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Transforming Sales in Healthcare: The Impact of Augmented Reality and Spatial Computing on the Medical Equipment Industry

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Abstract

Lately, there has been a surge of interest in spatial computing, which combines AR, VR and other technologies, especially in the health industry. While a lot has been done on its applications in such clinical aspects as surgeries and patient experience enhancement, there is less info on its application in medical equipment marketing in hospitals. This paper presents the current trends and practices in the use of networks of immersive technology in marketing medical devices. Besides surveying the secondary literature, the present investigation examines three case studies in this sector. Nowadays, most applications are not focused on promoting medical devices, making it easy to achieve innovation in this field mainly by utilising immersive technology, which has been developed for other industries.

Keywords: Spatial Computing; Augmented Reality; Medical Device Demonstration; E-commerce for Medical Devices; Medical Device Commercialization; AR/MR in Medical Equipment Sales; Clinical Applications of AR/MR

Nomenclature

AR Augmented Reality
CT Computed tomography
HMD Head Mounted Display
MR Mixed Reality
MRI Magnetic Resonance Imaging

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VR Virtual Reality
XR Extended Reality

1. Introduction

Over the last several years, spatial computing, which includes technologies such as AR, VR, and immersive environments, has received recognition and interest. Many consider this to be a thing of the future when, in fact, devices such as HMDs have been around since the 1980s. However, global changes and trends, toyed with costs and improved hardware and software, have revolutionised spatial computing wisely.

With the help of the *Apple Vision Pro*, *META* with the *Quest* line, and *Microsoft* with the *Hololens*, *Apple* heads towards the creation of apps that overlap the real world and the virtual world [1]. The importance of this technology is not limited only to entertainment and collaborative work; it is being utilised in a significant way in the field of medicine. Some work, such as that of Alves et al., focus on AR and MR use in hospital environments, e.g., during surgeries, or to enhance patients' overall experience [2].

In this regard, it becomes relevant to ask whether using spatial computing to sell hospital medical devices online is advantageous. Could socially-oriented technologies such as these improve the online sale of such goods? This study examines the available literature on AR and MR applications when selling medical equipment.

2. Method

To carry out this research, an extensive keyword search on SCOPUS and Web of Science databases was carried out under the words "Spatial Computing", "Augmented Reality"," "Mixed Reality," "Medical Equipment, "Hospital Equipment", and "Sales". Nonetheless, no article was relevant to this initial search. Given this, since there was no appropriate finding in the literature, we used "Marketing" instead of ''Sales" to widen the search to find the related studies. Still, no relevant articles were found.

The following research phase, the concept of Marketing, was not included in any stage of the process. In this phase, we got 27 articles in the SCOPUS database, of which only seven were published within five years. Nevertheless, after looking closely at the content of these 27 articles, we realised that it was impossible to find any articles that dealt with issues of selling medical products using immersive technologies, including but not limited to AR or MR.

The query conducted in SCOPUS for this purpose was as follows:

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((spatial computing) OR (augmented reality) OR (mixed reality)) AND (medical equipment) OR (hospital equipment) AND PUBYEAR=2019:2022
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Simultaneously, we performed a search on the Web of Science with the following query:

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("spatial computing" OR "augmented reality" OR "mixed reality") AND ("medical equipment" OR "hospital equipment" AND "sales") TS id
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This search revealed 22 articles. Nonetheless, as most articles were related to the phenomenon and focused on other industries, no articles described spatial computing or immersive technologies in the context of selling hospital medical equipment.

The shortage of literature in some areas indicates that this discipline is growing, and more work needs to be done to fill the gap in the dynamics of selling medical products through AR or MR technology. For this reason, it became apparent that further independent sources needed to be used to complete this study. Therefore, we decided to include our

information retrieval companies and other reputable sources on specialised internet resources to accumulate broader and more current information.

Concerning this, we surveyed a range of scholarly papers which we think are essential in understanding the present actions being undertaken beyond those demonstrated by Alves et al. [2], and in parallel, the analysis of three companies/case studies within this sector.

3. Results and Discussion

3.1. Augmented and Mixed Reality in Medical Education and Training

Immersive technologies, such as Augmented Reality (AR) and Mixed Reality (MR), have shown great potential in medical education. Studies such as that by Brenner et al. [5] indicate that MRI modules improve understanding of complex topics such as anatomy and surgical procedures, while Rebol et al. [9] highlights that MRI allows methods to be practised in controlled environments, helping students to gain confidence. In addition, Uhl et al. [12] shows that the combination of visual simulation and physical interaction in MRI enhances trauma training, providing a more complete educational experience.

Medical training with immersive technologies, such as AR and MRI, has shown great potential, allowing students to acquire skills in controlled environments and improving safety in treatment. MRI facilitates the 3D visualization of anatomical structures and the practice of invasive procedures with real-time feedback, as pointed out by Brenner et al. [5] and Rebol et al. [9]. Uhl et al. [12] explore tactile simulations for trauma training, and Parekh et al. [8] highlight AR by superimposing digital data on the real environment. These technologies create safe scenarios for repetitive practice, with the potential to integrate tactile feedback in the future.

3.2. Mixed Reality in Surgical Procedures

In surgery, AR has enhanced the surgeon and the procedure's effectiveness. Magalhães et al. [6] conducted a systematic review of operating theatre use of AR and referred in their findings to the device capable of projecting CT and MRI images in the surgeons' field of vision, thus removing the need for looking at external monitors. The research also claims that AR could result in shorter operative times and fewer complications in extensive surgical procedures.

Additionally, Rebol et al. [9] use AR for the induction of invasive procedures, such as central venous catheter placement by immersion into virtual environments that replicate the actual clinical scenarios with the possibility to provide hands-on repetitive training and immediate performance feedback which is paramount towards skills acquisition prior to clinical practice.

3.3. Telemedicine and Augmented Reality: Prospects for the Patient

The feasibility of using AR in telemedicine for medical examination by unskilled persons is investigated. Using AR to instruct by nonprofessionals and thus Bifulco et al. [4]. In the online appendices tested, the layout lighting of the video endoscopic screen makes this task less difficult and emotionally more comfortable for most individuals without medical background [4]. This innovation leads to a careful conclusion that patients may be instructed to perform relatively simple diagnostic tests at home using telemedicine technology.

3.4. Augmented Reality-Based Usability Evaluation of Medical Device Interfaces

Various studies have used AR to help users operate medical appliances more effectively and maximise their potential. Ribeiro et al. [10] worked with AR as a means to improve the usability of equipment since practitioners do not need to leaf through manuals or external devices, instructions and pieces of information viewed on the devices directly. The investigation reveals that AR can help lower the rate of operational errors and increase productivity, particularly during critical situations.

This argument is advanced by Ribeiro et al., who investigates the usage of MR for teaching the management of intricate devices such as venous catheters. In both of these studies, it has been determined that the AR and MR

technologies give opportunities for enhancing the processes aimed to increase the effectiveness of medical equipment usage by competent amateurs and novices during their routine activity[10].

3.5. Sale and Demonstration of Medical Products with Augmented Reality

The three companies presented – Nuvue, Augray and Threekit – represent different but supporting angles to the use of immersive technologies in the demonstration and sales of medical devices. Though all of them have the same vision that industries are being enhanced and improved because of the emergence of technologies like AR, MR, and 3D visualization, each takes a particular line in the effort to leverage these tools.

3.5.1. Focus on Visual Customization: Nuvue

As highlighted by Nuvue [7], healthcare products have a unique specificity in that their design effort is focused on the visual customization of devices, creating engaging and entertaining content. Nuvue's studio provides advanced 3D models, enabling clients to use devices in real time and even see how they work inside, which is physically impossible during demonstrations. This is done to enhance the overall experience of the clients through personalization.

On the downside, the emphasis on visual customization may limit the scope of Nuvue, as the production of elaborate 3D content is time-consuming and expensive, which may be a challenge for smaller medical device manufacturers.

Instead, Augray [3] stresses the potential of XR – including AR and MR – to design product demos that will be created without commercial devices. As stated by Augray, XR minimizes demonstration costs because there is no need to carry heavy devices where they are intended to be demonstrated. Such devices can be displayed virtually in the client's surroundings through mobile devices or XR glasses. This makes demonstration easier and gives companies a global perspective. On the one hand, Nuvue provides individual interactions while Augray aims for accessibility and efficiency, making the case for cost savings and not needing too much from logistics. Such difference shows the extent to which various approaches may be employed within a single organization, such as in the case of Augray, where all operations are centred on getting maximum returns on investment through efficiency in operations and logistics.

3.5.2. Use of AR in E-Commerce Platforms: Case of Threekit

Threekit [11] seems to have taken a subtle flip from their previous approach and instead, considers the implementation of 3D visualization and AR directly into online sales channels and their processes. They emphasize that when companies allow their customers to engage with specific medical devices through detailed AR and 3D visualizations on their platforms, companies get to improve the sales funnel and create a better shopping experience. To do that, Threekit recommends letting customers tailor and see products through the web in an interactive manner, as it would encourage one's desire to purchase, especially regarding scientific and technological devices [11].

Threekit's focus is strikingly different from that of Nuvue and Augray in that it is more aligned with digital spending and e-commerce practice. Nuvue and Augray have more hold on interactive and personal presentations, although they use XR and 3D visualization, Threekit's emphasis is on using these technologies to market directly in the customer's digital environment.

3.6. General Discussion: Advantages and Challenges

Computers and other devices have become an integral part of our lives and so have telekl Work flow demands from everyone. Still, expectations during its use are often unrealistic. Cost, accessibility and time are major concerns for the three approaches discussed. Channels for all these companies fall somewhere down the same market approach depending on their marketing and sales objectives.

Even though Nuvue [7] argues for the aspects of personalization and a rich content experience, Augray [3] views the use of immersive enhancing technologies as a method for eliminating the cost and logistical difficulties involved in the presentation of products. For Threekit [11], due to AR and 3D visualization, the sales process is also transformed where a customer feels more bought into the product without seeing it physically.

Even with such a high market understanding of the use of these technologies by healthcare professionals, all companies need to deal with this central problem: market accessibility and user habituation and adoption of these technologies. Although such scientific and clinical approaches produce positive results, such as time reduction and operational efficiency, there is a need for some level of training and adjustment of the way things are done, both on

the part of the supplier companies and their suppliers. technologies for healthcare professionals who will be the end users. Augray [3] and Threekit [11] seem to be more passionate about offering simple and comfortable solutions, while Nuvue [7] looks at everything in a more simple, but in parts.

All the companies, however, concur that the marketing of medical devices has changed considerably, with the use of immersive technologies changing the manner in which these products have been primarily marketed. What remains to be seen is how these technologies are going to be applied in practice at an industrial scale and how the companies will manage the relationship between the development costs and the return in the long run.

4. Conclusion

There are possibilities to change the approach of the medical devices market - the way they are sold and the effectiveness of medical training and education. Based on the scientific articles analyzed, such as the studies by Parekh et al. [8], Brenner et al. [5], Rebol et al. [9], it has become evident that these technologies are transforming both clinical and academic environments.AR and MR offer interactive modelling to help perform medical processes more safely and efficiently. At the same time, 3D rendering allows understanding the complicated items by health care providers and their target clients. The example of Nuvue [7], Augray [3] and Threekit [11] demonstrates effective business strategies for medical product marketing through immersive technologies. The main tools of the approaches used for optimizing the purchasing process in such an environment are the personalised, convenient, active and built-in purchasing system. Knowing this, we conclude that all tendencies, both scientific and business, refer to the expectation that whenever it might be required, immersive technology in medicine helps not only in sales and education but also in managing medical devices.

4.1. Limitations

The study's primary limitation pertains to the unavailability of longitudinal studies that measure the actual effect of these technologies on clinical practice and medical devices sales. While the limitations of available evidence in the studies by Parekh et al. [8] show positive changes in clinical practice, the too early and outspoken predictions of AR and MR as commercial and teaching instruments of the future have to be validated for a more extended period.

4.2. Future Research

The current study can be expanded in two directions to address the mentioned limitations. The first direction involves increasing the understanding of immersive technologies' role in clinical performance. The second direction involves increasing the effectiveness of medical device sales strategies. For instance, it would be interesting to explore the potential for medical device companies such as Nuvue, Augray, and Threekit to collaborate with academic institutes to create a unified ecosystem. This ecosystem would facilitate the convergence of commercial and educational innovative solutions, accelerating the integration of these technologies in sales and clinical practice. Additionally, it would be beneficial to explore the potential use of current technologies in different sectors.

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