

A critical review : Using Interactive Technology in the Retail Stores

The Impact of Interactive Technologies on Retailing Experiences and Space Efficiency

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Abstract: Retail stores are defined as outlets where retail activities take place. They include all stores, from kiosks and small grocery stores to supermarket chains and shopping malls that sell products and services to end consumers for personal and home use. Although online stores existed before the COVID-19 pandemic, their widespread expansion came following the precautionary measures and lockdowns taken by many countries to address the pandemic. The number of online stores has witnessed a steady increase. These stores provided a unique interactive shopping experience for customers online. After the pandemic, physical stores had to adapt to these changes and offer the interactive and engaging features provided by online stores to achieve a competitive advantage. Physical stores have leveraged interactive digital technology to achieve this. These modern technologies offer interactive features that can provide an engaging and enjoyable shopping experience. Interactive technology impacts not only the customer experience but also the design of physical stores. This technology potentially reduces the space required for product display or storage, or for trying on clothes in fashion stores. This improves the efficiency of interior spaces, creating open, interactive spaces without visual barriers. This review aims to determine the nature of interactive technology in retail stores and its impact on store efficiency, and space design, that adopted a critical review method. Also indicates the importance of these technologies in improving customer experience and enhancing the space design of retail stores.

Keywords: Interactive Technology, Retail Stores 'Design, Shopping Experience, Interactive Spaces.

I. Introduction

Physical retail stores are a component of urban environments that affect people's quality of life and well-being. These stores play an essential role in shaping the social and economic lives of the urban environment. In addition, they also affect the environment. Moreover, retail stores are an attraction point in the city. Thus, retail keeps the urban environment vibrant, livable, and conducive to social interactions (Caboni, 2020).

Physical retail is witnessing increased competition, attributed to rising rental costs, and the proliferation of online retail platforms and websites. These challenges have been exacerbated by the COVID-19 pandemic and lockdowns, contributing to an increase in online retail customers. Physical stores are among the most popular types of retail stores. However, they must focus on the added value they provide to the customer experience inside these stores (Wang et al., 2023).

To create a distinctive shopping experience, retailers have embraced digital technology and have introduced many ideas to become part of the customer experience (Archibald et al., 2020; Bonetti & Perry, 2017). Studies Lemon & Verhoef, 2016; Hagberg et al., 2017) have shown that modern technologies have contributed to shaping the new retail store setup layout. Moreover, retailers have used these technologies to attract customers, enhance their satisfaction, build strong relationships, and improve their experience (Bodhani, 2013). Although integrating technology into retail is not new, today it is used on a more sophisticated scale, whether in the front-end of retail stores or in activities that confront customers during the purchase process (Archibald et al., 2020).

There are multiple options for incorporating digital technology into retail design (Wang et al., 2023). These technologies have reformed the retail store setup layout. By integrating it into the design, these stores will become places that provide customers with a distinctive shopping experience. Interactive technology is a digital technology that can have many advantages to the user experience in physical retail stores (adakkepatt et al., 2010).

Two aspects are interwoven in the definition of interactive technology: interactive technology varies from one technology to another in terms of its type of interactivity. The degree of interactivity of some technologies is high, whereas others are low (Bolton & Saxena-Iyer, 2009). Highly interactive technologies go further to depict active and dynamic interactions that are mostly visual representations of products. For instance, augmented reality (AR), which is a technology provides users with an immersive interactive experience based on virtual artificial elements that simulate the real environment (Shankar et al., 2021), and VR technologies which is technology that stimulates the senses in a way that makes the digitally created virtual world appear real (Nesamalar & Ganesan, 2012) will help customers previewing how a certain furniture will look at their homes

before purchasing it (Bonetti et al., 2018). On the opposite end of the continuum, low-interactivity technologies exist, which serve more advertising, marketing, or operational purposes than engaging with customers and enhancing their experiences. For example, digital signage displays marketing materials, and digital payment systems enhance the operational aspect of a store and reduce the time a customer spends in a checkout queue (Pantano & Vannucci, 2019; Cervantes & Franco, 2020). Simultaneously, it varies according to the degree to which the individuals interact. In many web-based tasks, reciprocal interactions exist between man and man (e.g., person-to-person communication), between man and technology (e.g., interactive kiosks), or between machines (e.g., when a computer interacts with a website to make an order) (Vadakkepatt et al., 2010).

Interactive technology contributes to the retail industry in several ways. It helps to analyze customer behavior and understand customer needs. For example, merchants use loyalty cards to track purchase movements, timing, and patterns, which deepens their understanding of customer behavior and purchasing trends (Zhang et al., 2014). Moreover, merchants primarily use interactive technology to improve customer experience and satisfaction; however, they offer advantages in employee interaction with the store and their ability to serve customers (Möller-Herm & Herm, 2013). Furthermore, using interactive technology in retail is an attempt to accommodate the increasing use of smart devices, even as the number of physical retail stores increases. Therefore, integrating interactive technology into the design of these stores can provide customers with distinctive digital experiences consistent with their needs, which positively reflects the brand's mental image and competitive advantage (Siregar & Kent, 2019). The experience merges physical and digital environments through constant and mutual transformation between the physical and digital worlds and between digitalization and embodiment. Thus, the customer experience becomes a rich, enjoyable, entertaining, and memorable experience that strengthens the connection between customers and the brand (Bonfanti et al., 2023).

With the rapid acceleration of interactive technology, retail has used many of these technologies. The illustrations include augmented reality (AR), (VR), digital kiosks, digital displays, touchscreens, QR codes, magic mirrors, and virtual fitting rooms. (AR) is an immersive virtual environment (IVE) that provides immersion in the real world through digital content. In other words, it offers a high level of interactivity between the user and reality in the digital environment, and this interaction depends on different sensory media (Archibald et al., 2020). In retail, VR technology provides consumers with a visualization of products in the context of reality. It allows them to zoom in and rotate the product to view it from different angles and in multiple colors. Consumers can examine a product and obtain the information helping them to make a purchase decision. In addition, this technology transfers the user's facial expressions and appearance to integrate them with virtual objects, thereby verifying their fit. Thus, the shopping experience is a first-person perspective (Huang & Liao, 2015).

VR is another type of immersive environment. It is a simulation performed using specialized devices that process data and then enter them into technological tools that create integrated environments that can be navigated, viewed, and controlled (Gebczynska-Janowicz, 2020). Through V.R, consumers can better examine products (Verhagen et al., 2016). In crowded retail stores, crowding can negatively affect the customer experience. However, V.R provides a way to disconnect from reality and immerse oneself in an enjoyable, comfortable, and product-oriented environment, which improves the shopping experience (Kerrebroeck et al., 2017).

However, some retailers use digital kiosks to improve operational efficiency. It is equipped with touch screens, machine learning, artificial intelligence, and the Internet of Things. Compared to traditional kiosks, it creates unique experiences for consumers and improves the workflow (Vennapusa et al., 2018). Sachani (Sachani, 2018) indicated that traditional kiosks help automate repetitive processes such as payment, inventory management, and product inquiries. They also improve and accelerate service quality and simplify and facilitate procedures. Consequently, employees become more able to focus on complex operations and procedures that enhance productivity and provide added value and an exceptional customer experience.

Similarly, touch screens provide the ability to browse store content, obtain detailed information about each product, obtain feedback, and rate it (Liu, 2023). Moreover, a touchscreen makes the shopping experience appealing because it allows users to use their fingers instead of a pen or mouse. They also enhance positive product reviews, increase purchase intent, and respond to retailers' competitiveness (Cano et al., 2017).

In addition, QR codes enhance accessibility to the information needed to make purchase decisions through smartphones. Such information may include websites, emails, geographical coordinates, product details, offers, and prices. QR codes are widely used as a marketing method because they can be placed anywhere (magazines, social media, product packaging, publications, brochures, billboards, invitation cards for commercial events). However, QR codes add convenience and ease to the user experience and enhance the spirit of innovation and competitiveness (Nastase & Felea, 2015).

Magic mirrors are used broadly in retail, especially in clothing and makeup stores. By it, customers can virtually try products and see whether they fit them. These mirrors enhance purchase intentions and add comfort and ease to the experience (Schultz & Gorlas, 2023). Ahmed et al. (2022) confirms that magic mirrors are enjoyable illusions that allow consumers to imagine themselves as celebrities. However, magic mirrors may contribute to the formation of what is known as misattribution, which is the difficulty of distinguishing between

the reality of the product and the virtual image formed by the mirror. Thus, consumers may overrate a product while feeling disappointed when trying it in the real world (Cho & Schwarz, 2012).

Accordingly, interactive technology provides an essential opportunity to enhance the customer experience. The vast majority of the literature discusses the use of these technologies during the online shopping experience, and most studies focus on A.R and V.R technologies. Although many retailers are moving towards using these technologies in their physical stores, few studies discuss their impact on design and user experience. With the development of e-commerce and the emergence of many platforms and digital versions of retail stores, there has been a gap between physical and digital retail experiences. Physical retail stores have sought to reduce the boundaries between physical and digital retail experiences by employing interactive technology in their designs. In light of its vast and unlimited capabilities, this study aims to review studies related to retail stores and the impact of interactive technology on customer experience, design, and space efficiency.

II. Method

This study adopted a critical review, a research method that relies on reviewing the available literature, theses, and dissertations on a specific topic, identifying and discussing common themes. It provides a comprehensive view of the field of research interest, which allows for the provision of research frameworks for future studies, filling the gaps in the literature and providing a solid foundation on which studies can rely (Farrukh & Sajjad, 2023). In this study, the researcher identified the types of interactive technology used in retail stores and the technical tools used for each type and then studied their impact on space typology, morphology, and furniture design. Moreover, identifying limitations, conclusions, and suggestions for future research.

III. Results

During the COVID-19 pandemic, many sectors such as transportation, retail, entertainment, hotels, and restaurants have been affected. Retailers are among the hardest-hit sectors. In an attempt to adapt to lockdowns and respond to consumer demand, a new area of retail, online shopping, has seen remarkable growth. Numerous online store websites have emerged with features that provide shopping experiences that mimic, and in some cases, more engaging experiences (Guyen et al., 2021; Lu, 2021). Figure (1) shows the increase in On-line store Share of Total Global Retail Sales 2015 to 2024.

After the COVID-19 pandemic, physical stores had to make a greater effort to understand consumer needs and concerns, and adapt their products and display spaces. Some stores have minimized shelf displays, provided basic products and detailed product information online, used modern technology to process payments, and utilized robotics, artificial intelligence, and other technologies. Retailers' ability to utilize modern technologies has become a source of competitive advantage and a way to provide superior customer experiences and more efficient and smarter services (Guyen et al., 2021). Mortimer et al (2024) emphasized that the measures taken by retailers during COVID-19 facilitated a faster and more efficient shopping experience and were widely accepted by customers after the pandemic. Utilitarian value and interactivity have a stronger impact on the customer experience, leading to revisit intentions, figure (2).

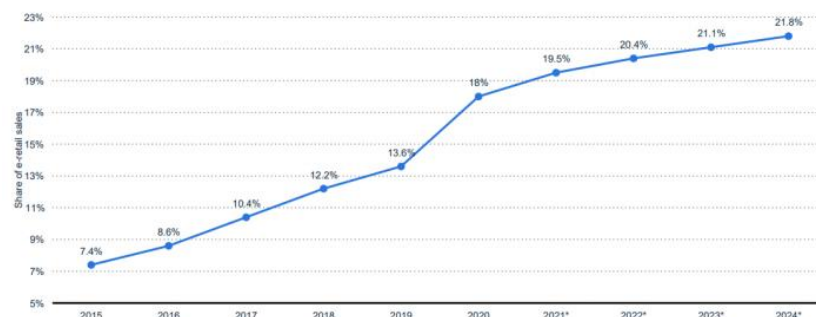


Figure 1. illustrates the increase in On-line store Share of Total Global Retail Sales 2015 to 2024, Source, (TRADE, 2025).

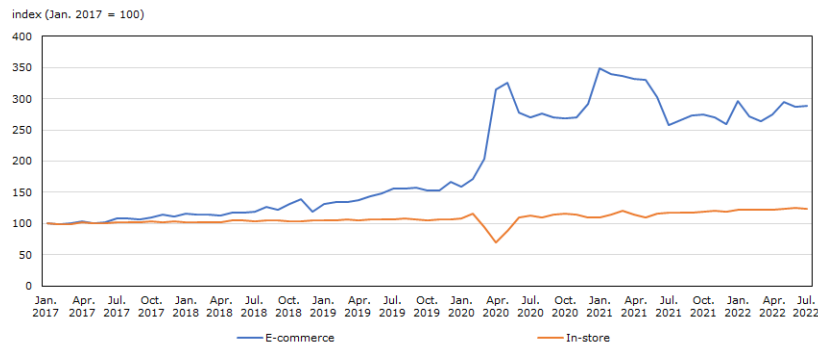


Figure 2. shows in store sales vs. online store monthly sales during the COVID-19 period, source: (Zanzana & Martin, 2023).

The use of interactive technology has proven to be a response to the challenges posed by the COVID-19 pandemic, a way to enhance customer experience, and a way to meet changing needs and expectations. The below is a review of each technology and how it affects the store setup layout and influence efficiency and sufficiency of retail stores space. The first category comprises technologies that provide technological interactivity, including AR, VR, interactive kiosks and displays, smart mirrors, and virtual fitting rooms.

3.1 Augmented reality (AR)

Augmented reality allows customers to visualize products in a physical world context through their devices. In other words, this technology allows physical and digital elements to merge in the real world (Caboni, 2020). The use of AR technology affects retail store design, particularly, fashion stores. It can change the way fitting rooms are designed, as they can be augmented with tablets and technologies that allow customers to see design suggestions when trying on clothes, change colors and sizes, return products, pay, control system lights, and save preferences for future visits. This also requires screens outside the fitting room so that consumers can browse the store while they wait. The store space itself does not have to include a large amount of merchandise, shelves, and stands to display the clothes themselves; it is enough to have samples, and through screens or smartphone applications and smart or magical AR-enabled mirrors, to try on pieces in appropriate colors and sizes, until the right color and size are adopted (Feng et al., 2020; Xue et al., 2023). This means that large spaces and certain parts of the store are dedicated to placing these screens without boundaries or actual fitting rooms as shown in figure (3). In other words, the number of products a store can sell does not depend on the physical space of the store, and stores designed with an open and flexible layout can incorporate physical and digital elements that enrich the user experience and enhance their satisfaction and future intention to visit the store again. What matters is a design that delivers utility, curiosity, attention, and convenience. In addition to providing physical aids (e.g., hangers) and privacy when needed (Battistoni et al., 2022).



Figure 3. shows using augmented reality on retail store, Source, (Feng et al., 2020).

3.2 Virtual reality (VR)

Some stores use virtual reality, which allows products to be experienced in a virtual environment that is supported by sensory stimuli (Jerald, 2015). These interactive environments simulate the real environment using a spatial high-tech device, and allow users to immerse themselves in the environment and interact with virtual elements. These environments are categorized into two types: immersive and no immersive. Immersive systems provide a higher degree of immersion in a simulated environment, and require high-resolution devices such as

displays, headsets, and glasses that give the user a sense of real presence in that environment. VR is used widely in fashion and furniture retail stores to improve customer experience, especially in crowded places, by providing a virtual environment that allows users to disconnect from the physical store environment and immerse themselves in an enjoyable experience (Park et al., 2018).

The use of VR can affect the store layout and space design. Although there is no evidence in the literature on how this technology affects store spaces, the use of VR shifts designers from focusing on designing compartmentalized spaces with product-filled showcases and storage spaces to large, flexible spaces with simple designs with minimal physical elements, and a focus on the customer's virtual experience and devices that enhance immersion, figure (4). This transformation maximizes the efficiency and adequacy of the simple spaces for displaying large quantities of products. The use VR in retail stores faces challenges regarding the degree of alignment between optimal customer experiences and how to translate these experiences into an effective customer-centric design. This is due to their lack of understanding of consumer preferences, as well as a lack of experience in developing effective and user-friendly virtual environments and how to integrate them into physical stores. Designers must create retail environments that produce specific emotional responses to customers, thereby improving their purchase intentions (Xue et al., 2020). Xue et al (2019) identified the characteristics of VR retail environments as comfort, content (information, product presentation, and features), accessibility and interactivity, environmental richness, social interactivity, perceived value, and product perception.



Figure 4. shows he first VR shopping experience in Alibaba Group, Source, (Xue et al., 2019).

3.3 Interactive Kiosks and Screens

Digital kiosks are fixed devices designed to provide self-service options for customers, allowing them to access detailed information about the product or service they desire, place orders, and pay—all from the same device (Aljohi et al., 2023). Interactive kiosks and displays are commonly found in locations such as airports, business centers, banks, universities, shopping malls, and retail stores like fashion, electronics and grocery stores (Adhoni et al., 2017).



Figure 5. shows Interactive kiosk, Source (Adhoni et al., 2017).

As shown in figure (5), interactive self-service kiosks are among the most important developments in interactive retail, revolutionizing the operational efficiency of retail stores. Compared to traditional kiosks, these kiosks are equipped with smart touchscreens, machine learning, artificial intelligence, and Internet of Things (IoT) technologies (Vennapusa et al., 2018; Sachani, 2018). These kiosks help simplify and automate repetitive (low value-added) processes such as payment, product inquiries, and availability (inventory management), so customers can easily check the location and stock level of an item themselves, allowing sales staff to focus on more complex and value-added processes (Kim et al., 2020). On the other hand, interactive kiosks and screens are used for promotional purposes by displaying products and advertising continuously, without the need for banners and posters. These technologies also make it possible to browse store content and obtain detailed information about a product, its location, available measurements, and other information (Sachani, 2018). In terms of store layout and space, self-service kiosks and interactive screens, figure (6), reduce the need for cashiers and checkout lines (Sachani, 2018), so these spaces become more effective in serving the shopping experience itself, as they can be utilized as interactive spaces rather than just spaces for customers to stand and wait for their turn to pay. Moreover, through this type of technology, the level of wayfinding can be enhanced without the need for signage and floor markings but rather through internal navigation systems.



Figure 6. illustrates Interactive kiosk in Retail Stores, Source: (Magner, 2022).

3.4 Smart (Magic) Mirrors and Virtual Fitting Rooms

The smart mirror, or sometimes known as the magic or interactive mirror, is a revolution in retail stores, especially those in the fashion and apparel industry (Palumbo, 2024). The technology is defined as an interactive experience that enables customers to stand in front of the mirror and choose from a variety of clothes. It is a two-way mirror with an electronic screen located behind the glass. This technology helps customers make a purchasing decision without actually trying on clothes and minimizes returns (Ogunjimi et al., 2021).

The smart mirror is based on augmented reality technology, allowing customers to quickly and conveniently browse clothes, explore the various options, and observe 3D from all angles without having to take off clothes. Clothes (virtual objects) are imposed on customers' bodies (real environment) to simulate a realistic fitting experience. These mirrors can be integrated into fitting rooms to produce smart fitting rooms that allow the lighting to be adjusted in different shades to enhance the visualization of clothing during different times of the day (Palumbo, 2024).

When magic mirror, figure (7), is part of a system that specifically aims to provide customers with an effective and alternative tool for trying on clothes, we refer to this system as an augmented reality fitting room or virtual fitting room, where a large number of garments can be tried on virtually in a short time, minimizing the wait in dressing rooms (Schultz & Gorlas, 2023).



Figure 7. Shows Magic Mirror, Source (Wroclawski, 2015).

The use of magic mirrors is not limited to apparel retailers, but is also used in accessories and makeup stores. Charlotte Tilbury has installed a magic mirror (figure7) in its flagship store in Westfield, allowing visitors to try on multiple looks on their face. The fact that these looks are carefully crafted by the makeup artist gives the brand a prestigious status (Javornik, 2018). As shown in figures (8 &9), the presence of magic mirrors is transforming the retail layout apace, eliminating the need for fitting rooms or shelves crammed with items and options. An open floor plan with flexible, movable physical elements and interactive mirror displays allows customers to experience a wide range of options. Spaces also become more efficient, and multiple options can be sold in a small space.



Figure 8. illustrates Magic Mirror in Charlotte Tilbury store in Westfield (London), Source: (Javornik, 2018).



Figure 9. illustrates Magic Mirror in Charlotte Tilbury store in Westfield (London), Source: (Javornik, 2018).

3.5 QR-codes

QR codes were invented by Denso Wave Incorporated in 1994 to conduct accurate and fast inventory checks (Hossain et al., 2018). Nowadays it used widely in all kind of retail stores. QR codes offer tremendous potential for accessing information about the products and services offered by retailers. By scanning with any camera or

smartphone, users are directed to a variety of data embedded in the code, which helps customers find all the information they need to make a purchase decision (Nodeland & Kjeldsen, 2022). Moreover, these codes provide marketers with data on customer preferences and interests. They also arouse consumer curiosity when present in marketing materials (Hossain et al., 2018). In contrast, QR codes are used as a convenient and secure mobile payment method. Mobile payments using a QR code are made by reading a QR code generated by the company through the customer's mobile phone and transmitting payment information or through a QR code that contains the customer's payment information and is scanned by a QR code scanner in stores (Eren, 2024). There is no evidence of the impact of QR codes on the layout and space of retail stores, but it is possible to activate simple spaces with a QR code next to product samples to enable customers to explore the type of materials, prices, sizes, and colors available. Stores can also do away with checkout points and queues and replace them with QR code-enabled screens. Thus, it can enhance space efficiency and provide simple and interactive spaces for selling an unlimited number of products.

3.6 Heat Maps and Store Navigation

Heat maps provide innovative assessments of user interactions and buying tendencies during the purchase journey, figure (10). This technology enables store owners to track and analyze customer behavior in real time as well as gather information about in-store customer interactions, enabling a deeper understanding of their preferences and thus managing the store more effectively. Through sensors, these maps provide information about the locations where customers spend most of their time. Consequently, reorganizing the store layout and placing high-demand or profitable products in optimal locations to increase sales (MohamedShili et al., 2024).



Figure 10. Representing current maps in retail stores, Source: (mirame, n.d, 2025).

One the other hand, In-store navigation technologies enable customers to quickly find the products or goods they need by showing the customer's location, the target product, and the paths leading to it. In-store navigation gives the brand added value, especially in large stores where products can be difficult to find (Khosrawi-Rad et al., 2023). This technology is used in most retail stores, especially those with large spaces that sell a large number of products, such as grocery and home appliance shopping centers, etc. As shown in figure (11), the use of in-store navigation affects design decisions in stores, as it gives the designer greater freedom in designing movement paths, so that an enjoyable experience can be added, and the customer can explore as many products as possible during their walk to obtain the desired product.

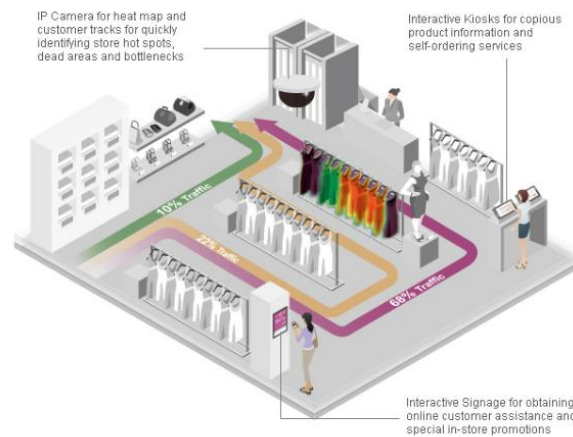


Figure 11. shows 3D representation of a retail store using a combination of techniques (heat map, interactive kiosks, smarty screens), Source: (nexcomusa, n.d.,2025)

IV. Discussion

Through a critical review of studies related to interactive technology in retail, it is clear that interactive technologies such as augmented reality, virtual reality, interactive kiosks, touch screens, magic mirrors, virtual fitting rooms, heat maps, in-store navigation, and other forms of interactive technologies offer many possibilities for improving customer experience and competitive advantage, especially given the widespread popularity of online stores. In terms of space design, the literature lacks conclusive evidence of the impact of these technologies on the layout of space and its interior design. This confirms the research gap regarding the impact of interactive technology on retail store design, space efficiency, and sufficiency. However, from the review, we conclude that in general, these technologies enhance the efficiency and sufficiency of spaces to display and sell large quantities of products without the need to arrange them on physical shelves and stands. In turn, these spaces can incorporate displays, smart mirrors, and AR and VR platforms, instead of traditional shelving and physical elements. Retail store design is moving towards an open-plan layout with minimal fixed elements and visual barriers.

V. Conclusion

The study indicates that interactive technologies generally impact retail store design by shifting the importance of physical spaces and replacing them with flexible, interactive spaces that incorporate interactive screens to visualize merchandise and products for purchase. Consequently, store designs are becoming more open plans with minimal barriers. Table 1 illustrates the most important interactive technologies, their use in retail stores, and their impact on store design and space efficiency. From the above discussion, it is clear that there is a research gap regarding the impact of interactive technology on space design and efficiency. This study suggests future research in the fields of architecture and interior design regarding the impact of interactive technologies on the design of store layouts.

Table 1. Interactive technology used in retail stores

Interactive technology	Benefits in retail stores	Type of retail stores	The impact on customer experience	The impact on space efficiency
Augmented reality (AR)	Allows physical and digital elements to merge in the real world	Fashion, Electronics, Furniture, Grocery and Supermarkets Stores	More enjoyable and interactive experience through customization their own product.	prompt space efficiency through open and flexible space design and reduce the need of display space with smaller number of products to display
Virtual reality (VR)	allows products to be experienced in a virtual environment	Fashion, beauty and Cosmetics and Furniture Stores	Enhances product information accessibility, with interactive experience that disconnect from crowded spaces.	Reducing the space required to display products, converting store spaces into open spaces with minimal visual barriers.
Interactive Kiosks and Screens	Facilitates duplicate processes that do not add value to the	Fashion, Electronics, Furniture, Home Goods, Beauty and	Easier experiences with self-service options, that	Eliminating payment lines enhances space efficiency.

	customer experience, such as payment and product inquiries.	Cosmetics, Grocery and Supermarkets Stores	allow high accessibility to all product details. Enhance the level of way findings inside the store.	
Smart (Magic) Mirrors and Virtual Fitting Rooms	helps customers make a purchasing decision without actually trying on clothes	Fashion and Beauty and Cosmetics stores	An interactive, fun, and easy experience, with a large number of options available in record time.	Eliminate traditional fitting rooms, reduce display spaces, minimize the cashier's lines, and provide several payment lines, while the Waiting's areas became more active spaces rather than standing areas with movable physical elements.
QR-codes	Used for payment and inquiries about product details before purchasing	Fashion, Electronics, Furniture, Home Goods, Beauty and Cosmetics, Grocery and Supermarkets Stores	A more convenient, secure experience with access to product information and payment process.	It eliminates the need for cashier space and waiting lines, thus improving space efficiency.
Heat Maps	Heat maps provide assessments of user interactions and buying behavior	Home Goods, Grocery and Supermarkets Stores	Heat maps don't directly impact the customer experience; they help store management organize them effectively.	Arrange stores for maximum efficiency, thus improving the efficiency of even small spaces.
In Store Navigation	enable customers to quickly find the products or goods they	Home Goods, Grocery and Supermarkets Stores	Easy and comfortable experience in record time	Wider and more creative options for organizing spaces

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