store technologies and their impact on customer experience and suggests possible research methods for empirical studies in the field of human-computer interaction.

Keywords: Customer experience · Interactive technology · Digital retail · Research methods

1 Introduction

In recent years, the retail industry has experienced increased pressure from competitors, not only in the traditional retail environment but also from online market players. As the online and offline retail worlds converge, traditional brick-and-mortar stores "will change into connected stores, serving as places for inspiration, experiences, showcases, and service centers" (p. 17) as Jongen [1] claims. According to a recent study by Capgemini Consulting [2], customers expect the same customer experience from traditional retail stores as from online shops. KPMG [3] state in their 2018 retail industry trend report that "[t]he customer experience is more important than ever as retailers are striving to differentiate themselves in a challenging and crowded market" (p. 4). The topic of technologies in the retail industry has been even more discussed in research and practice since Amazon's announcement of plans to open more than 3,000 self-service stores by 2021 [4]. In science, Grewal et al. [5] reveal the main topics of the future of retail, and Priporas et al. [6] conceptualize a future agenda for digital retailing. All parties agree on the central aspect: Customers demand a superior and engaging

experience in an interactive retail environment [6–12]. According to Roy et al. [11], the digital retail environment can be defined as "[a]n interactive and connected retail system which supports the seamless management of different customer touchpoints to personalize the customer experience across different touchpoints and optimize performance over these touchpoints" (p. 259).

Retailers and brands increasingly use technology to provide an engaging shopping experience in the physical retail environment [13]. For example, self-service checkout terminals can be found in almost every supermarket branch. This allows users to quickly scan and pay for products on their own [7] or easily retrieve detailed product information by scanning the product's barcode [9]. Willems et al. [12] address three major benefits of technology in retail stores: beyond (1) time and cost savings, customers gain (2) utilitarian as well as (3) hedonic shopping value. First, using self-service technologies helps customers to save time because they can proceed without spending time waiting for a salesperson or queuing at the service counter [9, 11]. Moreover, it is possible to monitor and control expenditure in the store [8]. Second, customers derive utilitarian benefits from a shopping trip when accomplishing an intended task [10], such as gaining more knowledge about the product and comparing different variations [12]. Third, interactive in-store retail technology in combination with fun and engaging tools enhance the customer's hedonic shopping value. For example, smart mirrors with augmented reality [10] or monitors with gamification mechanisms [14] provide such appealing experiences.

An abundance of researchers has examined the user acceptance of new technologies in a digital retail environment by using well-known theories, such as the theory of reasoned action (TRA) [15] or the technology acceptance model (TAM) [16, 17]. For example, Roy et al. [11] investigated the moderating effect of technology readiness on the customer's attitude and behavioral intentions when using smart technologies, such as smart checkouts, personal shopping assistance, and augmented reality. Other researchers examined the application, functionality, and adoption of RFID (Radio Frequency Identification) equipped retail stores in a complex field study [18]. Willems et al. [12] extensively reviewed and summarized 54 digital retail technologies from various manufacturers along the customer's path of purchase.

Following Parasuraman's [19] pyramid model of marketing services, retailers need to consider that technology mediates nearly any communication between the three dimensions involved in the physical retail environment: the company, its employees, and the customers. Human-computer interaction is intensively discussed in the literature of retailing, consumer services, business, and information systems. However, empirical findings are limited considering the impact of interactive technologies in physical retail stores on the customer's experience and its consequences, such as customer satisfaction [7, 10, 14, 20, 21], loyalty [22], intention to reuse [9], (re)patronage [10, 14, 23–25], word-of-mouth [26], and purchase intention [27]. In consideration of these criteria, this paper presents a systematic literature review based on 15 identified empirical studies.

The structure of this paper is organized as follows: Sect. 2 presents the methodology of this work, which is based on the guidelines for systematic literature reviews of vom Brocke et al. [28]. In the following Sect. 3, we conduct the review by defining the

review scope, describing the literature search, and how the studies are analyzed and synthesized. Afterward, Sect. 4 presents the results of the systematic literature review, categorized by technology usage, research methods, and the applied retail context. The same classification is adopted to discuss the future agenda and further research possibilities (Sect. 5). Finally, the conclusion can be found in Sect. 6.

2   Methodology

This work follows the guidelines for conducting systematic literature reviews in the field of information systems (IS) proposed by vom Brocke et al. [28]. The authors claim that a literature analysis must be "comprehensibly described" as researchers should be able to use the same data for their own research purposes. By analyzing previous work of IS researchers, vom Brocke et al. [28] found that most of the reviewed publications leave gaps in the process documentation. Therefore, the guidelines on systematic literature reviews have been developed and are now used in this present work. The authors define five phases to the literature review: (1) scoping the review, (2) conceptualizing the topic, (3) searching appropriate literature, (4) analyzing and synthesizing identified literature, and (5) stating the review's contributions to a research agenda.

In the first phase, researchers should define the scope of their literature review. The use of the six characteristics of Cooper's [29] taxonomy, which highlight some of the central aspects of the review, is recommended. In the second phase, vom Brocke et al. [28] state that researchers must provide key definitions relevant to the topic. Therefore, we describe the concepts of customer experience and interactive technologies in physical retail stores. The third phase reveals the exact process of the peer-reviewed literature search and provides the keywords used in digital libraries. Moreover, this phase outlines the including and excluding criteria as well as the total number of recognized publications. After we have identified the relevant literature, we applied phase four and analyzed the studies in relevance to the technologies, the research methods and the retail context. The fifth phase of vom Brocke et al.'s [28] guidelines comprises the research agenda and presents several approaches and questions for future research.

This present work contains all five phases of the systematic literature review of vom Brocke et al. [28] and accumulates the current state of empirical research on interactive technologies in traditional brick-and-mortar stores.

3   Systematic Literature Review

The following section will outline in detail the focus of our systematic literature review by defining the review scope and the key terms, describing the literature search process and how we conducted the analysis.

3.1   Definition of the Review Scope

We defined the taxonomy of our search query with reference to Cooper [29], who proposed to classify the review to the following six major characteristics which are shown in Table 1: goal, focus, organization, perspective, audience, and coverage. (1) Our *goal* is to integrate and summarize empirical studies (journals and conference proceedings) on the customer's experience arising from the use of interactive retail technologies. (2) Therefore, the *focus* is on the research methodology (qualitative, quantitative, or mixed) and the different physical retail environments (e.g., supermarket, fashion store) in which the studies have been applied. (3) The *organization* of the review follows a conceptual process in which the studies are initially organized according to the technologies' application scenario (e.g., self-service, shopping assistance, store atmospherics). Afterward, we categorized the reviewed articles by the research methods used (e.g., laboratory or field experiments, surveys). (4) A neutral *perspective* is chosen to summarize and synthesize relevant empirical studies, but no critical assessment of the research is conducted. (5) The relevant *audience* for this paper primarily consists of researchers in the field of IS and human-computer interaction. (6) Finally, we *cover* an exhaustive literature review on empirical studies examining the use of interactive technologies in physical retail environments in terms of customer experience and its consequences, such as purchase intention and loyalty.

Table 1. Scope of Review (highlighted in Grey) using the Taxonomy proposed by Cooper [29]

Characteristic	Categories			
(1) **goal**	Integration	Criticism		Central issues
(2) **focus**	Research outcomes	Research methods	Theories	Applications
(3) **organization**	Historical	Conceptual		Methodological
(4) **perspective**	Neutral representation		Espousal of position	
(5) **audience**	Specialized scholars	General scholars	Practitioners/politicians	General public
(6) **coverage**	Exhaustive	Exhaustive and selective	Representative	Central/pivotal

3.2   Conceptualization of Topic

Following the guidelines of vom Brocke et al. [28], the key terms and the theoretical background of customer experience and interactive technologies will be provided.

Customer Experience. In the 1960s, researchers started to investigate the customer's decision-making process and the phenomena influencing customerbehaviorin physical retail stores [30]. Holbrook and Hirschman [31] were among the first to recognize the consumer's "pursuit of fantasies, feelings, and fun" (p. 132), discussing emotionally rather than rationally driven customer choices. Ever since, however, marketing literature appears to develop from understanding the customer's behavior to creating a

customer-centric experience [30]. The work of Verhoef et al. [32] defines customer experience as a multidimensional construct that is "holistic in nature and involves the customer's cognitive, affective, emotional, social and physical responses to the retailer" (p. 32). Furthermore, the authors argue that "[t]his experience is created not only by those elements which the retailer can control (e.g., service interface, retail atmosphere, assortment, price) but also by elements that are outside of the retailer's control (e.g., influence of others, purpose of shopping)" (p. 32). Several researchers have investigated that the customer experience influences satisfaction and loyalty, both being crucial preconditions for a higher rate of shopping visits, higher spending and the retailer's growth [8, 30]. Recently, the consideration of technology in multi- and omnichannel environments has played a major role in enabling retailers to provide a superior customer retail experience [8, 30].

Interactive Technologies. The use of interactive technologies in the retail sector describes the communication between the customer and the retailer (the company and its employees) based on internet-enabled devices. The goal is to respond to customer needs by providing the requested service without any human interference [33]. Researchers intensively investigate self-service technologies such as order terminals and checkout systems, which allow users to experience service support or accomplish tasks without the involvement of service employees [34]. Interactive technologies offer a more engaging and superior shopping experience for customers in retail stores and beyond, by connecting channels with each other, such as interactive fitting rooms that would link to social networks [35]. Poncin et al. [10] claim that new digital technologies are key to enhancing the appearance of physical retail stores and lead to higher visitor rates as well as increased sales. Therefore, the use of interactive technologies results in an enhanced customer retail experience [10], strengthens customer engagement and generates a competitive advantage [36].

3.3 Literature Search

The search query covered interactive technologies (using the keywords "technology" or " technologies" or "smart" or "interactive" or "digital") in the context of customer experience (using the keywords "experience" and ("shopping" or "retail" or "customer" or "customers" or "consumer" or "consumers"). We included all types of English publications (e.g., research articles, proceedings papers, etc.) in the field of information and communication technology and business, the latter comprising the subcategory of marketing [12]. Based on the approach of Willems et al. [12] and due to the high-speed development of technologies, the ideal timeframe to review innovative in-store technologies covers 8.5 years, hence this present review contains scientific publications from July 2010 until December 2018. The search was conducted in the libraries of ScienceDirect (total number of results: 403; the number of results after the first review: 50; the number of results after the second review: 20), Web of Science (199; 55; 21) and Springer's disciplines of business and management (600;20;0) and computer science (263;14;0). In order to identify retail-related publications, we first reviewed the title and keywords and second, excluded duplicates and analyzed the abstracts of 133 remaining publications. Subsequently, we used these publications to conduct a forward

and backward search according to vom Brocke et al. [28]. Finally, we identified 15 studies that met our criteria, having investigated the use of interactive technologies and their influence on the customer's experience in brick-and-mortar retail stores.

3.4   Literature Analysis and Synthesis

According to the guidelines of systematic literature reviews, we organize and systematically analyze the papers collected in the literature review on the technologies' application scenario, methodology and research design, as well as on the retail context.

Application Scenario. We classify the identified empirical studies by the application scenario. First, we summarize self-service checkout technologies. Second, we group shopping assistance technologies, such as smart fitting rooms and self-scanning systems. The third group comprises all technologies influencing the store's atmosphere, such as smart mirrors and interactive window displays.

Methodology and Research Designs. The consideration of research methodologies (qualitative, quantitative, and mixed) and designs (e.g., experiments, focus groups, and surveys), which have been used to conduct research on the interaction with technologies in physical retail stores.

Retail Context. Finally, the literature review will show in which retail contexts the empirical investigations were conducted, such as supermarkets, fashion, or do-it-yourself (DIY) retail stores.

4   Results in the HCI Context

In this section, we provide the results of our systematic literature review. We follow the procedure proposed by vom Brocke et al. [28]. First, we describe the studies used in terms of interactive technologies and their influence on the customer experience in brick-and-mortar retail stores. Second, we report the research methodology used and third, the retail context in which the 15 empirical studies were conducted.

4.1   Interactive Technologies and Their Impact on Customer Experience

Self-service Checkout Technologies. The majority of the identified papers focus on the evaluation of self-service checkout technologies. Retailers increasingly implement checkout terminals in their physical retail environments, which allow customers to quickly scan and pay for products on their own instead of queuing at the cashier desk [7, 9, 20]. In addition to the speed advantage, researchers involve further attributes to determine the perceived service quality of self-checkouts [23, 37]. These attributes include the ease of use, reliability, fun/entertainment, and perceived control. Another approach to measuring the service quality of self-checkout systems is to use standard scales, such as the SSTQUAL [22], which consists of seven dimensions (functionality, enjoyment, security, assurance, design, convenience, and customization). Reliability (individual and as a part of functionality) has been identified as a main [22] and even

the most important [23, 37] driver of the customer's perceived service quality of self-service checkout technologies. Consequently, service quality positively influences customer loyalty [22], purchase intention [37], intention to reuse [9, 38], and repatronage intention [23], directly as well as through the mediating effect of customer satisfaction. On the other hand, if customers are forced to use self-service checkout systems and gain the feeling of unfairness and dissatisfaction (due to no/little technology readiness or the need for human interaction), customers will be more likely to spread negative word of mouth, reduce future spending, and develop intentions to become the competitor's customer [26]. Therefore, researchers suggest that employees should personally help to introduce new technologies to customers in order to create a positive customer experience, which will in turn, lead to higher satisfaction with the self-service checkout technology as well as with the store [7]. Satisfaction is considered one of the main drivers of the retailer's revenue performance, store appeal, patronage, positive word-of-mouth, and customer loyalty [7, 12, 38, 39].

Shopping Assistance. Self-scanning devices can be used with barcodes of products in order to receive enhanced product information, ratings from other customers, and recommendations for complementary products [7]. Moreover, the additional decision support features allow customers to manage and control their spending in the store [7], gain detailed product information, compare prices, check recommendations and ratings by other consumers [9, 13]. The advantages of self-service technologies enhance customer experience and subsequently overall satisfaction with the store [7]. However, retailers need to consider that the interpersonal service quality and the service quality of the self-scanning technology moderates the relationship between the customer and retail patronage [25]. This can be critical when the need for human interaction and technology anxiety are high.

Smart fitting rooms can support product choices by providing additional product information and recommendations [27]. The technology in the background of smart fitting rooms is the combination of RFID chips attached to the price tags of fashion articles and sensors installed in fitting rooms [18, 27]. The sensors are able to detect the products and display detailed information on the monitor, such as the brand's name and logo, as well as the price of the product [27]. If retailers provide details of their security policy, customers appreciate the possibility to enter personal data at the monitor for an enhanced and more personalized experience. This study shows, that especially in the case of low-quality brands, it is advisable to provide data security disclosure. Moreover, higher interaction and fewer security concerns lead to higher satisfaction and result in stronger purchase intentions [27].

Multimedia kiosks in physical retail stores deliver entertaining information and allow customers to perform transactions [21]. Research shows that customers gain the feeling of perceived control and convenience by performing tasks on their own, which consequently results in satisfaction and the intention to reuse the technology [21].

Store Atmospherics. Smart mirrors are considered as store atmospherics and are based on the technology of augmented reality [40]. A human-sized touch-screen monitor pictures the person standing in front of it. Customers are able to virtually try on digital clothing items by selecting and moving them on the touch-screen [41]. The holistic perception of a play store atmosphere can be supported by game terminals and

magic mirrors where children can engage in an interactive playing scenario [10]. The positive evaluation of store atmospherics influences the customer's perceived shopping value and positive emotions, which result in higher customer satisfaction and greater likelihood of future patronage and recommendation [10]. The gamification aspect also works for adults by stimulating positive feelings and enhancing the experience at the moment of play [14]. The results of the study showed, that the combination of gamification and augmented reality affects the likelihood of future patronage but cannot enhance the quality of the overall experience.

Besides in-store atmospherics, researchers examined the effect of exterior atmospherics by installing interactive window displays [42]. The main purpose of installing interactive screens in the shop window is to attract the customer's attention and to

Table 2. Results of the literature review conducted in accordance with the guidelines of vom Brocke et al. [28]

#	Authors	Year	Interactive technology	Group (Sec. 3)	Methodology	Research design	Retail context
1	Djelassi et al.	2018	Self-scanning & checkout	1 & 2	Quan	Field experiment	Supermarket chain
2	Fernandes, Pedroso	2017	Self-checkout	1	Quan	Field experiment	Supermarket chain
3	Kallweit et al.	2014	Self-scanning	1 & 2	MM	Lab. experiment	DIY store
4	Lecointre-Erickson et al.	2018	Interactive window display	3	Quan	Survey	Tourist bureau
5	Lee, Yang	2013	Self-scanning	2	Quan	Survey	Grocery store
6	Mukherjee et al.	2018	Smart fitting room	2	Quan	Lab. experiment	Fashion store
7	Orel, Kara	2014	Self-checkout	1	Quan	Interview	Supermarket chain
8	Pantano	2016	Interactive window displays	3	Qual	Focus group interview	Retail stores
9	Penttinen et al.	2014	Self-checkout	1	Quan	Survey	Supermarket chain
10	Poncin, Mimoun	2014	Magic mirror, game terminals	3	Quan	Lab. experiments	Toy store
11	Poncin et al.	2017	Augmented reality	3	MM	Lab experiment	Store for accessories
12	Siah, Fam	2018	Self-checkout	1	Quan	Survey	Supermarket chain
13	Wang et al.	2013	Self-checkout	1	Quan	Survey	Grocery store
14	Wang	2012	Multimedia kiosks	2	Quan	Field study	Convenience store chain
15	White et al.	2012	Self-checkout	1	Quan	Survey	Grocery store

motivate them to enter the store. Once the customer recognizes the display, it provides hedonic impressions (e.g., pictures and videos of white beaches) and presents utilitarian information (e.g., text descriptions of a travel destination), as well as insights into what the customer can expect in the store [42]. Obviously, the retail context is significant, as interactive window displays have a strong negative effect on perceived pleasure in terms of tourist travel bureaus, which sell local goods [24]. However, for tourist travel shop contexts only, the study found that customers are seeking for a high-contact and task-oriented shopping experience.

4.2 Methodology and Research Designs

We reviewed 15 empirical studies about interactive technologies and their influence on the customer experience in brick-and-mortar retail stores. As shown in Table 2, twelve publications used a quantitative questionnaire (quan), two used a mixed methods approach (MM) and one author conducted a focus group interview, which is considered a qualitative method (qual). Most of the studies used online or offline surveys, laboratory or field experiments as research design.

4.3 Retail Context

The results of the literature review indicate that nine of 15 studies conducted their research in food retail environments. In the case of non-food retail scenarios, researchers used laboratory environments or surveys. No field experiment has yet been conducted in a non-food retail store, such as a fashion, decoration, or sports shop.

5 Discussion and Research Agenda

The research agenda of this systematic literature review provides an overview of empirical studies which have examined technologies used for human-computer interaction in brick-and-mortar retail stores. In the following section, we demonstrate research gaps and promote various possibilities for further research.

5.1 Interactive Technologies

From the practitioners' and researchers' perspectives, we see a high level of interest in the examination of customers behavior with interactive technologies in physical retail stores, as these usually require high expenditure and investment. Researchers should support retailers by examining how or even whether customer experience can be enhanced in specific retail environments through the installation of human-computer interaction enabling technologies. For example, interactive digital shopping walls allow customers to order products on a touch-screen monitor, which will later be delivered to the customer's home or prepared for in-store pick up [12]. Modern checkout-processes include mobile payment as well as biometric authentication payment technology, such as face recognition or fingerprint [12]. Amazon presented a cashierless self-service checkout system called "Amazon Go" [5]. In Amazon's case, store visitors identify

themselves at the entrance by scanning a code in their smartphone app. Customers can pick up all the items they want and leave the store without any interference, either from a salesperson or a checkout terminal. According to Grewal et al. [5], this high-tech self-service technology, supported by a combined system of computer vision, sensor fusion, and deep learning technology, is what customers expect from shopping in the future. Artificial intelligence (AI), such as chatbots and AI-powered conversational interfaces, offers a whole new research field in the field of human-computer interaction and customer behavior. For example "Roberta" is a service-robot, working with chatbot technology, implemented to welcome customers, collect their inquiries as well as arrange appointments with a human service manager in the retail store [43].

Further investigation of the impact of interactive in-store technologies is recommended for several reasons. First, retailers are aware of the need for action to enable a superior and engaging customer experience in traditional brick-and-mortar stores. Therefore, scientifically proven results on the effects of technology on customer behavior are highly relevant for retailers. Second, the field of human-computer interaction in retail stores offers various research possibilities due to the number of different interactive technologies and retail sectors. Third, influence factors such as age, gender, countries, technology readiness, education, and motivation to shop, can determine in which retail environment the application of interactive technologies is recommended or discouraged.

5.2   Methodology and Research Designs

The great majority of the empirical studies in this review used quantitative questionnaires to measure the customer's post-purchase experience evoked by using interactive technology in physical retail stores. Most of these studies were conducted in a laboratory or field experiment, as well as in online or offline survey scenarios. Quantitative questionnaires deliver numerical results, which researchers can easily use to calculate the influence of one variable on another, generalize and compare results, reuse the data for other research purposes, etc. [44]. However, on the other hand, quantitative results neither provide a deep insight into the topic nor reveal strong evidence for causal relationships [44]. Moreover, the feedback is based on the customer's self-assessment of the human-computer interaction. Due to possible judgment errors, the self-evaluation might lead to deviations between the actual behavior and the answers given in the questionnaire [45]. Therefore, we suggest considering alternative measurement techniques from the field of Neurobiological Information Systems (NeuroIS), such as the ones below. These methods are usually applied in experimental settings [46] and allow researchers to identify responses to stimuli based on the nervous system [47].

- Eyetracking records the customer's eye movements and where they focus on. The results are usually aggregated and displayed on a heat map, which reveals which points were of high or low interest. Additionally, eyetracking can be combined with observation data or the "think aloud" technique in which participants comment on what they are doing, during or after the experiment. [48]

- Electrodermal (or galvanic skin response) measurement is a technique from the field of psychophysiology. It measures the sweat glands in the palms of the hands and soles of the feet. It is possible to examine various activities with the electrodermal measurement method: arousal, stress, coping, information processing or decision-making. [49]
- Electroencephalography (EEG) measures the electrical brain activation from the surface of the scalp. [50] A similar technique is called "functional magnetic resonance imaging" which measures brain activity by recognizing which areas are more active than others according to bloodstreams [47]. The measurement technique of EEG is often applied to investigate the performance of cognitive tasks with human-computer interaction system of an individual and serves as knowledge basis for the development of such systems [51].

According to Riedl and Léger [46] "[i]t is very common to use psychometric measures (i.e. surveys) in addition to neurophysiological measures in NeuroIS studies" (p. 108). Although one could assume that neurobiological measurements are more objective or reliable, they also have their weaknesses. This is, for example, highlighted by Riedl et al. [52] who state, that we should not assume that "neurobiological measurements are (necessarily) stable across repeated measurement and hence (perfectly) reliable [as] they are not" (p. xi). Various circumstances might influence the body's measured values, such as situational factors (e.g., the participant is nervous because of the laboratory environment) or the experience and skill of the respective experimenter [52]. Other constructs which need to be considered with neurobiological measurements in empirical research of information systems are validity, sensitivity, diagnosticity, objectivity, and intrusiveness as proposed and discussed in detail by Riedl et al. [52]. Besides the neurobiological approach, researchers use cardiovascular or biochemical methods to examine phenomena in empirical studies. Cardiovascular measures assess the participant's heart rate or blood pressure, which can be indicative of a stressful situation, whereas biochemical methods ascertain the hormone levels (e.g., cortisol) in saliva, blood or urine [53].

Technology development in the retail environment also leads to new measurement techniques for customer behavior in retail stores and evaluates implications to enhance the customer's experience. Various customer tracking possibilities are enabled through the customer's smartphone and near field communication (NFC) technology, global positioning systems (GPS) or wireless internet connection (Wi-Fi) in the local area network (LAN) [33]. These technologies are already commonly used in many retail stores and provide information on the customer's behavior. Attention estimation measure methods use camera or sensor (e.g., infrared) technology to assess if customers are in the state of "ignoring", "watching" or "ready to interact" with a stimulus [54]. Video observation is increasingly used to detect in-store shopping behaviors, such as walking (e.g., direction, speed, paths, stopping, queuing, etc.), the product choice (browsing, touching, holding, buying, etc.), socializing (people on the phone, with personnel or other customers, etc.), assistance behaviors (smartphone consultation, using hand-held scanners, using a shopping list, etc.), or other behaviors (redeeming coupons, eating, parking carts and baskets, etc.) [55]. Emotion recognition by the customer's facial expression is based on video technology, such as Microsoft's Kinect

v2 [56] or Noldus' FaceReader [57]. These devices are able to recognize the customer's head pose and emotions, such as happiness, anger, surprise, or a neutral facial expression [57]. The data are used to inform managerial decisions, for example towards the products, layout, and atmospherics in the physical retail store [56, 57].

These gaps should be addressed in future works by combining both, technology-based and traditional research methods, to gain a holistic view of the effects of human-computer interaction in physical retail stores. "Roberta" the before mentioned service-robot does not collect the customer's inquiries, but analyses the environment with integrated cameras and sensors [43]. Future research could investigate the customer's behavior by analyzing the data logs of chatbot "Roberta" and combining them with a quantitative questionnaire after the customer's experience in the store.

5.3   Retail Context

So far researchers have not yet examined interactive retail technologies in a non-food store field experiment. It can be assumed that most studies used self-checkout systems in a food store environment as this application scenario is already well established in practice. Future research questions should focus on the in-store human-computer interaction in different retail contexts, especially those that face increasing pressure coming from online commerce, such as fashion, active wear, sports equipment, cosmetics, and accessories.

6   Conclusion

The field of human-computer interaction has seen that investigating interactive technologies in a physical retail environment results in a better understanding of the customer's experience and its consequences. These consequences refer to constructs such as customer satisfaction, loyalty, intention to reuse, patronage, word-of-mouth, and purchase intention. Our systematic literature review reveals first, that researchers should focus on the examination of interactive in-store technology to support retailers in their decisions on the appropriate choices in their physical retail stores. Second, the identified studies are mainly concerned with self-service checkout services examined by the customer's self-assessment through quantitative questionnaires. We propose to extend the scientific literature on the customer's in-store experience by using neuro-biological, cardiovascular or biochemical measure methods complementary to traditional research methods in laboratory experiments, such as surveys or interviews. Moreover, using technologies (e.g., video cameras) to observe the customer's behavior with in-store technologies (e.g., smart mirrors) could also offer a deeper insight into the customer's perception of the experience in physical retail environments. Finally, our work proposes to cover many different retail scenarios, beyond food retail, such as fashion and cosmetics. In summary, researchers are encouraged to conduct studies on retail technologies by applying it to different technologies, research methods, and retail industries.

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