International Journal of Retail & Distribution Management

Space jam: how retail technologies are influencing store space production

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Received 15 December 2023
Revised 9 May 2024
Accepted 24 June 2024

Abstract

Purpose – Technologies are dramatically reshaping various aspects of the store space, modifying design, services and usage. Accordingly, several studies tackled technology impact on each of these aspects, investigating design, service and usage singularly, but lacking a holistic viewpoint. Thus, this paper aims to identify the different dimensions of the store space (levels) and assess the impact of technology introduction on store space dimensions (levels).

Design/methodology/approach – The research employs a qualitative approach based on direct observations of apparel brand stores located in London between March and April 2023. Data collection followed a structured observation protocol covering store information, adopted technologies and their effects across various store space levels, i.e. consumption activities, service environment and customer experience.

Findings – Results show that the store space can be defined as the sum of different dimensions consisting of consumption activities, service environment and customer experience. Accordingly, technology introduction holistically influences each of the three store space levels as follows: (1) first, technologies redefine how activities are performed or alters the location where certain activities are consumed; (2) within the service environment, technologies replace traditional elements, fill empty spaces and enhance the atmospherics; finally, (3) customer experience is enhanced in hedonic and/or utilitarian terms due to technology adoption.

Originality/value – This paper defines the space as a dynamic entity, providing a deeper understanding of how the store space is produced, from a holistic point of view and the role of retail technology in this process.

Keywords Retailing, Retail technology, Store space, Store space production, Consumption activities, Service environment, Customer experience

Paper type Research paper

1. Introduction

Effective retail store planning is paramount for retailers, as it plays a pivotal role in capturing consumers' attention and driving sales (Bonetti *et al.*, 2019; Alexander and Blazquez Cano, 2020). Accordingly, a vast deal of literature explored the design of store spaces with the primary goal of optimising sales and profitability (Kent, 2007; Mowrey *et al.*, 2018; Karki *et al.*, 2021), and to understand how service innovation (Artusi and Bellini, 2020; Zhou *et al.*, 2023) and store space usage (Grandi *et al.*, 2021; Chung *et al.*, 2022) affect the store experience.

International Journal of Retail & Distribution Management
Emerald Publishing Limited
0959-0552
DOI 10.1108/IJRDM-12-2023-0709

However, to the best of the authors' knowledge, these studies predominantly tackle space from a single perspective, investigating design, service and usage as not connected and reciprocal influencing elements, thereby lacking a holistic viewpoint.

Moreover, the introduction of advanced technologies has profoundly transformed retail stores in recent years, playing a pivotal role in reshaping various aspects of the store space. Considering the physical arrangement, technologies introduction produces ripple effects on in store customer behaviour (Newman and Foxall, 2003; Pantano *et al.*, 2021b; Benoit *et al.*, 2024), and product visibility/display (Mowrey *et al.*, 2018; Gul *et al.*, 2023). Technologies also enrich services provided within a space (Inman and Nikolova, 2017; Alexander and Kent, 2020; Marikyan *et al.*, 2023) and modify the usage made of the space (von Briel, 2018; Alexander and Blazquez Cano, 2020).

For instance, fast fashion brands like Zara are introducing advanced checkout desks, positioned either near traditional tills or in the fitting rooms area, to speed and simplify the checkout process. Traditionally, customers had to wait in queue at the cash desk to pay for the items they want to buy, which were scanned one by one by store employees. With this new technology, customers position the items in a basket that automatically recognises them and calculates the total amount to be paid (due to the Radio Frequency Identification – RFID - tags associated with each item).

Accordingly, understanding technological transformation of retail stores and the pivotal role of store space research emerges as a key topic in retail literature (Grewal *et al.*, 2023). Consequently, it becomes essential to understand how different elements of the store space, including technologies, influence the overall store dimension (Hagtvedt and Chandukala, 2023; Steadman and Coffin, 2023). To this end, the present research aims to answer the following research questions:

RQ1. What are the different levels or dimensions characterising the store space?

RQ2. How does the introduction of technology affect each level or dimension of the store space?

Drawing upon the "production of space" theory (Lefebvre, 1974), this paper investigates changes occurring in the store space following the introduction of technologies. To this end, the research employs a qualitative methodology, as suggested also by Hagtvedt and Chandukala (2023), based on in-store observations of apparel brands located in London between March and April 2023.

Results show that the store space can be defined as the sum of the consumption activities, the service environment and the customer experience. Accordingly, our results show how technology introduction holistically influences each of the three store space levels as it follows: (1) technologies redefine how activities are performed or introduce new ones and impact the space where certain activities are consumed; (2) technologies replace traditional elements, fill empty spaces and enhance the atmospherics within the service environment and (3) the technology adoption enhance customer in hedonic and/or utilitarian terms. Thus, retail technologies impact multiple levels of space simultaneously, urging retailers to consider their effects on all three levels when introducing new elements.

The remainder of this paper is structured as follows. Section 2 delves into the current literature on store space and the theoretical background of the research. Section 3 illustrates the adopted methodology. Section 4 summarises the key findings and discusses the results. Lastly, Section 5 summarises the contributions.

2. Theoretical background

2.1 Store space

Store space plays a pivotal role in shaping retail performance, since the cost-efficient space utilisation leads to increased margins and ultimately to higher revenue streams (Williams, 1996;

Juel-Jacobsen, 2015; Kim *et al.*, 2019; Abdelaziz *et al.*, 2024). Accordingly, financial and volume metrics were developed to measure the space performances, such as space productivity (i.e. sales per square metre) (Kent, 2007; Juel-Jacobsen, 2015). However, the scope of space design extends beyond physical layout and furnishing (Mowrey *et al.*, 2018; Karki *et al.*, 2021). Indeed, it also encompasses atmospherics, such as ambient conditions (noise, music and aromas) and visual cues (style and personal artefacts) (Kotler, 1974; Bitner, 1992; Babin and Attaway, 2000; Joy *et al.*, 2023), which consolidate into the service environment concept (Bitner, 1992). This concept comprehends the entirety of the store environment created by retailers to enrich customer experiences. Accordingly, past research delved into understanding the impact of various environmental aspects on consumer purchasing behaviour (Turley and Milliman, 2000; Mohan *et al.*, 2013; Stanca *et al.*, 2023), considering factors like layout (Pantano *et al.*, 2021b; Nguyen *et al.*, 2022; Gul *et al.*, 2023), technologies (Roux *et al.*, 2020; Kim *et al.*, 2020) and atmospherics (Basu *et al.*, 2022; Joy *et al.*, 2023) including colours (Bellizzi and Hite, 1992; Grandi and Cardinali, 2022), scent (Spangenberg *et al.*, 2006; Roy and Singh, 2023) and music (Raja *et al.*, 2019; Klein *et al.*, 2021).

Yet, the store space encompasses more than its physical attributes. Indeed, recent perspectives focused on the functions of store space for consumers, as a meeting place for social exchange and leisure activities (Hu and Jasper, 2006; Triantafillidou *et al.*, 2017; Pantano *et al.*, 2021a), thereby encompassing social elements within its ambit (Hu and Jasper, 2006). Consequently, the store space is the result of the interaction between the space and the consumers using the environment (Arnould, 2005). Therefore, great attention has been paid on consumers' usage of store space, which revolves around consumed services (Dabholkar *et al.*, 1996; Amorim and Bashashi Saghezchi, 2014; Rancati and Maggioni, 2023). Specifically, considering consumers logistics, emphasis has been placed on the point in space and time (i.e. location) where customers engage in consumption activities (Granzin and Bahn, 1989; Teller *et al.*, 2012). Other studies focused on customers' perception of the consumed services (customer experience) (Verhoef *et al.*, 2009; Bagdare and Jain, 2013; Nöjd *et al.*, 2020; Quinones *et al.*, 2023; Bonfanti *et al.*, 2023). Indeed, services largely impact the experience outcome, either in utilitarian or hedonic terms (Babin *et al.*, 1994; Zhou *et al.*, 2023). Enhancing services in utilitarian terms means efficiently meeting specific needs and preferences of customers, who, being task-focused, are concerned with accomplishing a specific goal. Therefore, customers value the most service attributes such as efficiency (e.g. saving time spent in doing something), convenience (e.g. easily accessing to product/service that matches their need), functionality (e.g. finding practicability and utility in service) or cost-effectiveness (e.g. when product prices align with the utility and quality) (Voss *et al.*, 2003; Scarpi, 2021). By contrast, service enhancement in hedonic terms focuses on creating an enjoyable, experiential shopping experience. Customers value the emotional aspect of the experience, seeking pleasure, excitement and novel experiences during the shopping process, often indulging in fantasy, escapism and exploration (e.g. through interactive product demonstration, pleasant scent and music, appealing visual cues or immersive experience) rather than task completion (Arnold and Reynolds, 2003; Nguyen *et al.*, 2012).

Therefore, store space can be perceived as a dynamic entity instead of a static one, which changes according to the changing conditions of its elements. As a consequence, the introduction of new elements within the store space, such as technologies, modifies the service environment, by enhancing the services offered or introduce new services (Bitner *et al.*, 2002; Lee and Yang, 2013), highly impacting customers' perception of the experience and influencing customers in their choices (Pantano, 2016).

Retail literature focused on a limited range of technologies and has evaluated each dimension of the store space and related production individually (Table 1). In other words, store has not been considered as the sum of all elements/dimensions that dynamically and reciprocally influence each other.

Table 1. Store space dimensions, related contributions and technology typology addressed

Store space dimensions	Main studies	Technology typology
Space performance	Williams (1996), Juel-Jacobsen (2015), Kim *et al.* (2019), Abdelaziz *et al.* (2024)	Location-based tracking technology
Service environment	Bitner (1992), Turley and Milliman (2000), Roux *et al.* (2020), Kim *et al.* (2020), Gul *et al.* (2023)	Digital signage
Space as social place	Hu and Jasper (2006), Triantafillidou *et al.* (2017), Pantano *et al.* (2021a)	–
Space and consumer service	Granzin and Bahn (1989), Dabholkar *et al.* (1996), Park *et al.* (2020), Fagerstrøm *et al.* (2020), Rancati and Maggioni (2023)	Robot, Self-service technology, Internet of Things
Space and customer experience	Babin *et al.* (1994), Verhoef *et al.* (2009), Nöjd *et al.* (2020), Bonfanti *et al.* (2023), Quinones *et al.* (2023)	Technology (in general)

Source(s): Table by authors

2.2 Space production and store space production

A first conceptualisation of the space dates back to 70s (Lefebvre, 1974), emphasising the social construction of space, arguing that it is not a static entity, but a dynamic product shaped by social relations, power dynamics and everyday practices. Specifically, he stated that space can be produced at three main levels: (1) perceived space (or spatial practice, which encompasses everyday routines, behaviours and actions of individuals and groups within a given space); (2) conceived space (or representations of space, is the abstract space of standards and values produced by planners and political decision-makers which is reflected in the physical space arrangement and (expected) usage) and (3) lived space (or representational space, which embraces the space formed by the experience of the users, the meaning that they attribute to a space (Lefebvre, 1974)).

The space production theory has been largely used in urban studies to understand how social relations and power dynamics shape urban spaces (Aquino *et al.*, 2022; Martin, 2023). For instance, past authors explore how different social groups influence the production of urban environments (Marcuse, 2009), or study spatial inequalities and injustices in urban areas (Harvey, 2003). Also, architects and designers adopt this theory to assess how social interactions, cultural practices and power relations can be reflected or challenged through the design of buildings and environments (Lohtaja, 2021) or to analyse public spaces, understanding how they are produced, used and contested by various social groups (Nagle, 2009). Moreover, other studies used Lefebvre's work to understand the political dimensions of space, exploring how states and geopolitical relations influence the production and control of territories and boundaries (Karplus and Meir, 2014).

The production of space theory finds further application in economics and business studies, for instance to investigate organisational spaces (Taylor and Spicer, 2007). In this case, the authors classified such spaces into three categories: space as distance, space as the materialisation of power relations and space as experience (Taylor and Spicer, 2007). Other authors adopted this theory in tourism studies, for instance by shedding light on the perspectives of local children, which must be considered by tourism businesses and policymakers when planning and developing tourism enclaves (Buzinde and Manuel-Navarrete, 2013). Similarly, other authors used this theory to suggest actions for a sustainable development of religious tourism destinations (Shinde, 2022).

Albeit there exist examples of the usage of the production of space theory in management, its application is generally limited, particularly considering physical retail setting. For instance, it has been used to investigate consumer behaviour in online virtual contexts (Houliez, 2010). In particular, by considering solely the spatial practices (or perceived space),

the author suggests that unique spatial practices associated with online virtual shopping affect the users' idea of what a brick-and-mortar retail experience should be. Thus, spatial practices should be coherent and consistent whether performed by customers online or offline, to reduce shopper confusion and build a stronger brand presence.

Nevertheless, retail store space, being a social space (Pantano and Gandini, 2017), can largely benefit from the application of the store space production theory, allowing researchers to consider the space holistically. Indeed, it transcends its physical components due to the interactions and activities carried out within it. These interactions determine its usage and embody the meaning of that place. Thus, retail store is used as a social space, in relation to the social activities executed within it (Pantano and Gandini, 2017). Accordingly, we can hypothesise the three produced level of the store space as follows (Figure 1):

(1) The perceived space encompasses all activities carried out by store users, namely customers, during their visit (consumption activities).

(2) The conceived space represents the physical planning of the store made by retailers, manifested in various elements such as aisles, shelving, tills, displays or atmospherics, i.e. the service environment.

(3) The lived space can be identified as the consumer's experience while visiting the store (customer experience).

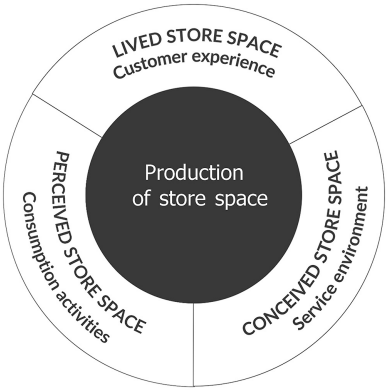

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Figure 1.
Theoretical framework

3. Methodology of research

The research employs a qualitative approach based on direct observations of apparel brand stores, since the apparel industry is one of the most advanced in terms of technology adoption (Amed *et al.*, 2022; Somani, 2023). The adoption of this methodology, being non-intrusive, allows researchers to understand phenomena in the exact context in which they take place, preserving their authenticity (Bonoma, 1985; Grove and Fisk, 1992). Given the purpose of the present study, field observations result also particularly effective in reaching the intended objective, as they enable the recording of customers' space fruition within their natural setting, similarly to Foster (2004).

Additionally, our observation-based research is intentionally purposive, which is typical when the objective is theoretical development rather than the generalisability of results, as

common in quantitative methods (Kelly and McAdam, 2022). Consequently, the inherent limitations in quantifying our data are recognised in the limitations section of this paper.

The observations took place in London (UK) between March and April 2023, in Oxford Street, Regents Street and Sloane Street. Indeed, London Oxford Street has been named the most popular shopping street in Europe (Delcol *et al.*, 2021), London's Regent is one of the most-visited retail destinations in Europe (Delcol *et al.*, 2021), while Sloane Street is recognised as one of the best luxury destinations for shopping (Sells, 2021). Thus, the observation of those streets enables the collection of data from fashion brands encompassing fast, premium/high streets, luxury stores and sports brands. Overall, 111 stores were visited, 34 for each fashion store category (fast, premium, luxury) and 9 for sports one. Among them, only those having at least one technology installed were considered in the analysis, resulting in 23 fast fashion stores, 22 premium stores, 13 luxury stores and 8 sports stores (66 stores in total). Each store included in the observation is a mono-brand and part of an international chain.

Based on the different levels emerging in the theoretical background (consumption activities, service environment and customer experience) a structured observation protocol was built and adopted in the data collection process, in order to limit the biases. Specifically, the protocol encompassed (1) general information of the store and (2) technologies adopted (if present) (Table 2).

Table 2.
Research protocol used for the observation of the stores

Research protocol	
Store characteristics	Name
	Street location (Oxford Street, Regent Street, Sloane Street)
	Category (fast, premium, luxury, sport)
Technology characteristics	Presence (yes/no)
	Typology
	Delivered service
	Impact on experience (hedonic/utilitarian)
	Area occupied within the store (product display, fitting rooms, checkout, shopping window)
	Position (central/lateral)
	Customers' usage (essential/optional)

Source(s): Table by authors

Data were collected independently by each researcher through notes during their visits to the stores. Each observation lasted for around 20 minutes, a duration considered sufficient for understanding the technology without arousing suspicions about lingering in the store without making a purchase (Lai *et al.*, 2014). The notes collected were transcribed into separate files. These separate files were merged into a comprehensive document, incorporating all the gathered data, thereby ensuring the richness of information (Pantano and Vannucci, 2019).

Afterwards, focusing on each typology of technology adopted, those presenting similar characteristics and offering similar services were classified in the same category (e.g. RFID self-checkout and self-checkout were merged into one category). Subsequently, each technology category was analysed in relation to the three identified store space levels to assess their impact.

4. Key findings and discussion

First, a comprehensive list of technologies actually available in the observed store has been developed based on the technology typology and the delivered service. Subsequently,

technologies with similar functionalities were merged in the same category. For instance, in the case of displays, whether interactive or traditional, they essentially showcase digital content, with interactivity being a distinguishing factor. Likewise, the category of ambience regulation tools comprises technologies facilitating alterations in the space's atmosphere, encompassing adjustments in lighting and/or scenarios. However, certain technologies with unique characteristics create a stand-alone category (e.g. photobooth and smart mirrors) (Table 3).

Category	Technology	Service
Display	Traditional display	It showcases digital content, such as advertising campaigns, brand logo, runaway shows, messages directed to customers for informative purposes (e.g. in-store events, fitting room assignment)
	Interactive display	It showcases digital content and engages with customers, allowing them to browse the product catalogue, find product availability information, insert contact information, online order placement, request items to the store employee
	Interactive display with RFID sensor	It showcases digital content and engages with customers, allowing them to explore the product catalogue and access information about product availability. Through its connection to an RFID sensor, it recognises nearby products and offers additional details, such as available sizes or the number of items brought in the fitting room
Payment technologies	Self-checkout	It enables customers to self-scan the items they wish to purchase and complete the payment process without requiring any assistance from employees
	Self-checkout RFID	It autonomously identifies items placed in the basket using RFID sensors and calculates the total amount to be paid by customers, eliminating the need for scanning items or employee involvement
Photobooth		It enables customers to take pictures and print them, typically featuring the brand logo
Smart mirror		It can superimpose items (such as clothing or makeup) onto a customer's image, allowing them to virtually try them on
Robotic arm		It simulates the walking movement with the shoes on display
Self-service collection technology		It allows the self-collection of online orders delivered to the store
Ambiance regulation	Light regulation	It allows for the adjustment of light intensity and atmosphere within the fitting room
	Light and atmosphere regulation	It allows for the adjustment of light intensity and atmosphere (e.g. displaying images and colours depicting a specific landscape, like a beach or mountains) within the fitting room
Tool for foot size measurement		It measures customers foot size

Source(s): Table by authors

Table 3. Technologies actually available in the stores and the delivered services

Subsequently, each store space level was analysed in terms of (1) perceived store space – consumption activities, (2) conceived store space – service environment and (3) lived store space – customer experience.

4.1 Perceived store space – consumption activities

The introduction of technologies produces three main changes in the consumption activities. Specifically, (1) it redefines the way activities are performed, (2) it introduces new activities to

be done within the store space (also modifying the dynamics of interaction with employees), (3) it modifies the location where certain activities are consumed.

Considering the former case, technologies redefine the way various activities are performed within the store space in several ways. For example, customers can engage with digital content, rather than static advertising boards, showcased within the store, such as campaign images, logos, runaway videos and in-store events (e.g. displays introduced in some luxury stores). They can measure body sizes, such as through foot size measurement tools, receiving assistance in choosing the correct size. Clothes fitting activity is facilitated as technologies aid in item counting and provide information on available fitting rooms (e.g. displays in fast fashion stores), along with convenient employee assistance features like calling for help (e.g. display at sports stores). Also, the checkout activity is modified, as customers can do the self-checkout through payment technologies. Similarly, customers can self-collect online orders delivered to the store, without interfacing with employees.

Focusing on the new activities that can be done by customers, the in-store technology might support more conscious consumption choices providing sustainability information about the products. Other technologies give consumers the possibility to take pictures in the store and share them online (e.g. photobooths technology). Technologies enable consumers to further browse the virtual catalogue and check the in-store availability, providing a comprehensive view of the inventory (e.g. displays in both premium and luxury brands). Customers can also gather more information about products performance, as technology can showcase their usage (e.g. a robotic arm that simulate feet movement while running). Customers can also customise the atmosphere within the fitting rooms, adjusting lights and colours (e.g. frequently adopted by sports stores). Finally, the adoption of smart mirrors enables virtual trials of clothes.

More generally, when considering these two cases, the introduction of technology also influences the dynamics of interaction between customers and employees. Indeed, its usage can lead customers towards engaging in more self-service activities (e.g. when using self-checkout or displays to check product availability) or, conversely, towards increased interactions with employees (e.g. when seeking assistance using smart fitting room features).

Regarding the third main change, the positioning of technologies significantly modifies the location where certain activities are consumed, since customers can perform more activities in the same place.

For instance, many fast fashion stores placed self-service payment technologies at the exit of the fitting rooms, enabling immediate payment. Similarly, interactive displays inside fitting rooms introduce additional activities alongside the primary one of trying on clothes, such as visualise the collection, browse the catalogues and request employees' assistance and/or more items to try (e.g. in fast fashion and sport brands). Lastly, the usage of self-service collection technology, placed in the product display area of the store, extends the space usage beyond the product discovery, now encompassing the retrieval of online orders.

4.2 Conceived store space – service environment

The integration of technologies produces a threefold impact on the service environment: (1) technology as replacing traditional furniture elements, (2) technology as filling previously empty spaces and (3) technology as atmospherics enhancement.

First, technology might replace some elements of the store. For example, technologies substitute pieces of furniture, such as shelves, racks and mannequins. This is the case of digital displays adopted by all brand categories, which were placed in the shop windows, substituting mannequins, or in the product display area, substituting pieces of furniture. Similarly, other technologies such as payment systems largely available in fast fashion stores, photobooth,

smart mirrors, robotic arm, self-service collection technology or the system for foot size measurement, being placed in the product display area, replaced racks and shelves.

Second, technology might fill previously empty spaces, without substituting existing elements. For instance, some retailers installed displays inside every single fitting room such as in the case of some fast fashion brands, or on empty walls such in the back part of the tills area as in the case of luxury fashion brands.

Third, technologies can modify the atmospherics. For instance, technologies enable the adjustment of lights and colour intensity in fitting rooms such as for sports brands (e.g. Adidas), thereby modifying the ambience within. Similarly, digital displays can make shop windows more captivating such as for premium brands.

4.3 Lived store space – customer experience

The introduction of retail technologies modifies the perception of the experience, either from utilitarian or hedonic points of view, based on the typology of service offered.

Within the utilitarian scope, technologies aim to assist task-focused customers in achieving their goals, promoting efficiency, convenience, functionality and cost-effectiveness.

Regarding efficiency, technology usage significantly saves time. For instance, payment technologies expedite the checkout process, while self-service collection technologies reducing waiting times in the retrieval of online orders (common in fast fashion stores). Likewise, smart mirrors, facilitating virtual try-ons, also reduce the time spent on this activity.

In addressing convenience and cost-effectiveness, technologies enrich the product information available to customers, enabling more informed purchase decisions that balance price, utility and better match their needs. An example is given by displays, through which customers can get detailed information about products, such as prices, promotions, or availability (as seen in all brand type stores). The robotic arm also plays a role in providing customers with clearer product insights and usage (e.g. On).

Lastly, with respect to functionality, technologies enable the access to useful and practical services. This is the case of ambiance regulation tools within fitting rooms, which enhance product showcasing (e.g. in sport stores). Similarly, tools designed for foot size measurement gives the possibility to customers to accurately measure parts of their body (e.g. New Balance).

Concerning the hedonic aspect, technologies contribute to an interactive, playful and aesthetically pleasing shopping environment.

Addressing the interactive aspect of the experience, customers can engage with technologies (e.g. digital displays) and participate in interactive product demonstrations (e.g. a robotic arm simulating feet movement while running). Moreover, some technologies, such as the photobooth or the smart mirror, add the playful dimension to the experience (e.g. premium and sport brands).

Considering the enhancement of the store environment from an aesthetic standpoint, ambiance regulation tools enable customers to adjust the fitting room setting to create the preferred atmosphere (e.g. sport brands).

5. Conclusions

This paper investigates the impact of technology introduction on in-store space. To achieve this, an omni-comprehensive definition of store space was established, drawing upon Lefebvre (1974)'s production of space theory. This theory identifies three levels of space—perceived, conceived and lived—which were applied to the context of retail stores, representing consumption activities, service environment and customer experience, respectively (Figure 2).

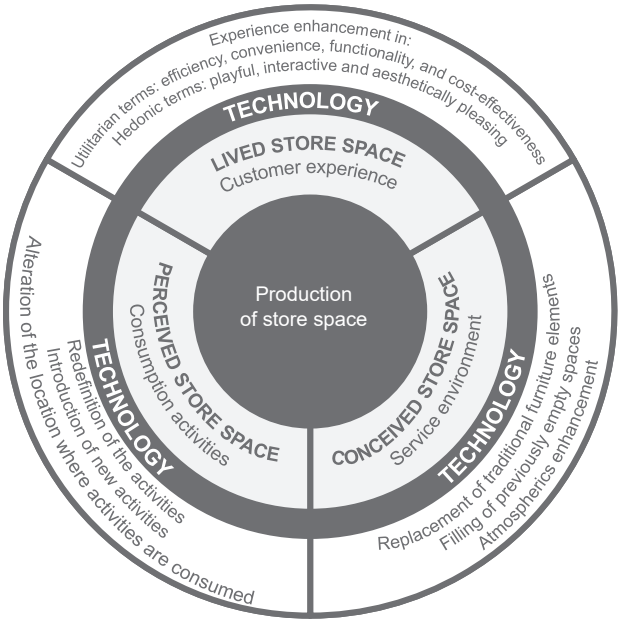

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Figure 2.
Production of space in retail stores and the impact of technology

From a theoretical perspective, this research first contributes to the debate on the impact of technology on physical retail stores (Grewal *et al.*, 2023; Hagtvedt and Chandukala, 2023; Steadman and Coffin, 2023), by considering the store space as a sum of different levels with reciprocal influences impacted simultaneously by the technology.

Second, our results extend the application of the "production of space" theory (Lefebvre, 1974; Aquino *et al.*, 2022; Martin, 2023; Marcuse, 2009; Harvey, 2003; Lohtaja, 2021) to the retail store space. In this way, it further contributes to the application of this theory in business and management domain (Taylor and Spicer, 2007; Buzinde and Manuel-Navarrete, 2013; Shinde, 2022; Houliez, 2010), with specific application in retail and consumer behaviour, by redefining the store as a social space that transcends its physical dimension due to the interactions and activities occurring within it. Indeed, findings shows the extent to which the store space is the outcome of in-person consumption activities, service environment and customer experience.

Third, our research shows the impact of technologies on the whole store space levels, in terms of (1) the way the space is used (e.g. by modifying the way the checkout is made), (2) creation of new space (e.g. enabling customers to take pictures) and (3) location where certain activities are consumed within the store space (e.g. enabling the try-on of items and their payment within the same area). In this way, our research contributes to the consumers' logistics theory (Granzin and Bahn, 1989), by assessing the impact of technologies on consumption activities occurring within the store, and also in reference to the location. More in detail, our findings show that technology introduction modifies the dynamics of interaction between customers and employees (Bitner, 1992), impacting the typology of service organisations and shifting it toward the self-service (e.g. in case of self-checkout) or the interpersonal services one (e.g. when seeking further interaction with employees using the technology functionality) according to the delivered service. Lastly, this paper highlights the extent to which technologies modify the perception of the experience, both in utilitarian (e.g. by saving time during the purchasing process) or hedonic terms (e.g. adding a playful

dimension to the experience when interacting with technologies), by adding new evidence from technology usage on the hedonic and utilitarian benefits of the shopping experience (Babin *et al.*, 1994; Arnold and Reynolds, 2003; Scarpi, 2021).

Our research also offers relevant managerial implications. Specifically, it shows that the introduction of retail technologies produces simultaneous effects of multiple space levels. Thus, when retailers plan to add new technology or new elements within the store space, they should consider the impacts on all three levels, since they are interrelated and not mutually exclusive. Moreover, technologies can assign multiple functions to the same space, thus retailers should exploit the multiple (additional) activities enabled by the technology in the same area (e.g. by placing the self-service check-out inside fitting rooms) accordingly. Indeed, placing retail technologies in different areas of the store can result in different customers behaviours' outcome, that could influence their experience and, ultimately, the purchasing decision (e.g. by reducing the time between purchasing decision and the actual payment, thus lowering the probability of a change of mind).

Despite the contribution, our research also shows some limitations that should be considered. Considering the methodology, first, data collected through direct observations could not be used to provide quantifiable evidence to our findings, but rather qualitative insights. Second, additional studies embracing interviews with retailers might provide more corroborating evidence on the conceived space, and the rationale behind retailers' decisions to deploy technologies in specific locations over others. Likewise, interviews and surveys directed to customers could deeper understand their perception of the lived space. Similarly, collecting data from retailers and customers would allow to understand if the retailers' conceived space meets customers' lived space in terms of expectations and requirements and identify the circumstances that (dis)confirm the two perspectives.

Moreover, this study does not explore how technology impacts space productivity (or performance) at different space levels. Therefore, future research could investigate how to use technology more effectively to increase space productivity. For instance, future studies might assess the specific impact (higher vs lower) of the technology on the three levels if located in different areas of the store (e.g. check-out area vs fitting room area).

Nevertheless, current research focuses on the beneficial outcomes of applying retail technology within store spaces. However, not all technologies may enhance space productivity for everyone and could potentially yield negative effects across the three levels. Hence, future research should explore the potential drawbacks or "dark side" of technology application, assessing its potential negative impacts on one or more space levels and evaluating the magnitude of these effects.

Finally, our research focuses on the apparel sector, thus future research could provide additional evidence from other sectors like grocery or beauty, extending the validity of our results.

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