

AR AND VR IN THE SPOTLIGHT: A SYSTEMATIC LITERATURE REVIEW OF SECURITY, PRIVACY, AND ETHICAL CONCERNS

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EXTENDED ABSTRACT

Virtual Reality (VR) and Augmented Reality (AR) are two immersive technologies that have gained a great interest in the business field and, as a result, are being implemented in many business-based activities (Cranmer et al., 2020; Han et al., 2019). AR allows to explore unknown surroundings in an interactive, informative and enjoyable way (Cranmer et al., 2020) and VR facilitates virtual visitation to environments from anywhere and anytime and becomes a resource able to transmit the experience and intangibility of spaces to the user (Huang et al., 2016).

Despite the great benefits and potential that AR and VR are showing for the industry, serious security and privacy concerns have been identified (Guzman et al., 2019; Lebeck et al., 2018). For instance, the possibility of recording sensitive information from the user's surroundings or interfere in the user's view of the environment are some of the main risks associated with AR according to Lebeck et al., (2018). However, up to the present time, there is no SLR that emphasizes a comprehensive understanding of privacy, security and ethical concerns in extended reality, an issue of foremost importance in the adoption of this technology. Consequently, the current study starts covering this gap by summarizing, analyzing, and synthesizing the relevant corpus of literature that arises issues of privacy, security and ethical concerns in extended reality focusing on business and management field. This is an issue that raises new research questions and still needs to be addressed by academia (Ameen et al., 2021). The purpose of the current study is to explore the AR/VR privacy and security concerns in business employing a systematic literature review (SLR) method.

SLR is pertinent for the identification, selection, analysis and evaluation of the relevant literature (Mohamed Shaffril et al., 2021; Tranfield et al., 2003). Its objective is to analyse the relations, contradictions, and gaps among the results of all the shortlisted literature and it represents an optimal start point to provide suggestions for future research (Jain et al., 2022). In order to conduct the present SLR, a structured process following the guidelines provided by Denyer and Tranfield (2009) was conducted. This rigorous process enables the search for all studies that are potentially significant (Denyer & Tranfield, 2009). The mentioned process for SLR has been recently employed in the business field (e.g. Heinis et al., 2021; Jain et al., 2022) with satisfactory results. This process includes five refinement stages: Question Formulation, Locating Studies, Study Selection and Evaluation, Analysis and Synthesis and Reporting and Using the Results.

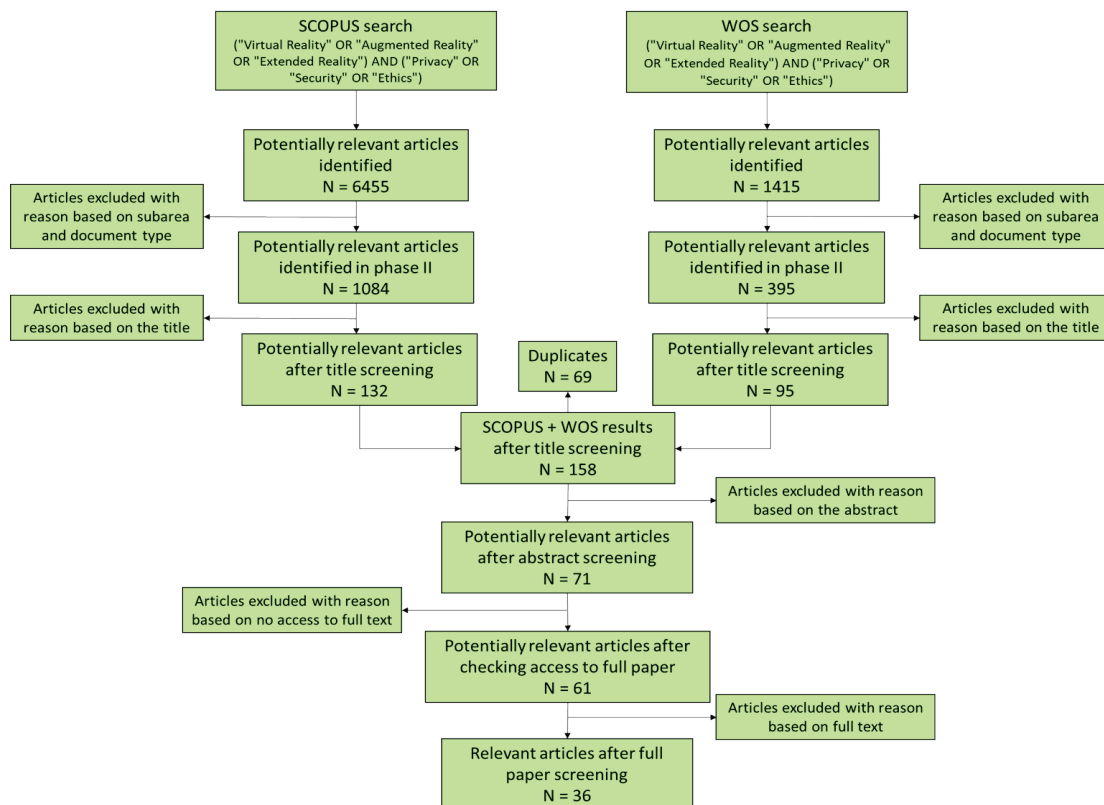
Regarding the first stage, question formulation, the selected question to be answered was: "What are the privacy, security and ethical concerns to adopt extended reality in the business field?". Following with the second stage, locating studies, 2 search engines were employed (Scopus and WOS) and the terms used for the search were "Virtual Reality" OR "Augmented

Reality" OR "Extended Reality") AND ("Privacy" OR "Security" OR "Ethics". This stage was made in December of 2021. Figure 1 shows the screening process followed for locating and selecting studies to answer the formulated question:

In the initial analysis of the selected articles, some notable trends and patterns have emerged. Firstly, a substantial portion of the articles were published in 2021, indicating a recent surge in research interest in the field of privacy, security, and ethical concerns within the AR and VR context. This suggests that the topic is gaining increasing attention and relevance within the academic community.

Of the articles reviewed, approximately 53% were empirical studies, while the remaining 47% were theoretical in nature. This distribution reflects a balanced mix of research approaches, enabling a comprehensive examination of the subject matter. The inclusion of empirical studies indicates a focus on gathering real-world data and insights related to security, privacy, and ethics in AR and VR applications, offering valuable insights into practical implications and experiences.

Figure 1. Screening process.



Regarding the context of the selected articles, it was observed that the most common context explored was technology, with 12 papers. This emphasis on technology highlights the significant impact that AR and VR has on various industries and the need to address associated risks and considerations. Following technology, the second most prevalent context was retail, with 7 papers. This finding suggests that AR and VR technologies hold promising potential for transforming the retail industry, prompting researchers to critically analyze the implications of implementing AR and VR in this domain.

Additionally, a smaller number of papers, 3 in total, focused on marketing. This indicates that researchers are beginning to explore how AR and VR can shape marketing practices and the potential challenges associated with safeguarding consumer privacy and maintaining ethical standards in AR/VR-driven marketing campaigns.

Moving forward, the next steps will involve a deeper exploration of the content within the identified studies. This includes critically examining and problematizing the literature to gain a comprehensive understanding of the security, privacy, and ethical concerns within the AR and VR context. By analyzing and synthesizing the existing research, the study aims to identify gaps, inconsistencies, and unresolved issues within the current body of knowledge. Moreover, the study seeks to identify future research directions and areas of exploration for AR and VR in the business and management field. This entails identifying key challenges, emerging trends, and potential opportunities that warrant further investigation. By doing so, the research aims to contribute to the advancement of knowledge in the field, providing valuable insights for practitioners, policymakers, and scholars interested in the intersection of AR and VR, privacy, security, and ethical considerations in the business and management domain.

KEYWORDS: Virtual reality, augmented reality, security, privacy, ethical concerns.

REFERENCES

- Ameen, N., Hosany, S., & Tarhini, A. (2021). Consumer interaction with cutting-edge technologies: Implications for future research. *Computers in Human Behavior*, 120(August 2020), 106761. <https://doi.org/10.1016/j.chb.2021.106761>
- Cranmer, E. E., tom Dieck, M. C., & Fountoulaki, P. (2020). Exploring the value of augmented reality for tourism. *Tourism Management Perspectives*, 35(March). <https://doi.org/10.1016/j.tmp.2020.100672>
- Denyer, D., & Tranfield, D. (2009). Producing a systematic review. In D. A. Buchanan & A. Bryman (Eds.), *The Sage Handbook of Organisational Research Methods* (pp. 671–689). London: Sage.
- Guzman, J. A. D. E., Thilakarathna, K., & Seneviratne, A. (2019). Security and privacy approaches in mixed reality: A literature survey. *ACM Computing Surveys*, 52(6). <https://doi.org/10.1145/3359626>
- Han, D. I. D., Jung, T., & Tom Dieck, M. C. (2019). Translating Tourist Requirements into Mobile AR Application Engineering Through QFD. *International Journal of Human-Computer Interaction*, 35(19), 1842–1858. <https://doi.org/10.1080/10447318.2019.1574099>
- Heinis, S., Bamford, D., Papalexi, M., & Vafadarnikjoo, A. (2021). Services procurement: A systematic literature review of practices and challenges. *International Journal of Management Reviews*, July 2019, 1–21. <https://doi.org/10.1111/ijmr.12281>
- Huang, T. L., & Liao, S. (2015). A model of acceptance of augmented-reality interactive technology: the moderating role of cognitive innovativeness. *Electronic Commerce Research*, 15(2), 269–295. <https://doi.org/10.1007/s10660-014-9163-2>
- Jain, R., Jain, K., Behl, A., Pereira, V., Del Giudice, M., & Vrontis, D. (2022). Mainstreaming fashion rental consumption: A systematic and thematic review of literature. *Journal of Business Research*, 139 (March 2021), 1525–1539. <https://doi.org/10.1016/j.jbusres.2021.10.071>

- Lebeck, K., Ruth, K., Kohno, T., & Roesner, F. (2018). Towards Security and Privacy for Multi-user Augmented Reality: Foundations with End Users. *Proceedings - IEEE Symposium on Security and Privacy*, 2018-May, 392–408. <https://doi.org/10.1109/SP.2018.00051>
- Mohamed Shaffril, H. A., Samsuddin, S. F., & Abu Samah, A. (2021). The ABC of systematic literature review: the basic methodological guidance for beginners. *Quality and Quantity*, 55(4), 1319–1346. <https://doi.org/10.1007/s11135-020-01059-6>
- Tranfield, D., Denyer, D., & Smart, P. (2003). Towards a Methodology for Developing Evidence-Informed Management Knowledge by Means of Systematic Review. *British Journal of Management*, 14(3), 207–222. <https://doi.org/10.1111/1467-8551.00375>