

# STUDYING CONSUMER EMOTIONS AND PURCHASE PREFERENCES IN A VIRTUAL REALITY ENVIRONMENT: A BIBLIOMETRIC ANALYSIS

**BADANIE EMOCJI I PREFERENCJI ZAKUPOWYCH KONSUMENTÓW W WIRTUALNEJ RZECZYWISTOŚCI:  
ANALIZA BIBLIOMETRYCZNA**

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## ABSTRACT

This study conducts a bibliometric analysis to explore the relationship between consumer emotions and purchase preferences within a Virtual Reality (VR) environment. Utilizing data from the Web of Science and Scopus databases, the research employs a structured literature review (SLR) approach to identify and analyze relevant academic literature. Custom queries were used to extract data on specific keywords, titles, and abstracts, which were then processed using VOSviewer software to generate bibliometric maps. The findings highlight significant but fragmented coverage of the intersection between VR and consumer emotions, underscoring a gap in integrated studies within this domain. The study identifies distinct research clusters in VR applications, including user experience and cognitive load, and emphasizes the need for further interdisciplinary research to enhance understanding and practical application of VR in influencing consumer behavior and emotions. This analysis provides valuable insights for academics and practitioners aiming to leverage VR for improved consumer engagement and decision-making.

**Key words:** consumer, emotion, Virtual Reality, VOSviewer, merchandising, bibliometric analysis

## ABSTRAKT

Niniejszy artykuł przedstawia współczesne badania bibliometryczne koncentrujące się na emocjach klientów i wyborze produktów w rzeczywistości wirtualnej. Głównym celem jest zbadanie dwóch znanych naukowych baz danych, Web of Science i Scopus, oraz przeprowadzenie ustrukturyzowanego przeglądu literatury (SLR). Celem badania było określenie powiązań między pojęciami emocji i wirtualnej rzeczywistości w oparciu o badanie bibliometryczne w dwóch bazach danych Scopus i Web of Science. Do analizy bibliometrycznej w każdej bazie danych zastosowano niestandardowe zapytania, wykorzystujące określone słowa kluczowe, terminy tytułowe i treść abstraktów. Zapytania te ułatwiły analizę ilościową pobranych danych, które następnie wykorzystano do wygenerowania map bibliometrycznych za pomocą oprogramowania VOSviewer. W rezultacie niniejsze badanie oferuje aktualną analizę bibliometryczną w tej dziedzinie.

**Słowa kluczowe:** konsument, emocje, wirtualna rzeczywistość, VOSviewer, merchandising, analiza bibliometryczna

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## Introduction

The modern consumer is a traveler navigating two distinct realms: the real world and the virtual world. The ability to move between these worlds makes it increasingly difficult today to gain the consumer's attention (interest). This challenge is faced by retailers, who are looking for new methods to capture and hold the consumer's attention, if only for a few seconds. Also, the consumer experience has heightened expectations, making consumers more demanding and expecting new emotions, as emotional-impulsive purchases account for an ever-larger share of their shopping carts.

Understanding and interpreting consumer behavior and the emotions driving it remains a critical objective in research. Researchers continue to seek an appropriate model able to at least partially elucidate what is going on in the consumer's head during decision-making. Concurrently, advanced tools have been emerging to record or track human behavior, such as electroencephalography (EEG), eye tracking, and virtual reality (VR).

A notable gap therefore exists at the confluence of emotional consumer decision-making and the application of modern technologies for emotion measurement. This paper aims to bridge this gap by conducting a Structured Literature Review (SLR) using two leading academic databases: Web of Science and Scopus. We highlight a particular deficiency in the literature concerning the use of VR tools to study emotions in consumers of fast-moving consumer goods (FMCG).

## Literature review

A prevalent tool used over the years for influencing consumer moods and emotions o has been merchandising, which has evolved from a form of merchandise display and planning store displays into comprehensive decor of the sales area (Laermans, 1993). However, verbal and visual stimulation of consumers proved to be insufficient, and so efforts expanded into the field of sensory experiences (Park et al., 2015; Parker, 2003). This has resulted in the emergence of two concepts in the literature today – Merchandising and Visual Merchandising (VM) –alongside the notion of shop atmosphere, related to the second concept. The distinction between these concepts – encompassing both the internal design of retail outlets and external attributes of the retailer’s offerings – has sometimes led to unnecessary confusion (Davies & Ward, 2005).

Merchandising encompasses the overall image of the store, including the architecture of the facility itself but also the interior display and retail brand communication. Within the framework of merchandising, studies have been undertaken on store layout (Levy & Weitz, 2001), fixturing (Donnellan, 1996), merchandise (Kerfoot et al., 2003), presentation techniques (Buchanan et al., 1999), color and packaging (Bruce & Cooper, 1997). Merchandising could be considered an umbrella term – designing places of purchase to enhance the consumer experience to convert potential customers into buyers, also often called the ‘silent selling technique’ (Bruce & Cooper 1997).

The application of Visual Merchandising (VM) is wide, as it is currently applied not only in stationary stores but also in e-commerce (Eroglu et al., 2003; Swanson & Everett, 2015). The goal of VM is to create sensory stimuli to stimulate purchase decisions (Nobbs et al., 2011), but also to attract the consumer to the store and provide an exceptional experience for the consumer and the store’s positioning (Nobbs et al., 2015). This positioning

is especially important for any company operating in the online environment because it provides an opportunity to gain attention in the minds of the consumers, to stand out from other companies. This can be achieved by creating a set of special values for the consumer (Bist & Mehta, 2023). Some authors consider VM to involve the overall perception of the store and the impression it makes (HKim & Lee, 2017), while others see it as the strategic display of goods in the store, supported by point-of-sale materials and events in the area (Dash et al., 2019; Iberahim et al., 2018). In marketing terms, VM is seen as a marketing communication tool aimed at persuading consumers to buy (Fill, 2009) and generating long-term profitability (Dash et al., 2016; Iberahim et al., 2018).

Despite the growing prevalence of online shopping habits, yet in more than 88% of cases, consumers abandon their shopping cart (Wang et al., 2023). Understanding and analyzing consumer behavior, particularly the emotions involved in the purchasing process, remains a critical focus area. Research in this domain underscores that consumers are often more emotional than rational in their decision-making, highlighting the importance of continued exploration into the emotional aspects of consumer behavior.

The contemporary landscape of research on consumer behavior, especially consumer purchase decision-making in the 21st century, is not uniform or consistent. Various attempts have been made to categorize concepts, analyze information processing, study consumer loyalty and experience, and capture patterns in consumer thinking (Halkias, 2015; Ishak & Abd Ghani, 2013; Jain et al., 2017; Novak & Hoffman, 2009; Wheeler et al., 2005; Zaltman & Zaltman, 2008). An important aspect of consumer behavior research, which has continued since the 1980s, has been the analysis of emotions surrounding market decisions (Achar et al., 2016; Chitturi, 2009; G. R. Foxall, 2011; Hirschman & Stern, 1999; Laros & Steenkamp, 2005; Niedzielska, 2016; Richard et al., 2002; Williams et al., 2014).

Of particular importance in studying the impact of emotions on consumer behavior is behavioral economics, a science that combines economic and psychological aspects (Hursh, 2014; Reed et al., 2013; Zalega, 2015). Behavioral economics uses scientific research on human, social, cognitive, and emotional factors to better understand the economic decisions of individuals (Achar et al., 2016; G. Foxall, 2017; Mruk, 2017; Williams et al., 2014). Behavioral economics research on consumer behavior has highlighted a number of contentious issues, such as irrationality (Arcidiacono, 2011;

Banyte et al., 2016; Matušínská & Zapletalová, 2021; Trevisan, 2016), unpredictability (Gabriel & Lang, 2006; Richardson Bareham, 2004; Valecha et al., 2018), and emotionality (Bell, 2011; Williams et al., 2014) in consumer decision-making (Babin & Harris, 2023).

Emotions can be defined as a significant state of agitation of the mind. They can appear suddenly, combined with somatic arousal and reaching high intensity, but can also be transient. From a psychological point of view, emotions encompass a set of changes involving physiological arousal, sensations, cognitive processes, and behavioral reactions, occurring in response to a situation that the individual perceives as important (Alsharif et al., 2021; Foxall, 2011; Gurgu et al., 2020; Hirschman & Stern, 1999; Izard, 1991; Laros & Steenkamp, 2005; Reisenzein, 2007; Williams et al., 2014).

The emotions that accompany consumers in their shopping and purchasing decisions can also result from, be shaped by, or be stimulated or mitigated by, the impact of other direct and indirect determinants (Das & Varshneya, 2017; Le et al., 2020; Mullen & Johnson, 2013; Szymańska, 2017; Verduyn et al., 2012). Understanding these influences is crucial, especially when considering the dimensions and categories of emotional perception.

One key dimension used to categorize emotions is known as Valence (Kruszewska, 2018; Rasmussen & Berntsen, 2009; Waszkiewicz-Raviv et al., 2018), which refers to the intrinsic degree of attractiveness of an event phenomenon or object, making it possible to characterize and categorize emotions (Gorbatkow, 2002). Emotions of the same valence have a similar effect on consumer judgments and choices (Gaczek, 2016; Kim & Gupta, 2012; Li et al., 2021; Patrzalek, 2016).

Another dimension used to describe emotions is Arousal (Robbins & Everitt, 1995), which denotes a state of increased physiological activity. Emotional arousal can manifest as both positive and negative states, including feelings such as fear, anger, curiosity, and love, which drive individuals to act, often impulsively (Thayer, 1990). The intensity of stimulation directly correlates with the level of arousal; stronger stimuli lead to greater arousal (Eysenck, 2012; Groeppel-Klein, 2005; Reisenzein, 1994; Robbins & Everitt, 1995).

There are numerous models in the literature that combine different dimensions of emotions. One such model is Russell's circumplex model of affect (Russell, 1980). Emotions in this model are viewed in terms of both valence and arousal, with four regions represented on a rectangular

coordinate system: enthusiasm, anxiety, satisfaction, and depression. The model includes 28 descriptors describing emotional states (Olson et al., 2014; Thayer, 1990; Thayer & McNally, 1992).

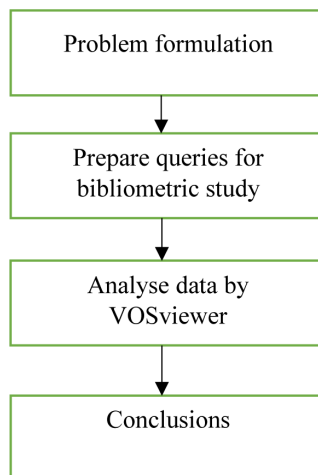
The complex nature of emotions complicates predicting consumer decisions. Therefore, research on emotions, particularly through the use of modern tracking tools, is vital for gaining deeper insights into consumer behavior.

The purpose of this study was to explore the links between the concepts of emotion and Virtual Reality (VR) based on a bibliometric survey conducted using two databases. The research question posed in the study was: What are the links between the concepts of consumer emotions and Virtual Reality?

The article is structured as follows: this introduction outlines the purpose and relevance of the problem under study; the next section reviews the relevant concepts (emotions, decision-making, merchandising) based on the literature on the subject; the research section then presents the research procedure along with the tools; the following sections of the paper present the results of the analysis, accompanied by a discussion of the findings and their implications.

## Research methodology

The methodology utilized in the investigation is illustrated in Figure 1.



**Figure 1.** Research procedure

In this article, bibliometrics is defined as a set of statistical and mathematical methods used to analyze scientific literature. This bibliometric study, using a Structured Literature Review (SLR), included two databases: Web of Science (WoS) and Scopus. Details of the quantitative content of these databases is listed in Table 1. It is worth noting that Google Scholar was excluded from further analysis (for the reason given in Table 1).

**Table 1.** The information within the scientific database

Name of database	Number of indexed publications
Web of Science	Over 171 million records
Scopus	Over 46 million records
Google Scholar	It is not feasible to gauge the quantity of cataloged papers because of the continuous uploading of content.

Source: Biercewicz and Sulich (2022)

It should, of course, be taken into account that this bibliometric analysis was performed based on two databases, which may limit the set of sources analyzed. On the other hand, we did utilize two of the most popular and high-scoring databases. WoS and Scopus are the preferred databases for conducting Systematic Literature Reviews (SLRs) due to their high coverage of scientific articles, high data quality, availability of advanced search tools, citation indexing, support for meta-analysis and recognition in the scientific community, which provides broad access to reliable data, facilitates analysis and adds credibility to research.

Table 2 presents the comprehensive query components, along with the outcomes derived from two databases investigated (WoS and Scopus).

**Table 2.** Keywords used in SLR

No	Keywords
1	"Virtual Reality" AND merchandising
2	"Virtual Reality" AND merchandising AND emotion
3	"Virtual Reality" AND merchandising AND Arousal
4	"Virtual Reality" AND merchandising AND Valence

5	"Virtual Reality" AND product AND emotion
6	"Virtual Reality" AND "visual merchandising"
7	"Virtual Reality" AND "visual merchandising" AND emotion
8	"Virtual Reality" AND "visual merchandising" AND Arousal
9	"Virtual Reality" AND "visual merchandising" AND Valence
10	VR AND merchandising
11	VR AND merchandising AND emotion
12	VR AND merchandising AND Arousal
13	VR AND merchandising AND Valence
14	VR AND "visual merchandising"
15	VR AND "visual merchandising" AND emotion
16	VR AND "visual merchandising" AND Arousal
17	VR AND "visual merchandising" AND Valence
18	VR AND product AND emotion
20	"Virtual Reality" AND "point of purchase" AND emotion
22	VR AND "point of purchase" AND emotion

After each query, the results were cumulatively added to the results of the previous query, maintaining additions for each database separately. The total number of results from the Scopus database was 213, while the the WoS database yielded 206.

These queries, as enumerated in Table 2, were employed within the framework of the Structured Literature Review (SLR) methodology to explore repositories. They were utilized to scrutinize the keywords, titles, and abstracts of indexed papers. Subsequently, each query was input into the respective database, with the results being subsequently exported in both .txt and .csv formats. This enabled the files to be imported into the VOSviewer software to conduct the final qualitative analysis. The queries were executed on the two scientific databases without any specific time frame, targeting the article title, abstract, and keywords as search fields.



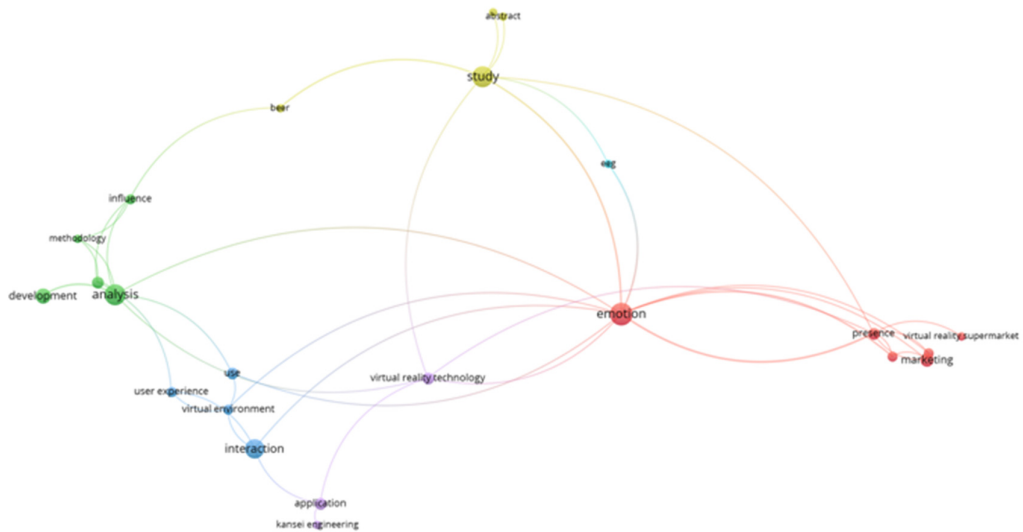
## Results

The files used in the bibliometric analysis were separately imported into VOSviewer software for Scopus and WoS databases. Graphical representations of the results are shown in Figure 2 and Figure 4. Regarding the WoS database, the title and abstract fields were chosen for extracting data, and the full counting method was employed. In the case of the Scopus analysis, after the format files were uploaded, the title field was selected as the field from which data would be extracted and the full counting method was chosen. The subsequent stage involved specifying the frequency of occurrences for a given term (keyword). Table 3 shows the results for the queries used.

**Table 3.** Result in quantity using SLR as per day 2023-11-28

No	Keywords	Scopus	WoS
1	"Virtual Reality" AND merchandising	24	47
2	"Virtual Reality" AND merchandising AND emotion	0	5
3	"Virtual Reality" AND merchandising AND Arousal	1	4
4	"Virtual Reality" AND merchandising AND Valence	0	0
5	"Virtual Reality" AND product AND emotion	118	68
6	"Virtual Reality" AND "visual merchandising"	7	7
7	"Virtual Reality" AND "visual merchandising" AND emotion	0	0
8	"Virtual Reality" AND "visual merchandising" AND Arousal	1	1
9	"Virtual Reality" AND "visual merchandising" AND Valence	0	0
10	VR AND merchandising	13	27
11	VR AND merchandising AND emotion	0	3
12	VR AND merchandising AND Arousal	0	2
13	VR AND merchandising AND Valence	0	0
14	VR AND "visual merchandising"	2	1
15	VR AND "visual merchandising" AND emotion	0	0
16	VR AND "visual merchandising" AND Arousal	0	0
17	VR AND "visual merchandising" AND Valence	0	0
18	VR AND product AND emotion	51	41
20	"Virtual Reality" AND "point of purchase" AND emotion	0	0
22	VR AND "point of purchase" AND emotion	0	0

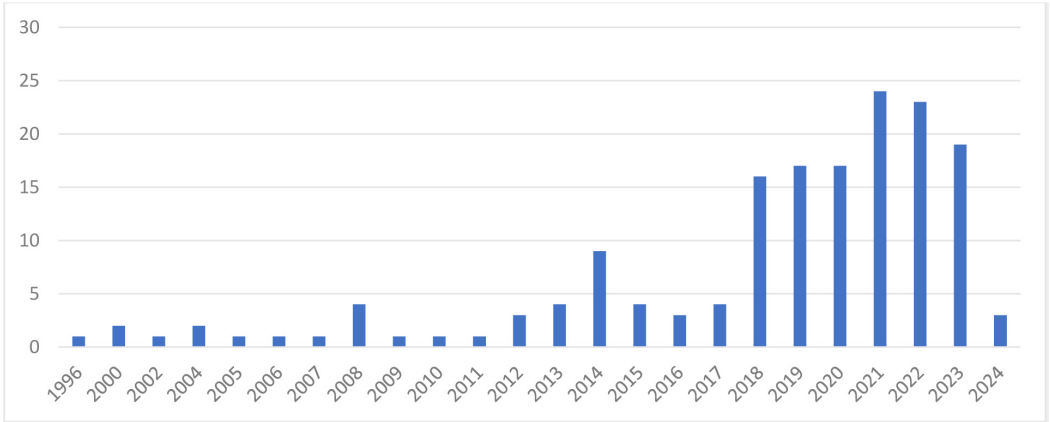
Regarding the Scopus database, the criterion of a minimum of 2 occurrences for each keyword was employed, leading to 501 terms and 58 instances that met the specified threshold. However, the final selection comprised 35 unique terms after duplicate keywords were eliminated. The outcomes from Scopus encompassed 23 items, constituting 42 connections that could be categorized into 6 groups. A graphical depiction of these findings is illustrated in Figure 2.



**Figure 2.** Network visualization from Scopus (produced using VOSviewer)

These can be identified as group 1 (red color) – virtual reality in the supermarket, group 2 (green color) – analysis/methodology, group 3 (dark blue color) – user experience UX, group 4 (yellow color) – survey, group 5 (purple color) – virtual reality, group 6 (light blue color) – EEG. The resulting categorization is an unprecedented categorization for this type of study; there is no combination of consumer emotions in the virtual store.

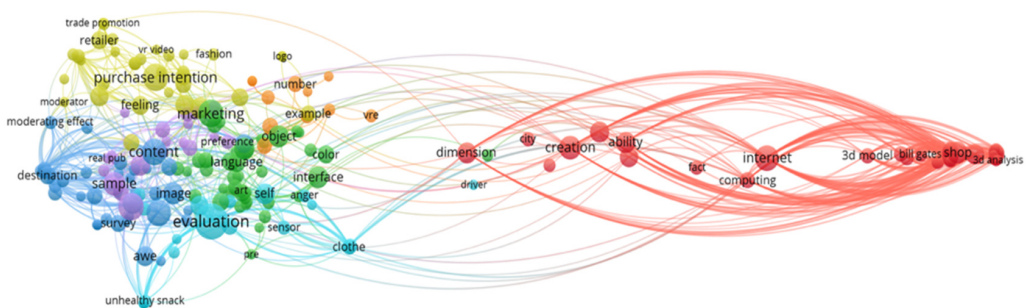
Figure 3 shows the distribution of publications by year for the Scopus database.



**Figure 3.** Distribution of the number of publications in the years (Scopus)

Until 2013, the number of publications remained at 3 or below. In 2014 there was a surge, reaching the number of 9 publications, and then in the following year, the number dropped to 3 per year and remained so until 2017. From 2018 to the present a significant increase was observed, reaching in excess of 15 publications per year.

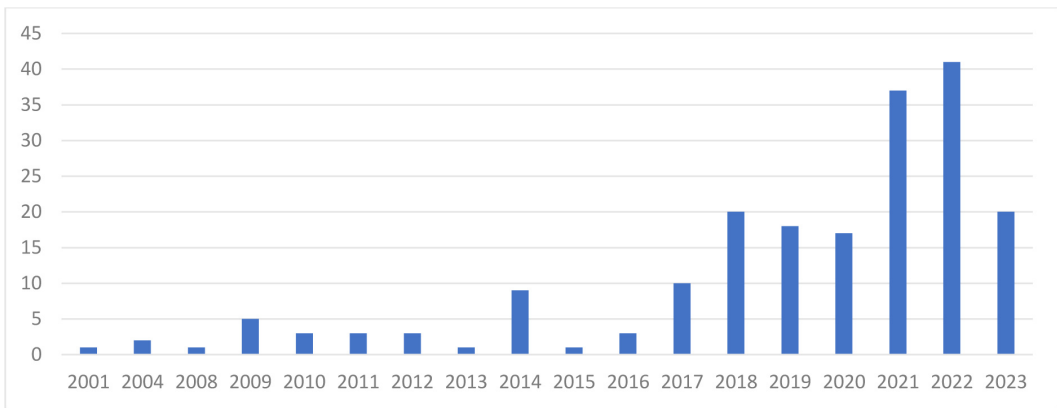
In the case of the WoS base, the condition of a minimum of 4 occurrences for each keyword was implemented, resulting in 3868 terms and 363 instances meeting the specified threshold. However, the final selection included 218 unique terms. Figure 4 showcases the outcomes from WoS, featuring 218 distinct items forming 3433 connections that can be categorized into 7 groups.



**Figure 4.** Network visualization from WoS

These can be identified as group 1 (red color) – 2D/3D models and interfaces, group 2 (green color) – Eye tracking analysis in a virtual environment, group 3 (dark blue color) – cognitive load, group 4 (yellow color) – marketing, group 5 (purple color) – immersive technique, group 6 (light blue color) – neuroscience, group 7 (orange color) – prototype. As before, this database also lacks a combination of research related to consumer emotions in virtual reality.

Figure 5 shows the year-by-year distribution of the number of publications for the Web of Science (WoS) database.



**Figure 5.** Distribution of the number of publications in the years (WoS)

Until 2017, the number of publications remained below 10 per year. The following years saw a significant increase, exceeding the level of 15, and this trend has continued into the current year. An exceptional jump in what is new was recorded in 2022, where the number of publications reached 41, the largest increase compared to previous years.

The differences in the selection of parameters for the two databases are the result of having to meet the set conditions, where selecting at least 4 expressions for the Scopus database results in 10 expressions. Such a situation would limit the analysis to two groups: the first on virtual reality with emotions and the second group on research. To obtain a more diverse set of results and to account for a greater variety of topics, a more flexible approach to parameter selection was needed.

## Discussion

The fact that consumers function in two worlds, virtual and real, is making it increasingly difficult to attract their attention and even more difficult to understand their emotions. On the other hand, consumers are becoming more aware and tech-savvy, and so searching for information and comparing options using new technologies has become much simpler and faster. These shifts in consumer behavior pose significant challenges for today's retailers, who have to decide in which world they engage with consumers. For example, recent studies have shown that consumers often buy online and pick up or return goods offline (buy-online-and-return-in-store (BORS)) (Nageswaran et al., 2019; Xie et al., 2023).

The retailer's choice of operating environment influences their choice of merchandising tools and techniques to stimulate consumer emotions. Today, it is already known that a well-planned storefront or website can spur purchasing decisions. Although there are many studies on the impact of Merchandising or Visual Merchandising on consumer purchase decisions, it is still not entirely clear what ultimately determines a particular purchase decision. This is also shown by qualitative research, in which consumers themselves are unable to identify the specific factors swaying their decisions.

Visuals at the point of sale can evoke emotions, both positive and negative, and thus influence the consumer's ultimate behavior. As a result, consumer emotions in Virtual Reality can not only determine the choice of a product or brand, making the final purchase decision, but also how long the consumer will stay at the point of sale, or what distance he will travel to find the product that is the "right" one in his or her opinion (Achar et al., 2016; Alsharif et al., 2021; Ceccacci et al., 2018; Chitturi, 2009; Dawson et al., 1990; East et al., 1994; Gaur et al., 2014; Guo et al., 2020; Hansen & Christensen, 2007; Hui et al., 2013; Larson et al., 2005; McDonald, 1994; Mostafa & Kasamani, 2020; Petrosky-Nadeau et al., 2016; Pluta-Olearnik & Szulga, 2022; Spanjaard et al., 2014; Syaekhoni et al., 2018; XWang et al., 2019)

The practical application of emotion research in Virtual Reality to analyze consumer behavior in the market may encompass a variety of aspects, such as emotional states and choices, extreme emotions in shopping, emotional evaluations of stimuli, the universality of emotions in consumer behavior, culture versus consumer expression of emotions, the functions of mood and emotions in consumer decisions, impulsive purchases, and advertising as a source of consumer emotions (Amin Ul Haq & Abbasi, 2016; Babin &

Harris, 2023; Cruz et al., 2016; Curtis et al., 2017; de Mooij, 2019; East et al., 1994; Furnham & Milner, 2013; Gerrig et al., 2015; Geuens et al., 2011; Grigorios et al., 2022; Hamelin et al., 2017; Hansen & Christensen, 2007; Laros & Steenkamp, 2005; Olney et al., 1991; Otamendi & Sutil Martín, 2020; Poels & Dewitte, 2019; Rodgers & Thorson, 2012; Schiffman et al., 2013; Soscia, 2013; Vainikka, 2015; Virvilaitė et al., 2011; Watson & Spence, 2007; Weinberg & Gottwald, 1982; Williams et al., 2014; Yi & Jai, 2020).

In our bibliometric study, 213 results were obtained from the Scopus database and 206 results from the WoS database. The empirical findings suggest that the notions of Virtual Reality and emotions are extensively described in the literature, albeit predominately as separate issues.

Our focus solely on two major databases may have resulted in our overlooking certain areas of the literature that may be present in other, less popular databases. Consequently, our conclusions based solely on these two databases might be incomplete or contain some gaps in the literature, potentially distorts the outcomes. This underscores the need for further research that integrates these topics with each other and with related issues.

## **Conclusions**

Consumer emotions are profoundly important for understanding consumer behavior. This study has provided an in-depth bibliometric analysis of the intersection between consumer emotions and Virtual Reality (VR) within the context of merchandising, utilizing data from two major databases, Web of Science (WoS) and Scopus. Our investigation revealed significant insights into how these domains are treated in the academic literature, highlighting both the extensive coverage and the fragmentation of the field. The study employed a systematic literature review (SLR) approach, ensuring a structured and comprehensive examination of the available literature. The use of VOSviewer for bibliometric mapping proved effective in visualizing the relationships and gaps within the research field.

The analysis identified a substantial body of literature addressing consumer emotions and VR, but these topics are predominantly treated as separate entities. There is a paucity of integrated studies that examine the combined impact of VR on consumer emotions and decision-making processes. The study noted a significant increase in publications related to VR and consumer emotions over the past decade. This trend reflects growing

academic and practical interest in understanding how VR can influence consumer behavior and emotional responses.

The bibliometric mapping identified several distinct clusters of research within the dataset. For Scopus, these included themes like VR in supermarkets, user experience (UX), and EEG studies, while the WoS database highlighted clusters around 2D/3D models, eye-tracking analysis, and cognitive load. These clusters indicate focused areas of study but also suggest opportunities for cross-pollination of ideas across these domains.

Future research should aim to bridge the gap between studies on consumer emotions and VR. There is a need for more integrated approaches that examine how VR environments can be designed to evoke specific emotional responses and influence purchasing decisions. While this study focused on WoS and Scopus, incorporating additional databases could provide a more comprehensive view of the literature and uncover niche areas that may have been overlooked. Leveraging insights from behavioral economics, psychology, and marketing could enrich the understanding of how VR impacts consumer emotions. Collaborative studies across these disciplines could yield more comprehensive insights. Retailers and marketers can use the findings to enhance VR-based merchandising strategies, aiming to create immersive experiences that elicit desired emotional responses and drive consumer engagement and sales.

In conclusion, while the current literature provides a robust foundation, there is substantial scope for further research to explore the synergistic effects of VR and consumer emotions. Such efforts will not only advance academic knowledge but also offer practical insights for enhancing consumer experiences in virtual retail environments. The analysis conducted indicates the need for further research in the field of emotions in Virtual Reality. A review of the literature in terms of emotions shows how important a role they play in the decision-making process. This area is not fully explored and requires constant up-to-date research, indicating the great potential of the phenomenon.

The results may also have certain practical implications. They can be used by institutions or organizations and business practitioners (e.g., managers). The findings can serve as a guideline for the creation of virtual sales venues and further exploration of the impact of emotions on consumer purchase decisions. At the same time, we acknowledge that the analysis of two databases is a limitation, but it is a subject of interest and ongoing research.

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