New technologies in the field of sensory marketing and customer experience: a systematic literature review

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ABSTRACT

Nowadays, we are noticing more and more new technological solutions that fit into the field of sensory marketing, the implementation of which is in a relatively preliminary stage. They are intended to improve customer experience. The main objective of the research is to determine the main topics covered in the literature. This article covers a systematic literature review of research conducted to date on new technologies that are part of the field of sensory marketing related to customer experience. The research search was based on two databases: Scopus and Web of Science Core Collections. Studies conducted between 2007 and May 2022 were included. Four inclusion criteria were used: database, terms, language, and cover period. No methods were used to assess the risk of bias in the included studies. 33 items of literature were qualified for qualitative synthesis. Based on the analysis, a conceptual framework of the most commonly used antecedents and outcomes in research was created, and two main research areas were identified: sense of telepresence and research by technology type. In view of this, further research directions based on the identified research gaps were indicated.

JEL classification: M30, M31, O33

Keywords: sensory marketing, new technologies, customer experience.

1. INTRODUCTION

New solutions that are part of the field of sensory marketing are being noticed increasingly nowadays (Flavián et al., 2019b). One of such solutions is modern technologies that are supposed to influence customer experience. Their implementation is in a relatively preliminary stage. However, it is worth noticing what impact these solutions have on customers. There is a belief (Ma et al., 2020) that multiple senses can be stimulated by virtual fitting rooms, posting videos where the model presents clothes, or photos with high magnification of the fabric – perhaps such techniques can stimulate the same regions in the brain as actual touch?

A systematic literature review was conducted to systematize the current state of research on new technologies that are part of the field of sensory marketing and their impact on customer experience. The results presented in the following chapters answer the research questions posed:
1. What main research areas have been covered in the existing literature?
2. What research gaps and directions for future research arise from the existing literature?

The structure of the rest of the article is as follows. The first part of the article is a theoretical background. The next part refers to the methods and materials used to conduct the systematic literature review. Then, its results are presented along with a breakdown of the research areas identified. The next section describes the directions for future research, that is what constitutes the essence of this publication. The conclusions and limitations of this review form the last part of the article.

2. THEORETICAL BACKGROUND

Sensuality fits into the field of marketing that is known as experiential marketing. Experiential marketing is a relatively modern concept that continues to expand the scope of covered marketing activities. For long, customers have been buyers of not just physical objects but of an experience (Boguszewicz-Kreft, 2010; Dziewanowska & Kacprzak, 2013). Schmitt (1999) distinguished 5 modules of experiential marketing:

- sensory module – contains activities that affect the senses of customers, and thus their perception and behavior; this module itself refers to the marketing field of sensory marketing (Krishna, 2010);
- affective module – refers to the feelings and moods of customers, which have a significant impact on their attitudes;
- cognitive module – forces the customer to think logically with the aim of creating a positive experience;
- behavioral module – involves enriching the experience through physical sensations;
- relational module – differs from the others in that the customer's experience depends on their social relationships (Dziewanowska & Kacprzak, 2013).

The concept of customer e-experience requires redefining the proposed modules and adding two new modules (Kacprzak, 2017): the utilitarian module, which mainly refers to the concept of use value, and the escapist module, which assumes such a strong shopping experience that will cause disconnection from reality and a loss of sense of time.

Although attempts to influence people's senses through marketing activities have accompanied commerce since its inception, the field of sensory marketing has been developing rapidly "only" for a dozen years or so. The elements of sensory marketing include sight, hearing, smell, touch, and taste (Grzybowska-Brzezińska & Rudzewicz, 2013). Research and theories within each have developed so much that they are themselves separate categories, such as audiomarketing, visual marketing, and aromamarketing.

The development of technology also results in the development of solutions used in marketing. More than 20 years ago, a shift from "atoms" (products and their brands) to "bits" (information and entertainment that the acquisition of a product brings) could be observed (Nordström & Ridderstråle, 2002). Today, the exact opposite process is coming, "by incorporating digital information into physical, solid products" (Schmitt, 2019, p. 1). The innovation of solutions such as the internet of things, virtual reality, or virtual assistants is not far from affecting the senses of customers, and their commercialization continues to spread (Schmitt, 2019).

The internet of things (IoT) implies that everyday objects can collect and process data via the internet or another network, enabling increasingly sophisticated services (Wortmann & Flüchter, 2015). An example of this is the smart fridge. Even the first prototypes assumed a number of functions not previously attributed to refrigerators such as generation of recipe suggestions based
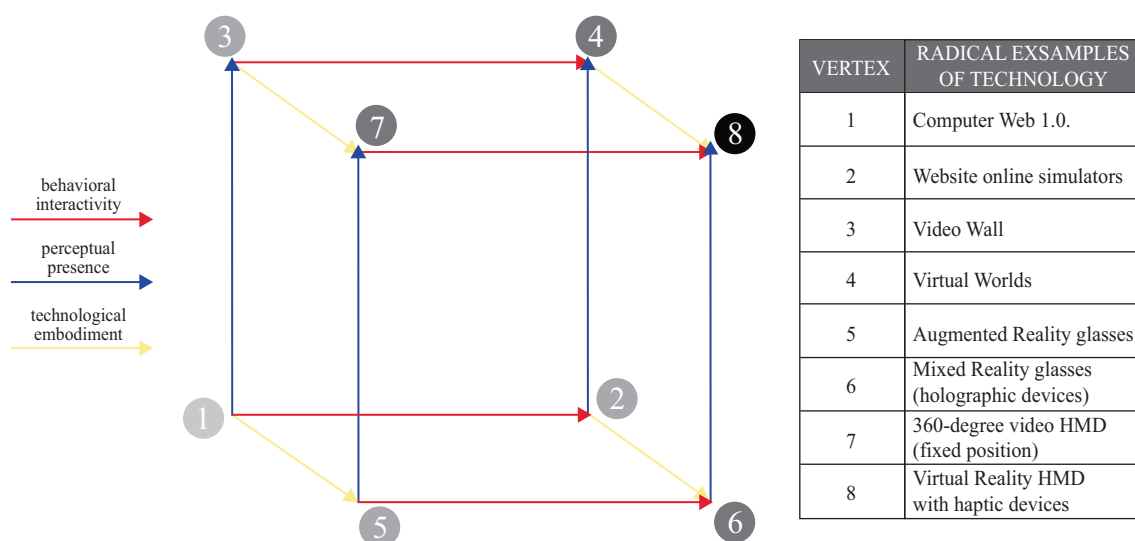
on the food stored in the fridge, multimedia presentation of cooking (via an internet connection), generation and updates of a store list and shopping list, warning about foods that are about to expire, displaying calories for various foods, scanning food and storing its information in a database, storing family information and medical records, or calculating the body mass index (BMI) to see whether the user is overweight or not based on his or her height and weight (Luo et al., 2009).

Augmented reality (AR), virtual reality (VR) or mixed reality (MR) are similar concepts, but only at first glance. Virtual reality rejects the outside world while using devices that block sensory perception of the real world (Hoyer et al., 2020). Among other things, VR technologies are being used in providing tourists with previews of experiences of sites, destinations, and attractions, such as hotels, cruise ships and the like, as part of a marketing strategy (Samuely, 2016). Augmented reality allows for the enhancement of information capabilities and user experience by adding an interactive experience in the real world (Hilken et al., 2017). An example is the Ray-Ban eyewear store, which has included technology in its shop window that allows a willing passersby to choose their favorite shape of glasses and virtually apply them to their face. Once the frames are attached to the face, they follow the model, twisting and turning the face in front of the camera (Radley, 2014). Mixed reality, on the other hand, is a combination of the virtual world and reality, allowing for a new visualization of the environment (Milgram & Kishino, 1994). Manufacturers such as Ford, for example, are using mixed reality applications to add new features to existing vehicles before the physical production of a prototype, allowing managers to evaluate and change a new concept faster and less expensively (Spears, 2017).

Computer programs that understand users' queries and are able to perform a certain limited set of actions for them are called virtual assistants, the basis of which is artificial intelligence (AI). A variation of such assistants is chatbots, which are able to carry on a conversation with the user using sound or text (Hoyer et al., 2020).

The boundaries between new-reality technology solutions have not yet been clearly defined by researchers and practitioners. An attempt to systematize existing and potential modern technologies is the EPI Cube model (Flavián et al., 2019b), which allows researchers to better understand their impact on the customer experience. The model (Figure 1) integrates technological (embodiment), psychological (presence), and behavioral (interactivity) perspectives. In addition, the EPI Cube is a practical tool for managers that can help them choose the most appropriate technologies with which to design value propositions for customers.

Figure 1
EPI Cube Model

VERTEX	RADICAL EXSAMPLES OF TECHNOLOGY
1	Computer Web 1.0.
2	Website online simulators
3	Video Wall
4	Virtual Worlds
5	Augmented Reality glasses
6	Mixed Reality glasses (holographic devices)
7	360-degree video HMD (fixed position)
8	Virtual Reality HMD with haptic devices

Source: Flavián, C., Ibáñez-Sánchez, S., & Orús, C. (2019). *The impact of virtual, augmented, and mixed reality technologies on the customer experience.*

This model shows very well the boundaries between the types of reality discussed earlier – virtual, augmented, and mixed reality. If we add technological embodiment to the reality around us, we get augmented reality. Introducing an element of interactivity into it will result in mixed reality. Virtual reality, on the other hand, will be obtained through the final element of perceptual presence.

The relevance of experiential marketing to customer behavior is the subject of many studies conducted in various markets and target groups (Ławicki, 2010; Niezgoda, 2013; Litvinova et al., 2015; Skorek, 2016; García et al., 2018; Nasution et al., 2020). The impact of individual experience modules on values such as customer satisfaction or loyalty is also studied (Lee et al., 2011; Alkilani et al., 2012); sometimes even as regards a specific brand or product category (Kustini, 2011; Platania et al., 2016).

Various research is also being done on sensory marketing. The impact of each of the senses is being studied: smell (Morrin & Ratneshwar, 2003; Garg & Chhikara, 2019), hearing (Beverland et al., 2006; Craton & Lantos, 2011), taste (Babin et al., 2003), sight (Henderson et al., 2003; Kahn & Deng, 2010), and touch (Citrin et al., 2003; Peck & Childers, 2006). The multitude of studies being conducted is due to the rapid pace of change in the environment and the widespread use of newer and newer solutions that fit into this field. Sensory marketing is the subject of research in many markets, such as the tourism market (Kuczamer-Kłopotowska, 2017), food service (Ifeanyichukwu & Peter, 2018), and hospitality (Ali & Ahmed, 2019).

Several research studies have reviewed the literature related to the field of new technologies and marketing. Elradi et al. (2017) investigated the key aspects of 3D e-commerce research areas by using a systematic literature review approach. Yung and Khoo-Lattimore (2017) conducted a systematic literature review on VR/AR research in tourism. Suh and Prophet (2018) conducted a systematic literature review of immersive technology research in diverse settings, including education, marketing, business, and healthcare. Yussof et al. (2019) researched augmented reality in advertising and consumer behaviors. Khakpour et al. (2020) conducted a systematic literature review to investigate greenability of reality technologies including virtual, augmented, and mixed reality. Taufik et al. (2021) examined the validity of VR in this type of research (for example: is behavior in VR accurately captured, compared to behavior in real life) and the effectiveness of using VR as a tool to change behavior in consumer domains using a systematic literature review as a method. Querejeta Lomas et al. (2021) studied the impact and significance of AI in fashion e-commerce by conducting a systematic review of the literature. Verma et al. (2021), Chintalapati and Pandey (2022), and Mariani et al. (2022) provided an integrated view on the body of knowledge on artificial intelligence (AI) published in the marketing, consumer research, and psychology literature. Lavoye et al. (2021), Abderahman et al. (2021), Kumar (2022), and Chen et al. (2022) reviewed the state-of-the-art literature on AR in retailing, customer behavior, and retail marketing. Nicolescu and Tudorache (2022) analyzed the overall customer experience with customer service chatbots in order to identify the main influencing factors for customer experience with customer service chatbots and to identify the resulting dimensions of customer experience using the systematic literature review method. Düzgün et al. (2022) conducted a systematic literature review on knowledge-based authentication schemes for augmented reality head-mounted displays. Hentzen et al. (2022) provided a systematic review of the literature on artificial intelligence (AI) in customer-facing financial services. Ledro et al. (2022) made an analysis of the AI literature within the CRM domain.

To the best of the author's knowledge, this study is the first to systematize and discuss the literature regarding the relationship between new technologies in the field of sensory marketing and customer experience.

3. METHODS

The first step of the review was to search the list of publications based on the selected criteria. Inclusion criteria are presented in Table 1.

Table 1
The inclusion criteria applied in the systematic literature review

Criterion type	Criteria
Database	Scopus, Web of Science Core Collections
Publication type	article
Cover period	2007–2022 (May)
Search language	English

Source: own research.

Terms related to the topic of the systematic literature review being conducted were used as the primary criteria, such as: "digital sensory marketing", "customer experience", "virtual reality", "augmented reality" or "internet of things". In order to provide the appropriate quality of the identified records, the search was based on two databases cited among the most comprehensive in terms of the number of indexed citations: Scopus and Web of Science Core Collections (Gusenbauer & Haddaway, 2019). The search string entered in both databases was identical (the only difference was the way the fields were described – appropriate for each database):

• Scopus:
TITLE-ABS-KEY ("digital sensory marketing" OR "sensory marketing" OR "senses") AND TITLE-ABS-KEY ("marketing" OR "consumer behaviour" OR "consumer behavior" OR "customer experience" OR "customer loyalty" OR "customer" OR "consumer") AND TITLE-ABS-KEY ("offline" OR "online" OR "augmented reality" OR "virtual reality" OR "mixed reality" OR "internet of things" OR "artificial intelligence")

• Web of Science Core Collections:
TS=("digital sensory marketing" OR "sensory marketing" OR "senses") AND TS = ("marketing" OR "consumer behaviour" OR "consumer behavior" OR "customer experience" OR "customer loyalty" OR "customer" OR "consumer") AND TS = ("offline" OR "online" OR "augmented reality" OR "virtual reality" OR "mixed reality" OR "internet of things" OR "artificial intelligence")

In the search string, there can be observed 3 subject areas included in the search. The first of them refers to the sensory aspect of the search (digital sensory marketing, sensory marketing, senses, marketing). Another one covers the customer behavior area (consumer behaviour, consumer behavior, customer experience, customer loyalty, customer, consumer).

The last one refers to new technologies included in the search (offline, online, augmented reality, virtual reality, mixed reality, internet of things, artificial intelligence).

Figure 2
The number of articles included in the qualitative synthesis
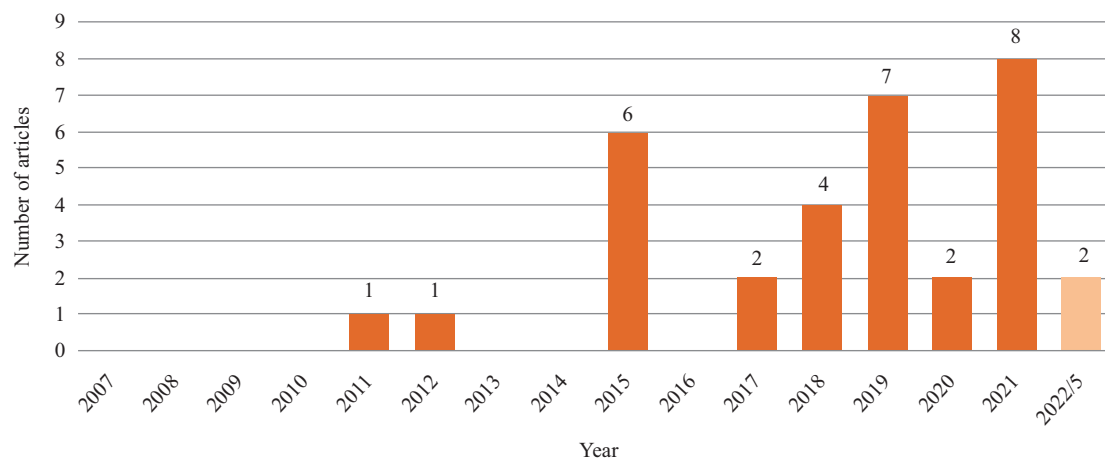
Source: own research.

The review included publications in English. The search took place on 19th May 2022 and was limited to the last 15 years, from 2007 to May 2022. The analysis of publications from the last 15 years makes it possible to show the development of topics related to new technologies within sensory marketing. No more limitations were applied in this stage of the search, in order to prevent omitting any significant results. The first stage resulted in 1541 publications from the two databases mentioned above (Scopus n = 1461; Web of Science Core Collections n = 80). All publications identified in this stage were exported to Mendeley software, a bibliography manager, which also served in the subsequent stages of this systematic literature review. After removing duplicates, the number of publications that advanced to the analysis stage based on title, abstract, and keywords was 1469.

Figure 3
The PRISMA flow chart showing phases of the selection process of systematic literature review
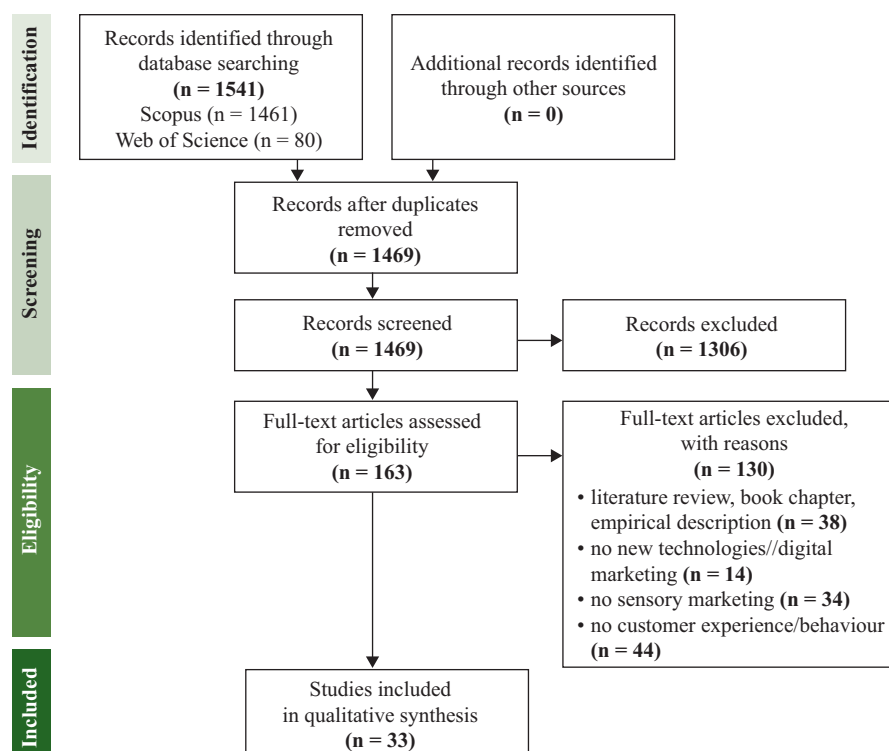
Source: own research.

The preliminary inspection to which these articles were subjected helped reduce this number by almost 90% (a decrease of 1306 records). The main reasons for this were other scientific fields investigated in the article and the topic, which was not directly compatible with the search. As a result of this reduction, 163 articles were qualified for the next stage and evaluated on the basis of the full text. At this stage, eligibility criteria were added – the record cannot be a literature review, a book chapter or an empirical description. After reading these articles, about 80% of them (a decrease of 130 records) were rejected on the basis of eligibility criteria mentioned, but also for reasons such as that the article was not related to the field of new technologies, sensory marketing, and customer experience (which appeared only after reading the full text). The final number of articles included in the qualitative synthesis was 33 (Figure 2). A full list of the identified publications is included in Appendix 1. The elaboration upon Appendix 1 is included in subchapters 4.2. and 4.3. The process of the described analysis with the listed stages is shown in the PRISMA flow chart (Moher et al., 2009) (Figure 3).
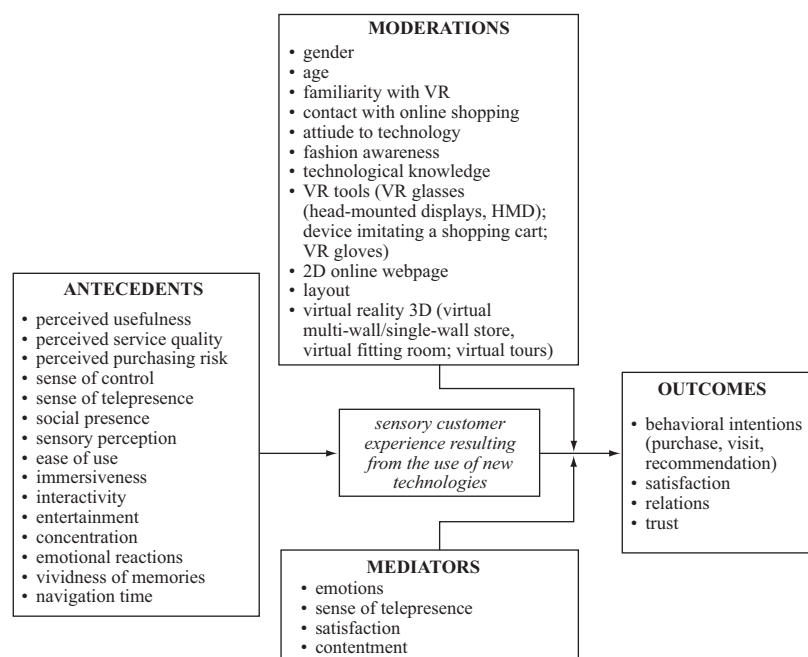
4. RESULTS

The subject of the 33 studies classified for qualitative synthesis is new sensory marketing technologies and customer experience. As a result of the analysis of the collected material, a model was created of the most frequently studied antecedents, moderators, mediators, and outcomes of the sensory customer experience resulting from the use of new technologies, and two main themes were identified: sense of telepresence and type of technology.

4.1. Conceptual framework of antecedents, moderators, mediators, and outcomes

The framework of the antecedent-moderator-mediator-result model (Mohammed et al., 2010) was imposed on the articles included. Antecedents are understood as input variables that lead to outcomes. The relationship between these variables and outcomes is explained by mediators and its direction and strength are influenced by moderators (Baron & Kenny, 1986).

Figure 4
Conceptual framework – synthesis of antecedents, moderators, mediators, and outcomes

Source: own research.

Generalizing the results of the 33 publications included in the qualitative synthesis, a conceptual framework is proposed as shown in Figure 4. Among the input variables, subjective feelings and perceptions of the users of the solutions under study are most frequently indicated. These include the perceived usefulness and quality of services, the sense of telepresence and social presence (understood as the awareness of the possibility of interacting with other participants and entities), the time it takes for users to learn about and then use the technology, or emotional reactions.

The variables explain the relationship between the customer experience resulting from the use of new technologies and marketing effects. It should be noted that these variables are determined by past experiences. Customers representing older generations may be characterized by greater reluctance toward, and sometimes even fear of, new technologies. Young people, on the other hand, will be eager for new experiences related to their use. The loneliness of shopping in a 3D virtual store may result in its negative evaluation by those who need even a minimal level of interaction with other shoppers. Such psychological barriers as well as gateways mean that a user's approach to shopping in a modern form may be predetermined by their attitude toward new technologies.

Any modern solutions that were analyzed in terms of the variables listed were moderators. These are presented in the following subsections, which describe the identified subject areas. Demographic (mainly gender and age) and psychographic (mainly related to new technologies, that is, familiarity with them, knowledge of them or previous experiences) factors were also moderators in the aforementioned studies: VR glasses (Martínez-Navarro et al., 2019; Herz & Rauschnabel, 2019; Meissner et al., 2020), VR gloves (Van Kerrebroeck et al., 2017), devices imitating a shopping cart (Carlson et al., 2011), virtual shop (Loureiro et al., 2021), virtual fitting rooms (Huang et al., 2019), virtual tour (Ba et al., 2012). Indirect mediating effects were emotions accompanying the use of new technologies, a sense of telepresence (Waterlander et al., 2015; Peng & Ke, 2015; Spielmann & Mantonakis, 2018; Park et al., 2018; Violante et al., 2019; Melo et al., 2022), which in the case of some studies was not a studied variable, but a mediating factor, and customer satisfaction and contentment, which were also not always an outcome, but an indirect effect. All of these affect the basic but all-important marketing effects of behavioral intentions (purchase, visit, recommendation), satisfaction, and even trust. Among these effects, researchers pay special attention to 3 of them: purchase intention, satisfaction, and customer relationship. Purchase intention is a customer's preference to buy a product or service. A customer who learns the value of a good is able to determine whether he or she would purchase it in the future (Younus et al., 2015). Customer satisfaction, on the other hand, is a response to customer fulfillment. In other words, it is the customer's judgment that the features of a given product or service, or the good itself, provide a sufficient level of customer fulfillment (Oliver, 1997). The relationship with the customer, on the other hand, is a category that includes both elements pertaining to the relationship itself, such as its durability or strength, but extending this concept will also arrive at other marketing effects, such as the aforementioned customer satisfaction, customer commitment, or loyalty (Dziewanowska, 2012, pp. 53–54). For each of the above-mentioned marketing effects, the customer's decision is influenced by both factors that characterize the product or service as well as external factors, including the technological solutions used by companies.

4.2. Sense of telepresence

The first research area highlighted by the analysis is the sense of telepresence. Of all the identified research areas, this one appears most often (30% of publications), even if not as the main one, then accompanying other areas. To get a good understanding of what telepresence is, it is necessary to start with the definition of presence, which is the sense of being in a given environment. This perception is a certain phenomenon since it is not mediated. If a medium

presents us with another reality, the perception is based on two environments. Thus, telepresence can be called the primacy of an imposed environment over the reality in which we physically find ourselves (Steuer, 1992). In other words, it is a person's subjective experience of actually being in a given environment.

There is no universal approach to operationalizing telepresence. However, researchers most often refer to the vividness of the information (operationalized as the width and depth of the message, colors, graphics, quality and resolution) and the interactivity of the technology (operationalized as control, speed, and feedback) (Algharabat & Dennis, 2011).

Waterlander et al. (2015) validated a virtual supermarket by comparing virtual and real food shopping behavior. A virtual supermarket is a computer-generated model with which participants can experience and interact intuitively in real time. Game technology is used to simulate a real supermarket shopping experience, where study participants buy virtual food products. Photographs of real food products are used to compose virtual food products, and prices are displayed on virtual shelf labels. The second objective of the aforementioned study was to obtain feedback from the participants on their perceived sense of presence in a virtual supermarket. Customer shopping patterns in the virtual supermarket were comparable to those in real supermarkets. Additionally, the vast majority of participants experienced a medium to strong sense of presence in the virtual supermarket.

Peng and Ke (2015) analyzed users' perceptions of the authenticity and trustworthiness of virtual prototypes of the three-dimensional (3D) virtual world, as well as users' potential purchasing behavior in a real-life situation. The results showed that users of the 3D virtual world felt a strong sense of telepresence and social presence. The sense of telepresence positively influences online users' trust in virtual prototypes and thus increases the intention to purchase them in the real world. Users' sense of social presence, in turn, interacts positively with users' perceptions of authenticity and trust, and thus purchase intention.

Spielmann and Mantonakis (2018) examined how interactivity encourages telepresence capable of influencing customer attitudes toward an advertised object, such as a city, vehicle, or hotel. After comparing its level with online videos and virtual tours (that is, by clicking the mouse, moving the view of the environment with the mouse, zooming in and out with the touchpad), they found that telepresence was a key factor in creating more memorable brand experiences. Activities performed during virtual tours resulted in higher levels of immersiveness.

Park et al. (2018) studied the use of virtual reality (VR), examining the extent to which participants experience a sense of telepresence and whether this is related to their behavior. They used a 3D modeling computer program to create virtual clothing stores. The VR stores were tested in a Virtual Reality Design Laboratory equipped with the necessary technology to create immersive VR experiences. The researchers showed that there was indeed a high correlation between telepresence, in their study measured as the perception of actually being in a retail store, and the participants' intention to purchase clothing in that store.

The results obtained by Violante et al. (2019) show that the use of virtual technology in marketing efforts allows marketers to identify and respond to opportunities through new technologies that are faster, more efficient, and less expensive, as well as better respond to customers' needs by providing virtual experiences where they want them, how they want them, and when they want them. The researchers have created a VR environment showcasing a 360° virtual supermarket allowing for the creation of highly immersive sensory experiences. The virtual supermarket was designed to look like the actual aisles and shelves of a regular store, making for a very user-friendly and real experience – users could walk through the aisles of the virtual supermarket to see the products on the shelves as if they were in a real store. Study participants were invited to visit the entire virtual supermarket, taking as long as they needed. In the end, they evaluated the virtual supermarket and its impact on engagement. The results showed that in retail, VR experiences allow users to immerse themselves in realistic scenarios where they

can virtually explore products, brands and services, exploring and manipulating visual images, features and functions in different ways.

Melo et al. (2022) conducted a study to obtain information on the impact of VR technology and gender on the user's sense of presence, satisfaction, emotions, and attitudes. They conducted a study with a gender-balanced sample of users, comparing two VR configurations (audiovisual and multisensory), taking into account the user's gender. The virtual environment represented a 3D replica of an actual tourist location in Portugal. Navigation through the virtual world was possible through either a real walk (limited to the tracking area of the VR configuration) or teleportation by pressing the trackpad of the VR controller indicating where to teleport to. The results collected through a questionnaire showed that women scored significantly higher in terms of spatial presence in the various VR configurations and demonstrated greater engagement and overall presence in the audiovisual setting.

The immersiveness of the technological solutions discussed is one of their most key features. Their goal is to draw the customer into the world of a particular store or brand, absorbing him or her with the product or service in a way that is the least different from reality while maintaining the most realistic sensory perception possible. Thus, telepresence as a subjective feeling of being actually in an imposed reality is almost synonymous with maximum immersion. Researchers so often undertake to analyze this phenomenon because new technologies are supposed to provide customers with a real shopping experience without leaving home. In addition to noting the functional advantages of these solutions, the participants in the studies discussed above are also positive about them, as they are in themselves something new and arouse a desire to use them.

4.3. Type of technologies studied

Some of the studies do not directly address the impact of new technologies on customer experience, but with this concept in mind, make a functional comparison between them. Among the studies within new sensory marketing technologies, there are several solutions that researchers are most interested in. VR goggles, also called head-mounted display (HMD), is a device that allows the user to completely disconnect from reality and move into the virtual world by fully engaging visual perception. If this solution is also accompanied by others who engage cognition through the other senses, it is a very effective solution with a high level of immersion. Another frequently studied subject is the comparison of different types of display and the materials displayed on them (in 2D, 3D or using several displays). These comparisons make it possible to choose the solution best suited to a particular type of customer. Somewhat fitting into this theme are the so-called virtual fitting rooms. This is one of more convenient solutions for customers, and thus eagerly analyzed by researchers. However, this does not mean that other possibilities of the virtual environment are overlooked.

4.3.1. VR googles/head-mounted display

The results of a study conducted by Martínez-Navarro et al. (2019) indicate differences in purchase intent depending on the VR format and device used. The effectiveness of VR devices (PC monitor, powerwall, head-mounted display) and VR content formats (360° and 3D) in attracting positive customer responses was studied, which was then compared to the responses from customers of physical stationary stores. The analysis of the results of the questionnaire survey showed that there were no differences in the sense of presence and affect depending on the VR format and device. The model tested by the researchers suggests a dual pathway for VR's influence on customers' purchase intentions in virtual stores: one through emotion and sense of presence, and the other through affect triggered by the virtual environment and brand recall.

Herz and Rauschnabel (2019) sought an answer to the question of what benefits and risks influence customer responses to VR devices, and how VR-specific factors such as virtual presence, virtual embodiment, and their interplay influence adoption among users. The results indicate that customers have a moderately positive attitude toward using VR glasses, while the intention to purchase again remains relatively low. Additionally, the results of the survey show that customers are inclined to see the ability to explore new places and access entertainment as the main benefits of VR glasses. Respondents perceived less value for VR glasses in terms of utilitarian and embodied benefits, and they attribute relatively low importance to the fashion element of VR glasses, particularly in terms of comfort and perceived fashionability.

VR devices are in close contact with the human senses, mediating user experiences, creating immersive and sensory-stimulating experiences that enhance tourists' information-seeking processes and thus help them make final decisions (Huang et al., 2016). In view of this, Flavián et al. (2019a) used the S-O-R (Stimulus-Organism-Response) model in their study to better understand the impact of this particular feature of VR devices on tourists' responses. Conducting a study on the travel market, they highlighted that VR head-mounted monitors generate more immersive experiences, greater sensory stimulation, higher engagement levels, and stronger behavioral intentions toward a destination than desktop PCs or cell phones. The same researchers in 2021 analyzed the impact of technological embodiment on the emotional responses and engagement of potential guests in the context of a hotel's virtual reality experience. The results of the laboratory experiment showed that compared to desktop PCs and cell phones, virtual reality devices generated more positive emotional responses and higher levels of psychological and behavioral engagement.Meissner et al. (2020) compared customer choices on virtual shelves in two environments: a highly immersive VR environment using a head-mounted display and hand-held controllers, and a low-immersion environment in which products are displayed on a desktop computer screen as rotating 3D models. Empirical results show that customers using high-immersion VR choose more differentiated products and are less price sensitive. However, choice satisfaction did not increase with high-immersion VR.

4.3.2. 3D virtual environment

Carlson et al. (2011) sought to answer the question of whether, in a virtual store, the presence of multiple walls minimizes the time it takes a user to find products. They hypothesized that a five-wall immersive display would, on average, yield significantly faster navigation times than a single-wall display. This hypothesis was confirmed, and what is more, participants in the five-wall environment found that the device imitating a shopping cart was easier to use than in the single-wall environment. This study indicates that using multiple walls to provide a greater immersive experience improves the ability to locate items in a virtual shopping situation.

Ba et al. (2012) compared customer service quality and user satisfaction in 3D virtual worlds with satisfaction with online services. Two online 2D and 3D environments were designed. The SecondLife platform was used to create a virtual water cruise based on the image of real cruises. The participant was able to have direct contact with customer service. In the 2D version, a mockup of the cruise service website was designed with photos, text, and videos. A pop-up chat window was embedded in the site to get information about the cruise service from an active customer service representative. The results of this study showed that users of 3D virtual worlds gained a better sense of being in an online environment, and the use of a 3D customer service platform could increase user satisfaction by providing a higher quality of customer service in an immersive environment.

Huang and Tseng (2015) examined the relationship between vivid (visually clear and intense) consumption memories and four types of exploratory online consumption behavior (that is, concentration, exploratory consumption behavior, playfulness, and time distortion). This study used software to try on clothes. The study exhibited playful and exploratory consumption behavior

immediately after using interactive augmented reality technologies to activate vivid memories. This study also showed that the degree of autotelic need for touch influences the formation of self-references and the activation of vivid memories.

Yoon et al. (2015) investigated whether different visual cognitive styles (understood as approaches to processing visual information) affect the sense of presence (that is, simulated experience in a virtual environment) and how visual cognition and presence affect user satisfaction with an integrated 3D system. There are two basic styles: spatial visualization and object visualization. In broad terms, object visualization is defined as the representation of the literal appearance of individual objects in terms of their form, size, shape, color, and brightness. Spatial visualization, on the other hand, refers to a relatively abstract representation of the spatial relationship between objects. A group of survey respondents of 181 students (90 male, 91 female) from various disciplines participated in an experiment using a virtual environment stimulus and received a questionnaire. The questions in the questionnaire were designed to measure the participants' propensity to use object visualization or spatial visualization, their sense of presence and satisfaction. The results showed a relationship between visual cognition, presence, and user satisfaction in the virtual environment. Significant gender differences were also observed in satisfaction, as well as in visual information, which affect the user experience of the embedded interface of the 3D virtual environment. It was found that for women, the style of visualization of objects influenced their sense of presence in the virtual environment, while for men it was spatial visualization.

Krasonikolakis et al. (2018) investigated the impact of the atmosphere of the retail store on customer behavior in 3D online shopping environments. They found that ease of navigation is influenced by types of store layout in 3D online environments. This research showed that the layout of the store is an important determinant of the cognitive mapping.

Xu et al. (2020) in their paper presented an AR (augmented reality) fashion show system that uses personalized 3D models of users. This system allows ordinary customers to participate in a fashion show in their real environment. A preliminary evaluation was conducted to validate this system. It showed that it is effective and can help customers make better decisions about buying clothes, which could have potential applications in the future.

Jitkusolrungrueng and Vongurai (2021) set out to study the impact of virtual reality on the purchase intention for cutting tools at trade shows in Thailand. This study showed that customers' intention to purchase cutting tools using VR technology depends on a sense of authenticity, credibility, and functional value.

Cowan et al. (2021) sought answers to the question of how media-induced presence (360 VR and video) leads to increased attitudes and purchase intentions, and how this effect depends on customer knowledge of product categories, as well as haptic information. 360 VR (compared to low-presence media) evokes more favorable ratings. However, in-store 360 VR evokes less positive reactions. When customers are highly knowledgeable about a product, 360 VR reduces customer reactions to a brand. On the other hand, when customers have low product knowledge, 360 VR increases customer reactions to the brand.

Kamil et al. (2021) evaluated the effectiveness of interactive virtual reality in the design of home interiors for real estate purchase decisions. They designed a user interface that, when enhanced, allowed respondents to navigate through an interactive virtual environment similar to a home. The survey included 30 respondents between the ages of 25 and 40 (including potential real estate customers). The results of the questionnaire survey showed that 90% of the respondents believed that interactive virtual reality was effective in helping them make real estate purchase decisions.

Loureiro et al. (2021) conducted a study to extend the S-O-R (Stimulus-Organism-Response) model. The virtual environment simulated a shoe store with which participants could interact. The wall textures were prepared using simulated shelves and printed brand advertisements.

All participants began their exploration of the virtual environment at the entrance to the store, standing in front of the counter. They could move in any direction to explore the items inside the store. The moving distance was limited by the cables of the head-mounted VR goggles and by the simulated walls of the virtual environment. Escapism, as one of the customer experience modules, stimulates customers' cognitive and affective states that increase their pleasure. Customers' sense of pleasure increases vividness and in-store presence in virtual reality, which positively influences their intentions. In addition, the relationship between perceived presence and behavioral intentions is stronger with calm background music, while the relationship between arousal and pleasure is stronger when customers listen to music with upbeat rhythms in the virtual store.

4.3.3. AR-based solutions

Huang and Liao (2017) demonstrated that augmented reality (AR) generates more multisensory experiences than other forms of technology when it comes to hedonic values. They identified several experience-related values that influence customers' intention to visit virtual fitting rooms, including control, concentration, and pleasure.

The goal of Huang et al.'s (2019) study was to examine the psychological factors influenced by augmented reality (AR) services, an augmented reality fitting room system. The results show that modality, a synchronous sense of ownership control, and the ability to reprocess the AR try-on system positively affect customer experience. Both body observation and modality awareness significantly modify the effect of AR fitting system features on customer experience.

Scholz and Duffy (2018) explored how the customer-brand relationship could be facilitated through augmented reality. Through an ethnographic study of how customers use Sephora's mobile app for AR shopping in their own homes, they found that a close relationship could be formed through how the branded AR app is integrated into the customer's personal space and sense of self.

Petit et al. (2021) examined how customers' food purchase intentions change depending on the visualization mode (3D vs. AR) and product format (served vs. packaged). They showed that AR visualization of the food served improves simulation of the eating process compared to 3D visualization. They also showed that 3D visualization increases purchase intention for packaged versus served products, while the opposite is true for AR visualization.

The results of Batat's (2021) study suggest that AR can positively or negatively affect customers' perceptions of their restaurant experience along five dimensions, namely sensory (intensity of the five senses), affective (pleasure), behavioral, social, and intellectual dimensions. These dimensions can improve the customer experience and can be managed by restaurateurs to improve positive attitudes toward AR in the restaurant industry.

4.3.4. Technologies focused on sensory perception

Overmars and Poels (2015) conducted a study to identify elements of product presentation design that interact with the sense of touch to create an emotional connection between customers. The results show that an interface using pictorial interactivity to simulate stroking gestures elicits more positive emotional responses and suppresses the negative emotions associated with an interface using static images.

The study by Van Kerrebroeck et al. (2017) aimed to identify specific tactile features worth including in e-commerce, the type of customer value they can provide, and the factors in and barriers to customer acceptance of tactile technologies in online shopping. The study found that touch-enabled technologies can provide utility and hedonistic value to customers, mainly at the prepurchase stage. Valuable uses invented by customers are mainly related to offering information on material and geometric properties of products. An obstacle for customers seems to be the need for a special output device, such as a glove. Liu et al. (2019) studied various customer hand

movements and how each facilitates mental simulation of touch. Rotating the product 360 degrees makes it easier for customers to simulate haptic sensations in their minds. Touchscreen gestures create stronger haptic imagery than airborne gestures and mouse interaction. Using touchscreen gestures, customers can directly touch product images, although contact is mediated by the touchscreen. In addition, customers can interact with products using natural tactile gestures and get the kinesthetic experience that is often associated with the actual touch experience.

Luo et al. (2019) examined the impact of sensory feedback (visual and tactile) and its convergence with customers' online shopping experience. The results show that a customer's evaluation of a product can be shaped by sensory feedback enabled by interaction technologies. The researchers pointed out that sensory congruence is critical in determining whether sensory feedback is helpful in shaping customers' evaluation of a product. They suggest that marketers should use interactive images to showcase a product, increasing its tangibility, and thereby reducing customers' perceived purchasing risk. Specifically, by presenting products that have a similar haptic feel to the surfaces of touchscreen devices, marketers should encourage customers to view products via touchscreen devices, allowing them to become more familiar with the product. However, if the haptic attributes of products conflict with the feel of the touchscreen surface, they should use gesture-based devices in the air to avoid sensory incompatibilities.

Pelet et al. (2019) investigated the opportunities and risks that arise from the application of artificial intelligence (AI) and the internet of things (IoT) to the multisensory brand experience of guests in 4- and 5-star hotels. They showed that both hotel managers and guests seem to believe that the use of IoT can stimulate guests' sensory experiences and increase satisfaction and loyalty. The same team of researchers in 2021 examined how stimulating the senses of guests at upscale hotels through IoT devices affected their emotions, affective experiences, well-being, and ultimately their behavior. The results showed that while the senses of smell, hearing, and sight influenced guests' emotions, the senses of touch, hearing, and sight influenced guests' affective experiences. The senses of smell and taste influenced the guests' eudaimonism. The sense of smell had a greater impact on eudaimonism and behavioral intentions among women than among men.

Brengman et al. (2022) sought answers to the question of how conventional VR ads can be enhanced by incorporating the sense of smell and whether doing so actually provides a more engaging experience. The results indicate that the compatibility of a product's smell (with sound) is a factor that increases the attractiveness of an offer, although the incompatibility of a product's smell with an offer is not necessarily a factor that decreases it.

The research discussed above shows that new immersive technology solutions aim to absorb the customer to the highest possible degree (preferably fully) in order to influence the customer's purchase experience through the senses. The higher the level of immersion, the more influence marketers have on the customer. It is noticeable that researchers prefer to focus on one selected technology or on a specific aspect of customer experience. The influence on the evaluation of a particular product or service seems to be a key issue, but not the most important one. After all, it should not be forgotten that nowadays it is not always the good purchased that is at the center of the purchasing process, but the purchasing situation itself.

5. FUTURE RESEARCH DIRECTIONS

The results of the presented research not only provide theoretical input, but help marketing specialists to better adapt modern solutions that make the customer's purchasing process more attractive. It should also not be forgotten that modern technological solutions are only part of the marketing strategy, and the relevance of these solutions in the overall marketing effort is still not clearly defined. One of the disadvantages of the new technology market (which, from a social point of view, is an advantage) is the speed of changes that occur on it. This causes a constant

need to update the state of research. Based on the results of the research presented in the literature review conducted, thematically divided research gaps have been identified. The identified research gaps relate to the type of technologies studied and their characteristics, customer characteristics, marketing effects, and the markets studied.

5.1. Research gap based on type of technology

The first category of research gaps relates to the type of technology being studied. The most common technological tool used in research is VR glasses (Martínez-Navarro et al., 2019; Herz & Rauschnabel, 2019; Flavián et al., 2019a; Meissner et al., 2020). This may be due to the fact that this device is becoming increasingly more common, both in terms of its use and availability on the market. The fact that users are using this type of device more frequently makes it necessary to study it from many angles. Indeed, it is no longer a study of a prototype, but increasingly a purchasable product. There is no shortage of examples of research on this device, but certainly not all aspects of it have been taken into account. Very rarely do researchers undertake comparisons of specific devices (at the level of the same sense, of course, so that the results can be comparable). The reason for this may be a barrier in the form of access to technology. Just as VR goggles are increasingly available, VR gloves (Van Kerrebroeck et al., 2017) or other devices that allow transfer to a virtual environment are rare and most often require creation and preparation specifically for the study, at considerable cost. After analyzing the studies presented, one can find comparisons of low-immersive solutions, such as 360° video or interactive advertising, but there are no analyses that undertake a direct comparison of technologies with a relatively high level of immersiveness, such as VR or AR. This comparison can be based on the selection of specific devices and testing them on a narrow target group, or based on the particular sense they affect. VR technologies most often come in the form of physical devices, while AR takes the form of applications that allow virtual modification of reality. With this in mind, it remains to be seen whether the level of immersiveness, which according to the EPI Cube model discussed above is lower for AR compared to VR, will prove to be more effective. After all, a higher level of immersiveness of the technologies in question is not synonymous with a higher degree of impact on the customer. In fact, it may work more effectively, but the question is whether it is necessary to reach the maximum level of immersiveness to achieve a satisfactory effect in the form of the assumed marketing effects.

5.2. Research gap based on characteristics of technology

Related to the previous one, the next category of research gaps concerns the characteristics of the technologies in question. The sense of telepresence, which has been the subject of many of the aforementioned studies (Waterlander et al., 2015; Peng & Ke, 2015; Spielmann & Mantonakis, 2018; Park et al., 2018; Violante et al., 2019; Melo et al., 2022), is worth investigating through its comparison between different tools with different levels of immersiveness. The relationship between the sense of telepresence and elements of customer experience is also lacking in the current research. Are customers succumbing to the virtual environment so absorbed by it that telepresence reduces the need for social presence? Or does the virtual world lack the social context and sense of being in the company of others? The purchasing process is often not just an individual decision, but the result of the need of the purchasing center. In addition to positive or negative attitudes towards new technologies, it is important to analyze whether customers appreciate the hedonistic or utilitarian aspects of these solutions more. Does the customer rate the solution highly because it actually meets his or her expectations, or is it the effect of the first contact with such new tools? In addition to escapist and functional elements, future research may focus on the aesthetics of the given solutions and their entertainment aspect. Spreading

a brand's signature scent in a showroom in the form of an online store or technologies that would allow a company to provide online visitors with a taste of the latest product in its assortment sounds futuristic. Despite the myriad solutions that may come to mind, unfortunately, the state of development of scent and taste technologies for online commerce is not as advanced as in the area of technologies related to other senses. Testing such technologies is thus even more challenging. However, given the importance of online shopping and the rapid pace of evolution of sensory technology, as well as developments in the IT discipline, the future of further research in this area seems to be heading in this direction.

Given that the topic of new technologies in sensory marketing has been in development for years and only today is seeing a big jump in its development, researchers can undertake to analyze the effectiveness of the solutions in question over a long period of time. This is because there is a lack of studies showing the impact of new technologies on a particular customer over the years. Today, customers may be fascinated by this kind of solution, but in hindsight, when it becomes commonplace, perceptions may change.

5.3. Research gap based on customer characteristics

Customers who use new technologies are mostly young people who have grown up with them. The most common group of participants in the described studies are students – people under the age of 30 (Carlson et al., 2011; Peng & Ke, 2015; Overmars & Poels, 2015; Huang & Liao, 2017; Krasonikolakis et al., 2018; Violante et al., 2019; Meissner et al., 2020). It is worth conducting a survey to study the perceptions of customers of other generations and compare them. Similarly, when it comes to other variables. Demographic factors (such as income, level of education, place of residence) or psychographic factors (such as stress level, level of self-esteem, attitude to fashion, propensity to risk, propensity to save) are as possible as those that can determine the power of modern solutions to influence specific customers. Marketing science distinguishes many typologies of customers, indicating their types, most often based on personality type. Comparing the effectiveness of a given solution in relation to a customer type or personality type provides important information for businesses. Also, there are less common characteristics, such as fear of technology. It can play a big role because the effect of touch technology is not yet known. One of the solutions that uses glove technology has actuators, which some customers may find disturbing. It seems interesting to compare perceptions of new sensory marketing technologies in a cross-cultural context. This is also related to the fact that new technologies are increasingly being used in less developed countries, and for the time being the vast majority of such studies are conducted in developed countries. Comparing the effectiveness of the same solutions on customers in less and more developed countries will be an important answer not only for marketing theorists but also for practitioners implementing these innovations. Observing and comparing stationary purchases with those made online will also provide an answer to the question related to price sensitivity. Are they more or less sensitive to product prices in a virtual store?

5.4. Research gap based on marketing effects

Among other things, the use and improvement of tools from new experience marketing technologies is aimed at improving customer experience. Among the studies conducted to date, one encounters those that analyze the impact of these solutions on customers' behavioral intentions (such as intent to purchase, visit, or recommend), satisfaction, or customer trust. However, customer experience is a much broader concept in which many aspects are overlooked in the conducted studies. Described in the theoretical section, the concept of a modular approach to e-experience marketing points to 7 modules. The sensory and escapist modules are the ones on which most research is focused. However, too little attention is paid to the emotional,

behavioral, and relational module. The social presence aspect has already been mentioned with the research gap related to the features of modern technologies, but the emotions accompanying the customer in a virtual shopping situation and his or her behavior are still the subject of very little research. Examining customer attitudes here seems to show the difference in the importance of the customer's cognitive, affective, and conative reactions. Does the customer recognize the shapes and colors of familiar products just as easily in a virtual environment, or worse? Does the layout of a virtual store affect the amount of time a customer has to navigate to identify a particular product? How does this time differ between VR and AR solutions? Will in-store music have an identical impact on the customer in a virtual store compared to a stationary store? Generalizing these questions, one should compare the difference in effectiveness of identical marketing solutions used for stationary and virtual stores.

5.5. Research gap based on market investigated

The use of new sensory marketing technologies is most applicable to the shopping process. For this reason, most of the research is based on an artificial shopping situation in which the customer moves through a virtual store (in most cases, a supermarket with many products) (Waterlander et al., 2015; Krasonikolakis et al., 2018; Violante et al., 2019). In addition to supermarkets, there is often the clothing industry mainly based on the use of new technologies in the form of virtual fitting rooms and furniture showrooms, which allow you to easily arrange the space of your choice. There are also examples from the tourism market (Ba et al., 2012; Huang et al., 2016; Spielmann & Mantonakis, 2018; Flavián et al., 2019a; Pelet et al., 2019; Melo et al., 2022) that allow virtual tours of a place before actually visiting it. Still, other questions arise: are virtual tours more likely to evoke telepresence when the destination is farther away from the customer's location, or does the physical proximity of the product help the customer better visualize and authenticate their virtual tour? Researchers are also focusing on the cosmetics industry (Scholz & Duffy, 2018), where customers can test the selected products themselves, thanks to an application based on augmented reality, even before purchasing them. In view of this, it is worth extending the research to other industries, such as fitness or education. After all, the use of new technologies is not limited only to the virtual purchase of products. Often, purchasers of services can also enjoy new solutions, such as a virtual trainer in the case of workouts at the gym or the ability to virtually adjust a hairstyle before it is actually done at a hair salon. What is more, customer perception can vary depending on the situation in which these modern tools are used. A customer who appreciates the advantages of a virtual environment in the case of a shopping situation in a virtual supermarket may already evaluate the same tool differently in the context of a different industry. In view of this, it is possible to compare perceptions of the rightness and usefulness of new technologies in selected markets, as well as the category of the good being purchased – a product or service.

6. CONCLUSIONS AND LIMITATIONS

This paper systematically reviews the literature on new technologies that fall into the field of sensory marketing and how they relate to customer experience. These topics are eagerly taken up by researchers, as they make it possible to analyze the phenomena we are dealing with today. New technologies related to virtual, augmented or mixed reality, the internet of things or the virtual environment in the broadest sense are constantly being improved in order to better understand the customer. This is because they are tools that are used to diversify the market offer and, by extension, customer experience. For this reason, these solutions are analyzed in terms of many aspects described earlier. Therefore, the relevance of studying this phenomenon is high.

Generalizing the results obtained, the use of new technologies by marketers in many markets is enjoying a positive response from their users. One of the modules of sensory marketing is the escapist module (Kacprzak, 2017), which assumes such a strong shopping experience that will cause a disconnection from reality and a loss of the sense of time. Researchers refer to it by analyzing the level of telepresence, simultaneously compared with the intention of making a purchase. Very often, the level of immersiveness positively correlates with purchase intention. The use of new technologies that interact with the customer's senses also leads to better shopping experiences, enjoyment, satisfaction, and even trust. The fact that the described technological solutions are in their preliminary stages is proven by examples of studies that focus on the typically technical-mechanical aspects of these solutions. We are talking, among other things, about the convenience of using the devices, the customer's reaction time to certain stimuli or the identification of barriers to using these devices.

When interpreting the results of this review, certain limitations must be taken into account. The search was limited to studies described in English. The review also omits grey literature, for its lower level of reliability and the absence of peer review. Only articles from two databases were included in this review: Scopus and Web of Science Core Collections. These are among the largest databases where one can find relatively most articles related to a particular area of science, but not all items of literature are included. This causes the review to overlook articles that the aforementioned databases do not cover. Furthermore, the review showed that new technologies that fit into experiential and sensory marketing are a subject of research analyzed from many angles. This is both a strength, as this area of marketing is widely analyzed, and a weakness, as a search for studies focusing on only one specific aspect (such as customer satisfaction or buyer trust) would significantly reduce the number of identified studies to just a few. This, in turn, still leaves the way open for researchers wishing to undertake analysis of this problem.

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APPENDIX 1

List of identified publications included in the qualitative synthesis

YEAR	JOURNAL	AUTHORS	TITLE	THEORETICAL FRAMEWORK	STUDY SAMPLE SIZE	NEW TECHNOLOGY SOLUTION STUDIED	AIM OF THE STUDY	RESULTS
2011	Proceedings of the ASME 2011 World Conference on Innovative Virtual Reality, WINVR 2011	Carlson P., Kirpes C., Pavlik R.A., Vance J.M.	Comparison of single-wall versus multi-wall immersive environments to support a virtual shopping experience	N/A	23	a multi-wall and single-wall immersive environment	to compare the use of a multi-wall immersive environment to a single-wall immersive environment	the use of multiple walls to provide an increased sense of immersion improves the ability of consumers to locate items within a virtual shopping experience
2012	10th Workshop on E-Business on E-Life: Web-Enabled Convergence of Commerce, Work, and Social Life, WEB 2011 (2012)	Ba S., Ke D., Stallaert J., Zhang Z.	Comparing the quality of customer service in 3D virtual worlds to web-based service	media richness theory	189	2D and 3D online environment	to compare the service quality and user satisfaction in 3D virtual worlds to web-based service	users of 3D virtual worlds felt a better sense of being in the online environment and using the 3D platform for customer service can increase user satisfaction by providing higher customer service quality in the immersive environment
2015	Journal of Electronic Commerce Research	Huang T., Tseng C.	Using augmented reality to reinforce vivid memories and produce a digital interactive experience	script theory	336	an ARIT try-on environment	to investigate the relationship between vivid memories and exploratory consumption experience in an ARIT context according to script theory; to investigate how consumers' sense of ownership affects the relationship between vivid memories and exploratory consumption experience in an ARIT context; to investigate how consumers' autotelic need for touch affects the relationship between vivid memories and exploratory consumption experience in an ARIT context	vivid memories positively influence exploratory consumption experience (that is, concentration, exploratory behavior, playfulness, and time distortion); the degree of autotelic need for touch influences the formation of self-referencing and activation of vivid memories
2015	International Journal of Human Computer Studies	Yoon S., Choi Y., Oh H.	User attributes in processing 3D VR-enabled showroom: Gender, visual cognitive styles, and the sense of presence	object–spatial–verbal cognitive style model	181	a 3D VR showroom	to investigate whether different visual cognitive styles influence the sense of presence (that is, simulated experience in VEs) and how visual cognitions and presence affect user satisfaction of the 3D integrated system, as well as to uncover empirical evidence of gender influence on those relationships	the results demonstrated significant gender differences in satisfaction as well as in processing visual information that influences user experience of the 3D VR embedded interface; women's object visualization style was found to affect their sense of presence in VEs; for men, it was spatial visualization
2015	Nankai Business Review International	Peng Y., Ke D.	Consumer trust in 3D virtual worlds and its impact on real world purchase intention	media richness theory	156	a Second Life Virtual World	to examine the three-dimensional (3D) virtual world users' perceptions of authenticity and trustworthiness in the virtual prototypes and users' potential purchase behavior in the real-world settings	the research results showed that 3D virtual world users obtained a high sense of telepresence and social presence; the sense of telepresence positively leads to users' perceptions of online trust in the virtual prototypes and thus increases their intention to purchase real-world objects; users' sense of social presence is positively associated with their perceptions of authenticity and online trust and, therefore, their purchase intention

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YEAR	JOURNAL	AUTHORS	TITLE	THEORETICAL FRAMEWORK	STUDY SAMPLE SIZE	NEW TECHNOLOGY SOLUTION STUDIED	AIM OF THE STUDY	RESULTS
2015	International Journal of Design	Overmars S., Poels K.	A touching experience: Designing for touch sensations in online retail environments	emotions theory	43	two product presentation formats (static interface, interactive interface)	to identify product presentation design elements that appeal to the sense of touch and therefore affect the extent to which the displayed product can be experienced emotionally	interactive cues enhance the realism of tactile human-product interactions in mediated environments
2015	Journal of Medical Internet Research	Waterlander W., Jiang Y., Steenhuis I., Ni Mhurchu C.	Using a 3D virtual supermarket to measure food purchase behavior: A validation study	N/A	123	a virtual supermarket	to validate the Virtual Supermarket by comparing virtual and real-life food purchasing behavior; to obtain participant feedback on perceived sense of "presence" in the Virtual Supermarket.	shopping patterns in the Virtual Supermarket were comparable to those in real life; overall, the Virtual Supermarket is a valid tool to measure food purchasing behavior
2017	International Journal of Retail and Distribution Management	Van Kerrebroeck J., Willems K., Brengman M.	Touching the void: Exploring consumer perspectives on touch-enabling technologies in online retailing	the Technology Acceptance Model; the Unified Theory of Acceptance and Use of Technology	37	a haptic touchscreen tablet; a haptic glove and virtual environment	to identify the specific touch-related properties worthwhile to enable in online retailing and the type of customer value that can be provided, as well as the drivers of and barriers to consumer acceptance of touch-enabling technologies for online shopping	touch-enabling technologies can provide utilitarian and hedonic value to consumers, mainly at the pre-purchase stages in the path-to-purchase
2017	Internet Research	Huang T., Liao S.	Creating e-shopping multisensory flow experience through augmented-reality interactive technology	virtual liminoid theory	336	an ARIT try-on environment	to investigate what features and elements are involved in decorating psychological states when e-shoppers are engaged in online fitting; which decorating psychological states accelerate immersion in virtual avatar decoration in an e-shopping context; what design features of ARIT induce e-shoppers' decorating psychological states and engagement in online fitting	haptic imagery (that is, the effect of actual touch) and sense of self-location (that is, the emphasis on creating a feeling of real space) positively influenced perceived sense of body ownership, perceived ownership control, and self-explorative engagement
2018	Journal of Business Research	Spielmann N., Mantonakis A.	In virtuo: How user-driven interactivity in virtual tours leads to attitude change	theory of telepresence	92	An online video or virtual tour	to provide insights into the process mechanisms that occur in virtual tours, contributing to research on online interactivity and the influence of consumer-driven online interactions on consumer perceptions and behavior	when users interact in virtual tours via their input (rather than being passive in front of an online video), they are able to transform more information, which results in stronger attitudes; users in virtual tours are more immersed and better able to construct, store and understand advertiser representations
2018	Fashion and Textiles	Park M., Im H., Kim D.	Feasibility and user experience of virtual reality fashion stores	emotions theory, theory of telepresence	40	a VR environment	to identify advantages and challenges of using an immersive VR technology in the fashion retail context for practitioners and scholars; to understand VR user experience of virtual stores and how it affects shopping outcomes	the immersive experience of VR was positively related with important shopping outcomes such as pleasure, attitude toward virtual stores, and purchase intention

continued Appendix 1.

YEAR	JOURNAL	AUTHORS	TITLE	THEORETICAL FRAMEWORK	STUDY SAMPLE SIZE	NEW TECHNOLOGY SOLUTION STUDIED	AIM OF THE STUDY	RESULTS
2018	European Journal of Marketing	Krasonikolakis I., Vrechopoulos A., Pouloudi A., Dimitriadis S.	Store layout effects on consumer behavior in 3D online stores	the Technology Acceptance Model; the stimuli–organism–response (S–O–R) model	59	a 3D virtual store	to investigate the effect of the retail store's atmosphere on consumer behavior in 3D online shopping environments, focusing on store layout as a critical influential factor	online shopping enjoyment, entertainment and ease of navigation were shown to be influenced by the store layout types of 3D online environments; conversely, online customer experience was not influenced by the store layouts; online shopping enjoyment in terms of store layout evaluation was shown to have a predicting power on online purchase intentions, whereas online customer experience, ease of navigation and online shopping enjoyment were shown to have a predicting power on word-of-mouth intentions; finally, telepresence moderates the degree of store layout influence on customers' online shopping enjoyment
2018	Journal of Retailing and Consumer Services	Scholz J., Duffy K.	We ARe at home: How augmented reality reshapes mobile marketing and consumer-brand relationships	triple articulation of media technologies framework	31	a mobile AR shopping app	to investigate what are consumers' activities and experiences with an AR shopping app that they use within their domestic space and what consumer-brand relationships arise as the retailer is invited into consumers' familiar environments	the intimate, familiar, casual, and relaxing atmosphere of consumers' homes allows them to interact with a brand in ways that feels personal and supportive of self-expression and self-experimentation
2019a	Journal of Travel & Tourism Marketing	Flavián C., Ibáñez-Sánchez S., Orús C.	Integrating virtual reality devices into the body: Effects of technological embodiment on customer engagement and behavioral intentions toward the destination	the stimuli–organism–response (S–O–R) model	202	360-degree videos with different devices (desktop PC, laptop, tablet, mobile phone, VR HMD)	to analyze how the degree of technological embodiment (high: VR HMD, medium: mobile phone, low: desktop PC) affects the customer pre-experience with a destination	compared to desktop PC and mobile phones, VR head-mounted displays generate more immersive experiences, higher sensory stimulation, more engagement, and stronger behavioral intentions toward the destination
2019	Advances in National Brand and Private Label Marketing	Pelet J., Lick E., Taieb B.	Internet of things and artificial intelligence in the hotel industry: Which opportunities and threats for sensory marketing?	a holistic concept of customer experience	224	IoT and AI solutions	to investigate which opportunities and threats the use of artificial intelligence (AI) and the internet of things (IoT) may have in relation to the multisensory brand experiences of guests in 4- and 5- star hotels	both hotel managers and guests seem to believe that the application of IoT may stimulate guests' sensory experiences and increase their satisfaction and loyalty
2019	International Journal of Interactive Design and Manufacturing	Violante M., Vezzetti E., Piazzolla P.	How to design a virtual reality experience that impacts the consumer engagement: The case of the virtual supermarket	consumer engagement theory	50	a 360 degree virtual supermarket	to develop an immersive virtual reality online shopping environment that includes the major advantages of offline and online shopping and to study its effect on consumers' behavior	applying virtual technology to marketing activities allows marketers to identify and respond to opportunities through new technologies which are faster, more effective, and lower cost and to become more responsive to consumers' needs by providing virtual experience where they want it, how they want it and when they want it

continued Appendix 1.

YEAR	JOURNAL	AUTHORS	TITLE	THEORETICAL FRAMEWORK	STUDY SAMPLE SIZE	NEW TECHNOLOGY SOLUTION STUDIED	AIM OF THE STUDY	RESULTS
2019	Journal of Services Marketing	Huang T., Mathews S., Chou C.	Enhancing online rapport experience via augmented reality	self-determination theory (SDT); the concept of self-evaluation; consumer–augmented reality rapport experience	207	an AR try-on system	to draw on self-determination and self-evaluation theories to examine the psychological factors impacted by augmented reality (AR) services, an augmented reality try-on system	modality, synchronous sense of ownership control and re-processability of an AR try-on system positively affect the consumer's rapport experience; both body surveillance and fashion consciousness significantly moderate the effects of AR try-on service system characteristics on consumer rapport experience
2019	40th International Conference on Information Systems, ICIS 2019	Luo C., Shen Y., Liu Y.	Look and feel: The importance of sensory feedback in virtual product experience	virtual product experience (VPE);	N/A	a simulated online shopping webpage	to explore the impacts of sensory feedback (that is, visual feedback and haptic feedback) and its congruence on consumers' online shopping experience	consumers' product evaluation would be shaped by sensory feedback enabled by interaction technologies; sensory congruence is critical in determining whether sensory feedback is helpful in shaping consumers' product evaluation
2019	Journal of Business Research	Martínez-Navarro J., Bigné E., Guixeres J., Alcañiz M., Torrecilla C.	The influence of virtual reality in e-commerce	the VR experience: affect, cognition and conation	178	PC desktop; powerwall; HMD	to analyze the effectiveness of VR devices (PC monitor, powerwall and head-mounted displays (HMD)) and VR content formats (3D and 360°) in eliciting positive consumer responses and to compare these to responses evoked in physical store settings	virtual stores are more effective in generating cognitive and conative responses; brand recall appears to be significantly more distinct in all v-commerce conditions than in a physical store; emotions experienced in a virtual store impact on sense of presence, which, in turn, increases consumers' purchase intentions; the consumer's affective assessment of a virtual environment impacts on brand recall, influencing his/her purchase intention; discomfort perceived in a virtual store does not influence sense of presence or brand recall
2019	Technological Forecasting and Social Change	Herz M., Rauschnabel P.	Understanding the diffusion of virtual reality glasses: The role of media, fashion and technology	the Technology Acceptance Model	611	VR glasses	to propose and empirically test a comprehensive framework for the study of consumer reactions to VR glasses	consumers have a moderately positive attitude toward using VR glasses, while (re)purchase intention remains comparatively lower; consumers tend to react positively to VR glasses if they associate them with hedonic benefits; neither perceived physical risk nor psychological risk significantly impact people's attitudes toward VR glasses; however, people do fear health risks associated with the actual use of the device

continued Appendix 1.

YEAR	JOURNAL	AUTHORS	TITLE	THEORETICAL FRAMEWORK	STUDY SAMPLE SIZE	NEW TECHNOLOGY SOLUTION STUDIED	AIM OF THE STUDY	RESULTS
2019	Journal of Management Information Systems	Liu Y., Jiang Z., Chan H.	Touching the future: The effects of gesture-based interaction on virtual product experience	virtual product experience (VPE);	183	two websites with either 3D or 2D product presentation / mouse or Leap Motion (a mid-air gesture controller)	to investigate how gesture-based interaction modes, namely, mid-air gesture and touchscreen gesture, compared with mouse-based interaction, affect consumers' virtual product experiences (VPE) by eliciting mental imagery (that is, haptic imagery and spatial imagery)	touchscreen gesture outperforms mid-air gesture and mouse-based interaction in terms of eliciting haptic imagery, and this effect is mitigated when 3D presentation is used; mid-air gesture outperforms touchscreen gesture and mouse-based interaction in terms of eliciting spatial imagery when 3D presentation is used; both haptic imagery and spatial imagery can further reduce consumers' product uncertainty
2020	Journal of Business Research	Meissner M., Pfeiffer J., Peukert C., Dietrich H., Pfeiffer T.	How virtual reality affects consumer choice	a consumer decision-making and choice behavior; a VR experience	296	a head-mounted display/ a regular computer screen	to investigate how experiencing products in high-immersive compared to low-immersive VR affects consumer choice	consumers in high-immersive VR choose a larger variety of products and are less price-sensitive; choice satisfaction, however, did not increase in high-immersive VR
2020	Thematic Area on Human Interface and the Management of Information, HIMI 2020, held as part of the 22nd International Conference on Human-Computer Interaction, HCII 2020	Xu S., Yuan J., Sun X., Liu Y., Liu Y., Cheng K., Masuko S., Tanaka J.	Augmented reality fashion show using personalized 3D human models	N/A	10	an AR fashion show	to validate an AR fashion show system	an AR fashion show system is effective and can help customers make better decisions on the purchase of clothes, having potential applications in future
2021	Journal of Distribution Science	Jitkusolrungrueng N., Vongurai R.	Distributing data in virtual-reality: Factors influencing purchase intention of cutting tools	a narrative theory; customer experience	500	two metalworking exhibitions	to investigate the impact of virtual reality on real world purchase intention of automotive cutting tools in Thailand's exhibitions	authenticity, functional value, and trustworthiness induced higher experiential value towards purchase intention; those variables are stimulated by telepresence and perception narrative towards VR experience; consumer's purchase intention towards VR experience on engineering cutting tools rely on consumer's sense of authenticity, trustworthiness, and functional value
2021	Journal of Business Research	Cowan K., Spielmann N., Horn E., Griffart C.	Perception is reality ... How digital retail environments influence brand perceptions through presence	virtual experience	128	360-virtual reality	to evaluate how presence induced by media (360-VR versus video) leads to heightened attitudes and purchase intentions and how this effect depends on consumer's knowledge of the product category as well as haptic information	when consumers have vast product knowledge, 360 VR decreases consumer responses toward the brand; alternatively, when consumers have low product knowledge, 360 VR enhances consumer responses toward the brand; introduction of haptic instructions attenuates the unilateral negative effect of product knowledge; mental imagery underpins these relationships

continued Appendix 1.

YEAR	JOURNAL	AUTHORS	TITLE	THEORETICAL FRAMEWORK	STUDY SAMPLE SIZE	NEW TECHNOLOGY SOLUTION STUDIED	AIM OF THE STUDY	RESULTS
2021	Technological Forecasting and Social Change	Batat W.	How augmented reality (AR) is transforming the restaurant sector: Investigating the impact of "Le Petit Chef" on customers' dining experiences	a multidimensional customer experience theory	20	the AR video-mapping technology	to understand how the restaurant sector is changing and the impact AR and video mapping are having on the customer's dining experience	AR plays an essential role in terms of improving the overall food well-being of consumers and thus can lead to positive post-consumption behaviors; AR can affect consumers' perceptions of their restaurant experiences according to the five dimensions of the customer experience framework: sensory, affective, behavioral, social, and intellectual dimensions
2021	International Journal of Contemporary Hospitality Management	Pelet J., Lick E., Taieb B.	The internet of things in upscale hotels: Its impact on guests' sensory experiences and behavior	a holistic concept of customer experience	357	IoT and AI solutions	to examine how stimulating the senses of guests at upscale hotels through IoT devices affected their emotions, affective experiences, well-being, and ultimately their behavior	while the senses of smell, hearing, and sight influenced guests' emotions, the senses of touch, hearing, and sight influenced guests' affective experiences; the senses of smell and taste influenced guests' eudaimonism; the sense of smell had a greater impact on eudaimonism and behavioral intentions among women than among men
2021	Journal of Hospitality Marketing & Management	Flavián C., Ibáñez-Sánchez S., Orús C.	Impacts of technological embodiment through virtual reality on potential guests' emotions and engagement	theory of technological mediation; the Embodiment-Presence-Interactivity Cube; customer experience	141	a VR headsets	to analyze the impact of technological embodiment on potential guests' emotional reactions and engagement in the context of a hotel-based virtual reality experience	compared to desktop computers and mobile phones, virtual reality devices evoke more positive emotional reactions and higher levels of psychological and behavioral engagement; emotions and psychological engagement mediate the impact of embodied virtual reality devices on behavioral engagement
2021	Journal of Business Research	Loureiro S., Guerreiro J., Japtura A.	How escapism leads to behavioral intention in a virtual reality store with background music?	the stimuli–organism–response (S–O–R) model; the PAD (pleasure, arousal, dominance) model	200	a VR store	to extend the S-O-R framework by considering escapism as a stimulus and incorporating vividness and telepresence as an organism and to examine the role of calm versus upbeat music tempo in the background	background music has an important role in a VR store, as it has in a real store; music has been considered to influence the time spent at a store, the pleasure of being in the store and the desire to purchase; however, it depends on whether the music is congruent with the environment or not
2021	Malaysian Journal of Computer Science	Kamil M., Yahya N., Abidin I., Norizan A.	Development of virtual reality technology: Home tour for real estate purchase decision making	the ADDIE (Analysis, Design, Development, Implementation, Evaluation) model	30	an interactive virtual reality walkthrough application	to evaluate the effectiveness of interactive virtual reality walkthrough applications in home interior design for the real estate purchase decision	90% of respondents believe that an interactive virtual reality walkthrough application is effective in assisting the real estate purchase decision

continued Appendix 1.

YEAR	JOURNAL	AUTHORS	TITLE	THEORETICAL FRAMEWORK	STUDY SAMPLE SIZE	NEW TECHNOLOGY SOLUTION STUDIED	AIM OF THE STUDY	RESULTS
2021	Journal of Retailing	Petit O., Javornik A., Velasco C.	We eat first with our (digital) eyes: Enhancing mental simulation of eating experiences via visual-enabling technologies	customer experience	approx. 200	an AR software	to better understand the effect of 3D packaged food (with both sensory and instrumental properties) on purchase intention	AR visualization of served food improves simulation of the eating process over 3D visualization, with a positive effect on purchase intention; 3D visualization improves purchase intention for packaged products (high instrumental properties) over served products (low instrumental properties) while the opposite is true for AR visualization; 3D increases purchase intention by eliciting mental simulation of the eating outcome when the food is visible due to transparent (vs. opaque) packaging (displaying both sensory and instrumental properties), but no such differences emerge for AR
2022	Frontiers in Psychology	Brengman M., Willems K., De Gauqier L.	Customer engagement in multi-sensory virtual reality advertising: The effect of sound and scent congruence	digital sensory marketing	235	VR ads; a head-mounted VR device	to identify what the added value is of augmenting a conventional VR ad with sound and/or scent appeals, taking into consideration product odor congruence, and to disentangle the mechanism through which sensory-enriched VR affects customer engagement	whether sound is enabled or not, adding a product-congruent scent (e.g., rosemary herb for a cream cheese ad), consistently results in a more compelling sensory experience than without enriching the VR ad with any scent; the incongruent scent conditions of this study's experiment do not result in significantly lower sensory experiences among consumers than the conditions without scent augmentation; adding an incongruent smell results even in a slightly better sensory experience than without adding any scent to the VR ad
2022	Multimedia Systems	Melo M., Coelho H., Gonçalves G., Losada N.	Immersive multisensory virtual reality technologies for virtual tourism: A study of the user's sense of presence, satisfaction, emotions, and attitudes	N/A	74	two VR setups (audiovisual vs. multisensory)	to investigate the influence of immersive multisensory VR setups and gender on the sense of presence, satisfaction, user emotions, and user attitudes	the female sample scored significantly higher spatial presence across VR setups and reported more involvement and overall presence in the audiovisual condition; multisensory stimulus can mitigate possible gender differences in passive VR scenarios; the capability of the VR system to make users feel physically present in the virtual environment contributes significantly to the development of positive emotions and enjoyment, which can contribute positively to the user's consumer behavior towards touristic products and services