

Mapping the Knowledge Base of Haptics in e-Commerce: A Bibliometric Analysis

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Abstract:

E-commerce has grown in popularity, and it changes the way consumers shop. However, e-commerce still falls short in providing customers with multisensory shopping experiences, especially regarding the haptic sense. In the future, VR (virtual reality) and AR (augmented reality) together with sensory-enabling technologies (SETs) are likely to compensate this, as they operate as tools in creating a feeling of presence together with tactile feedback, giving users an experience that they can virtually interact and touch products. This has raised the interest of retailers; however, we lack an understanding of consumer's haptic experiences mediated by technologies. In this study, we perform a bibliometric analysis on 63 journal articles published between 2001 and 2022 to synthesize the research on this theme. Based on co-citation analysis, we identify three most central research streams regarding haptics in e-commerce, and we suggest how the future research could take these themes further.

Keywords : e-commerce, technology-mediated touch, virtual reality

Track :Digital Marketing & Social Media

1. Introduction

Today's e-commerce lacks in its the ability to offer immersive shopping experience for consumers (Schnack, Wright & Holdershaw, 2020). Consequently VR (virtual reality), AR (augmented reality) and sensory-enabling technologies (SET) are estimated to become a future trend in retailing as they can provide an immersive shopping experience for consumers (Petit, Velasco & Spence, 2019). In today's e-commerce, consumers are unable to touch products which is likely to hinder the attractiveness of it. Without the ability to touch and inspect the products, it is challenging to gauge quality, especially for experiential items (Van Kerrebroeck, Willems & Brengman, 2017). To compensate for the lack of touch in e-commerce, a variety of compensating methods have been developed with the help of advanced technology (Van Kerrebroeck et al., 2017; Racat, Capelli & Lichy, et al., 2021; de Vries, Jager, Tijssen & Zandstra, 2018). VR, AR and sensory-enabling technologies are likely to become more widely adopted in future retailing, which will transform the conventional e-commerce toward multisensory omnichannel shopping experiences that seamlessly combine brick-and-mortar shopping with virtual technologies.

Humans interact with the outside world through the five senses of sight, hearing, smell, taste, and touch. Related to touch, the term haptics refers to any acts and movements relating to the sense of touch. Haptics, i.e., touch with hands, is action-focused and frequently entails bodily movement (Luangrath, Peck, Hedgcock & Xu, 2022). While existing studies have explored the effect of haptics in physical interaction including recent developments and applications of haptic devices, hand-feel touch cues and their influences in the context of food and beverage experience (Krishna, 2012; Vrána & Mokry, 2020; Laycock & Day, 2003; Pramudya & Seo, 2019), only few studies address the knowledge base and core topics of haptics in e-commerce. Consequently, to better understand the possibilities of haptics in e-commerce, we perform a bibliometric analysis to explore: 1) What are the key studies that have contributed to this thematic development? and 2) What are the core research topics of haptics in e-commerce.

2. Theoretical Background

Technology-mediated haptics presents new prospects for e-commerce, given that a major barrier to online sales is the consumer's inability to touch products (Racat et al., 2021). The technology is currently limited to providing touch cues related to products; however, touch-interfaces have been developed to enable tactile feedback mediated by technology. Shen,

Zhang & Krishna (2016) show that different touch interfaces, indeed, affect consumer product choices. For example, Overmars & Poels (2015) show how an interface may convey tactile perceptual information by simulating stroking gestures with visual interaction, and it further improves the comprehension of product features. Jin (2011) further associated 3D visualization with consumers' need for touch, concluding that consumers with a high need to touch products to inspect product functionality experience a more positive product evaluation than consumers with low need for touch. Need for touch (NFT), here, refers to a consumers' preference for haptic information processing (Peck & Childers, 2003a; Peck & Childers, 2003b). Indeed, many scholars have emphasized the importance and the role the need for touch plays for product judgments and in e-commerce environment (Kühn, Lichters & Krey, 2020; Rathee & Rajain, 2019). Indeed, the research emphasizes that consumers with a high need for touch typically prefer to handle and examine products before making a purchase decision, and easily become upset if they do not have the chance to do so (Peck & Childers, 2003a, Peck & Childers, 2003b)

3. Methodology

3.1 Data collection

The bibliometric analysis of this study is based on the scientific articles indexed in the Web of Science (WoS) database and published between the years 2001 and 2022. We performed the literature search in November 2022 using the following search criteria: “virtual real*” OR vr OR ar OR “augmented real*” OR technology AND shop* OR retail OR store OR consumer AND haptic* OR tactile OR touch. The first part of the keywords was designed to capture different forms of virtual and augmented reality environments, while the shopping related keywords were used to include only literature that relates to consumers and shopping experiences. Finally, the words “haptic”, “tactile”, and “touch” were used to filter studies that somehow related to touch and haptics. Our initial search resulted with 480 records, yet we restricted our search to studies written in English language, and in the areas of Business economics and Psychology which yield 123 journal articles. Thereafter, we manually screened these 123 records to assess their applicability considering our research questions. Consequently, the final sample includes 63 journal articles that match our inclusion criteria.

3.2 Data analysis

We extracted the data from the Web of Science database and used R Studio to export it into Bibliometrix open-source science mapping software (Aria & Cuccurullo, 2017), to generate descriptive analyses and statistical graphs. The use of bibliometric analysis methods has become commonplace across disciplines (Song, Chen, Hao, Liu & Lan, 2019) and such methods are well suited for science mapping when the focus on empirical inputs has led to numerous, dispersed, and contentious research streams (Aria & Cuccurullo, 2017). Bibliometric analysis employs a quantitative research approach to analyze, examine, and visualize the research that exists on a specific topic, and it is performed at a specific point in time to present a static picture on the research that exists at that moment (Aria & Cuccurullo, 2017). In data analysis, we follow a standard workflow designed for bibliometric analysis described by Zupic and Čater (2015) which consists of five sequential stages: study design, data collection, data analysis, data visualization and interpretation.

4 Bibliometric Analysis Results

4.1 Descriptive information

We illustrate the three stages of the historical development of research of haptics in online shopping in Figure 1. The first stage, which we refer to as exploratory stage, ranges from year 2001 to 2013. The earliest study by Hall (2001) was published in the *International Journal of Human-Computer Studies*, and altogether, only five studies were published between the years 2001 and 2013. The second stage, which we refer to as initial development stage, ranges from year 2014 to 2018. During this period altogether 18 studies dealt with the topic of haptics in e-commerce which indicates that scholars started to recognize the potential of technology-mediated haptics and gradually deepened their understanding on the significance for exploring the effect of haptics in e-commerce. The rapid development stage appears to start in 2019 and lasts until today. During this period, the number of studies grew rapidly, and the peak was in 2021 with a total of 13 published studies. This development seems to continue also in year 2022 as it is noteworthy that the year 2022 depicted in Figure 1 is not a full calendar year. A look at the descriptive statistics reveals that 174 different authors contributed to the studies that were published in 41 different scientific journals with an annual growth rate of 9.71 percent. The average number of authors per article is 2.97, and the average number of citations per article is 29.79.

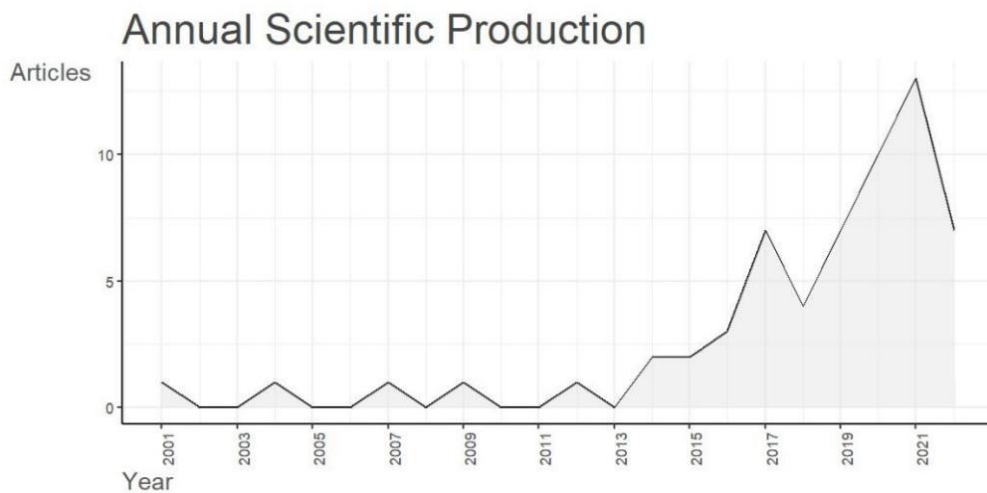


Figure 1. Annual Scientific Production

4.2 Core research topics and knowledge base

To better understand the knowledge base of haptics in virtual shopping, we use co-citation analysis, which examines the frequency with which two studies are being cited in tandem by other studies (Small, 1973). A higher co-citation strength generally indicates that the studies are likely to be semantically related (Small, 1973). Figure 2 illustrates the three main clusters of research on haptics in virtual shopping which are depicted using red, green, and blue color and with 12, 19 and 19 studies in each cluster, respectively. In the figure, a larger node and font size indicates a higher co-citation score and implies a higher centrality withing each cluster.

A look at the blue cluster reveals that this stream of research has initiated from Peck and Childers (2003a) focusing on individual differences in haptic information processing, with a betweenness score of 77.683 and closeness score of 0.019. In this study, Peck and Childers (2003a) developed the need for touch (NFT) scale that divides into autotelic and instrumental dimensions, designed to assess individual preferences for haptic information processing and the hedonic and utilitarian dimensions related to it. Studies within the blue cluster were mainly published in the late 1990s and early 2000s and they thrived to understand the concepts and elements of haptic information processing with a focus on touch and haptics from different perspectives, including hedonic vs. utilitarian motivations (Peck & Childers, 2003b) and information processing style (Childers, 2001). The studies applied different theories, such as technology acceptance model (Davis, 1989) and telepresence to explain the mechanism of online shopping (Klein, 2003).

Within the red cluster, a study which focuses on the role of haptic information on product judgements (Peck and Childers, 2003b) plays a central role with a betweenness score of 170.247 and closeness score of 0.020. This study shows how the relevance of haptic information varies among products, consumers, and situations. The authors propose a conceptual framework to evaluate how these factors combine to hinder or facilitate the acquisition and use of haptic information. Based on that, scholars have become aware of the value of touch, and the studies explore the impact of haptic input on consumer behaviors, such as product judgment, impulsive buying, and purchase intention. For example, the papers published by Peck (2006) illustrate that individual difference in autotelic NFT has an impact on impulse-purchase behavior. Citrin, Stem Jr, Spangenberg and Clark (2003) suggests that the need for touch input in product evaluations plays a significant role in selecting the choice of a shopping medium. Additionally, in comparison to males, females demonstrated a greater requirement for tactile input while evaluating products(Citrin et al., 2003).

Articles in the green cluster were mainly published in recent decades. Within this cluster, the study by Peck, Barger, and Webb (2013) shows the highest betweenness and closeness score with 61.142 and 0.018 respectively. The study argues that imagining touching an object can influence the perceived ownership. In fact, the more vivid the haptic imagery, the greater the perceived ownership. From this cluster, it is obvious that scholars are increasingly aware of the influence that haptics has on the customer experience and its impact on consumer behavior and emotion. Therefore, the research interest has shifted to various touch-enabling technologies and how to utilize those technologies to evoke haptic imagery. For example, Van Kerrebroeck et al. (2017) discovered that touch-enabling technologies can provide utilitarian and hedonic value to consumers, especially at the pre-purchase stages in the path-to-purchase. Moreover, Brasel and Gips (2014), and Cano, Perry, Ashman & Waite(2017) focused on how touchscreen influence on consumer attitude. In addition, the application of virtual reality technologies has also become a hot topic as these technologies are regarded as powerful tools influencing consumers' shopping behavior (Schlosser, 2003). It is interesting to notice that in all the field, Peck's research occupies a pivotal position and makes significant contributions to the field of haptic research. The research has led to various new insights into the haptic direction and can be used to guide future research in this area.

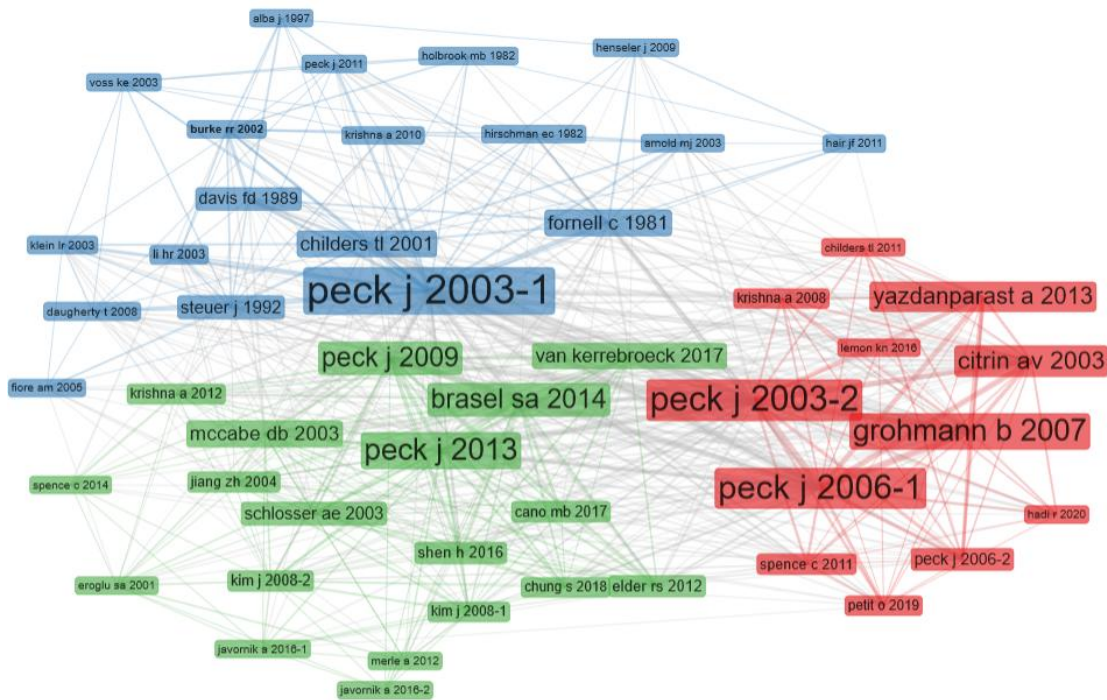


Figure 2 Co-citation network of haptics in digital environment studies

5 Conclusion

This study conducted a bibliometric analysis based on 63 publications to better comprehend the fundamental body of knowledge and key research that have contributed to the thematic development on haptics in e-commerce. By discussing haptics in e-commerce and integrating visualized figures, this work improves our knowledge of the effects of technology-aid haptics. We identified the core research topics of haptics in e-commerce and categorized them as follows: the concepts and elements, the impact of haptic input on consumer behaviors, and the effects of utilizing haptic-enabling technologies. Based on our findings, need for touch is as an important moderator when consumers shop online, and future research could explore the interaction of need for touch with consumer's personality and cultural characteristics. Additionally, so far, most of the existing research only focus on the interaction of two senses: vision and haptics. However, in addition to immersive visual effects, consumers can become immersed of realistic sound effects and it would be interesting to investigate how the haptic sense interacts with other senses. Related to haptic sense, another interesting avenue of exploration would be to discover which type of touch devices can provide optimal shopping experiences for consumers. Depending on the application, one type of equipment might be more suitable than another for providing the desired effect for the consumer.

For the purposes of this study, we extracted haptics related publications from the Web of Science database. The papers we include those discussing stimulation of haptics created by all sensory-enabling technologies, for example visualization technologies (zoom in and out, 3D effects and virtual reality) and haptic interfaces (touchscreen or other haptic equipment). Future studies should take a better look at haptic technologies developed specifically for the purposes of AR and VR, including haptic gloves. By focusing on only one condition, researchers could explore the effects of haptics in greater detail and draw more reliable conclusions about the role of haptics in virtual environments. This could lead to more informed decisions about the use of haptics in virtual environments and better understand the possibilities of haptic technologies with respect to consumers' shopping experiences.

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