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Enhancing Empathy in Virtual Reality: Software Classification

Iuliia Khukalenko[1] and Daria Khanolainen[2]

[1] University of Sydney, Sydney, Australia
iuliia.khukalenko@sydney.edu.au
[2] University of Jyväskylä, Jyväskylä, Finland
daria.p.khanolainen@jyu.fi

Abstract. The unique affordances of virtual reality (VR), such as high immersion, embodiment, and a profound sense of presence, position it as a promising medium for enhancing perspective-taking and fostering empathy. This study explores VR's role in promoting empathy and provides a preliminary market analysis of available VR software in this domain. Through a systematic review of peer-reviewed articles, the largest online distributors of VR games and applications, and a comprehensive Google search, 45 VR products fitting inclusion criteria were identified. These products demonstrate a range of approaches and are classified into five main types: 1) 360-degree video content, 2) immersive experiences, 3) applications for empathy training, 4) multisensory simulations, and 5) content creation platforms. This classification highlights the diversity of fields where VR is being applied to enhance empathy, including education, healthcare, therapy, diversity and inclusion, customer service, and social work. The results underscore the growing relevance of VR in facilitating emotional engagement across multiple sectors. Future research will focus on a detailed analysis of instructional design elements within VR-based empathy training, aiming to optimize these applications for broader and more effective use. This work emphasizes the potential of VR as a tool for not only emotional learning but also practical applications in training and professional development across various fields.

Keywords: Virtual Reality, Market Analysis, Software Review, Empathy.

1 Introduction

Empathy, defined as the ‘ability to understand and share in another's emotional state or context’ [1], has become a pivotal factor in the assessment of virtual reality (VR) applications in recent years [2]. In this study, virtual reality (VR) is understood as ‘a system that aims to bring simulated real-life experiences, providing topography, movement, and physics that offer the illusion of being there’ [3]. The unique affordances of VR, such as high immersion, embodiment, and a profound sense of presence, position it as an effective medium for perspective-taking [4]. Unlike traditional perspective-taking methods, VR minimizes cognitive load by allowing participants to experience situations directly, potentially addressing methodological challenges in research, such as the control–realism trade-off, replication issues, and unrepresentative sampling [5].

The market of applications for empathy training in virtual reality is constantly expanding. VR applications have been previously classified previously in different speres, such as language learning [6], more broadly for higher education [7], or as a market analysis of a specific platform [8]. With our study, we contribute a preliminary market analysis of VR apps in the sphere of empathy research. Thus, this paper aims to provide a classification of different types of software that was created and used to increase empathy.

1.1 Brief Literature Review

The concept of empathy encompasses various definitions, highlighting its multifaceted nature across contexts. Some definitions emphasise understanding internal states, such as ‘the ability to share and understand others' internal states’ [9], while others underscore behavioural change as a crucial component, describing empathy as a complex capability enabling compassionate behaviour [10]. Beyond human experience, [11] propose empathy as a universal ability shared by humans and many animals, evolving to facilitate a spectrum of prosocial behaviours.

As a behavioural competency, empathy involves responding with appropriate prosocial and helpful behaviour [12].

The effectiveness of virtual reality (VR) as an educational tool for promoting prosocial behaviour through empathy training requires rigorous research validation. Emerging research shows positive findings, with some studies highlighting actual behavioural changes in the physical world following VR experiences [4, 13]. Noteworthy are studies measuring both empathy levels and prosocial behaviour, revealing VR's potential to evoke positive attitudes and actions beyond self-reported measures. However, methodological issues in VR studies, particularly the distinction between emotional and cognitive empathy, introduce complexities. While emotional empathy appears to be automatically aroused in VR, cognitive empathy may demand more deliberate engagement, influencing the interpretation of results across studies [14, 15]. As researchers navigate these nuances, understanding the impact of VR on specific empathy-related skills and selecting appropriate learning environments becomes paramount for the development and assessment of empathetic training programs in virtual reality [5, 16].

2 Method

The systematic search of VR products aimed at developing/training empathy was performed and the following inclusion criteria were applied:

- Be a VR product designed for empathy training/development (empathy training and/or corresponding behavior change needs to be stated in the description as a goal/an activity performed in the app/game; it is important that empathy is trained/experienced specifically towards people rather than towards animals, fantasy creatures and/or inanimate objects).
- Be a VR product that achieves its stated goals without the use of extra equipment (anything that goes beyond the standard VR headset itself and its handheld controllers is viewed as extra).
- Be available online for free (at least a trial/demo version).
- Be available in English.

The search consisted of three main steps. Step 1 involved searching through the largest distributors of VR games and apps (STEAM, Epic Games Store, MetaQuest online store, VIVEPORT, PlayStation VR games, PICO VR and Pimax). The keywords that were applied for searching within each digital platform were “empathy”, “empathic”, “empathetic”, and “empathize”. In total, across all platforms, 18 applications were identified but only three met all our inclusion criteria.

Step 2 included a systematic literature search aimed at identifying peer-reviewed studies that utilized VR tools for empathy training. The electronic databases that were searched included Pubmed, EBSCOhost and ERIC. The following search string was applied: empath* AND (“virtual reality” OR VR). The titles and abstracts of 270 items were extracted and screened after 44 duplicates were identified and merged. Following the screening 127 studies were subjected to full text reading. Overall, only 45 VR products identified this way fitted our inclusion criteria.

Step 3 involved a google search with the application of the following search string: (“virtual reality” OR VR) AND (“empathy” OR “empathetic” OR “empathic” OR “empathize” OR “compassion” OR “perspective-taking”) AND (“train*” OR “develop*”). This search returned over 5 million results, and we reviewed the first 300 of them. After the first 200 results were screened, it became clear that the results were becoming increasingly irrelevant and almost no new products were emerging. In total, 28 VR products were identified this way.

3 Results

There are four main types of VR software used to increase empathy: video content, VR experiences, training software, multisensory simulations, and platforms for content creation.

1. The video content consists of two types: 360-degree videos capturing panoramic views and computer-generated 3D videos produced through computational rendering. Examples of 360 videos include films such as ‘Clouds over Sidra’ or ‘The Displaced,’ which observe the lives of children who survived wars. ‘Mindfield' and ‘Accused#2’ are examples of the second type of video content. The ‘VR for Good’ series includes various types of videos covering different topics, aiming for social impact through education and empathy. The main characteristic of the video content is non-interactivity, where the user assumes a passive role.

2. VR experiences immerse the user in a virtual environment, allowing some level of interactivity. Thus, in 'Becoming Homeless: A Human Experience', users take on the role of a homeless individual, navigating through stages such as selling possessions, living in a car, and ultimately being on the streets while listening to the stories of others in similar situations. In the VR experience called 'DeathTolls', the user navigates through spaces filled with the bodies of individuals who perished in war. The application's concept aims to visually illustrate the stark reality underlying the dry statistical figures of casualties. Another noteworthy experience is 'Notes On Blindness', offering a unique perspective by allowing users to see the world 'through the eyes' of a blind person.

3. VR empathy training applications include educational modules, programs, or training scenarios. Unlike the first two types, this software incorporates essential elements of instructional design: learning objectives, learning activities, and assessment/feedback [17, 18]. Typically, these apps are commercial and target specific audiences rather than the general user. Examples include 'Bodyswaps', 'People Tech Revolution' (PTR), 'Skills^{VR}', and others.

4. Multisensory simulations. These products vary in their exact configurations, but they always include more than just a VR headset with controllers. For example, they can offer special shoe inserts, stiff gloves, or even full-body suits that facilitate multisensory experience. Examples of this product type include *Baycrest Virtual Reality Dementia Simulation, Mr. UD*, and *Dementia Live*. These are utilized in dementia and disability research, with the aim of improving the training of healthcare workers.

5. VR Platforms for content creation. These platforms do not provide ready-to-use content; instead, they offer to develop customized videos, VR experiences and educational modules. The following platforms are used: 'Engage', 'VRTY', 'The Motive VR', etcetera.

The examination of VR software reveals a diverse array of tools that aim to foster empathy across diverse fields, including education, healthcare, therapy, diversity and inclusion, customer service, and social work, among others. Fig. 1 summarizes the numbers and reveals how different types of VR software are distributed across product identification sites.

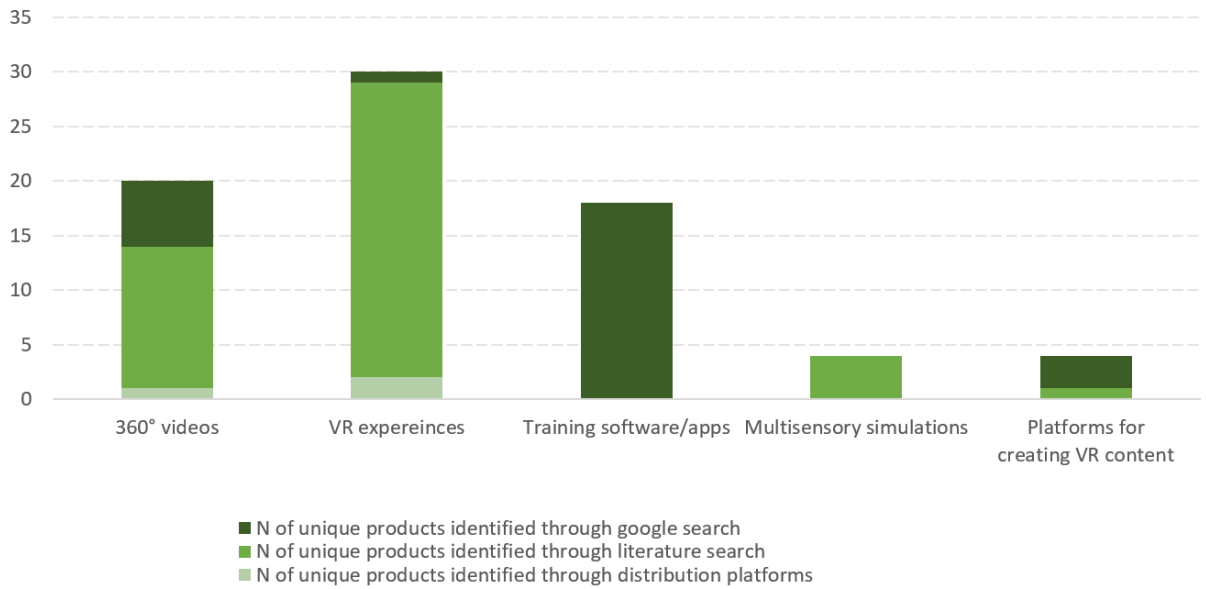

Fig. 1. The Distribution of VR Products by Type Across Different Product Identification Sites.

4 Discussion

The conventional classifications of VR software do not exist, although there is 'the need for a new taxonomy for VR beyond traditional genres' [19]. Indeed, VR software can be classified according to a wide range of criteria, such as application domains and design elements [7], hardware, user rating, sociality [20], etcetera. The classification we propose involves two key criteria: interactivity and instructional design.

Research indicates that VR technologies stimulate higher levels of empathy through greater engagement [21]. The concept of engagement is intrinsically linked to immersion [22, 23]. However, these are distinct concepts, and immersive interfaces do not always enhance user engagement [24, 25]. Immersion defines the VR environment, while engagement involves the tasks and activities within it. Immersion teleports users to a new reality, while engagement ensures active interaction. O'Brien and Toms [26] emphasize that engaging digital

environments captivate attention without causing undue effort or frustration, leading users to return and recommend the experience to others.

Regarding instructional design, this is the most important characteristic of VR content in the sphere of education. There is a wide range of instructional strategies and techniques used in virtual environments [27–29], including particular recommendations for creating learning environments for empathy-related abilities [16]. Thus, methodological instruments for assessing empathy training content are available in the market and claimed to be effective [30].

This review serves as a valuable resource for diverse stakeholders, such as educators, healthcare professionals, researchers, investors, and VR content developers. We hope this review inspires researchers interested in using VR for empathy development to explore the following lines of scientific inquiry. First, VR-based interventions should be compared to conventional empathy-enhancing interventions with similar content but presented without VR technology. Second, dedicated research is needed to determine whether the effectiveness of VR products depends on user immersion and engagement levels. Third, once the effectiveness of certain products is established, longitudinal research should examine how long the effects persist. Additionally, longitudinal studies can assess whether prolonged use of VR products leads to technological fatigue potentially reversing some of the initial effects. Furthermore, ethical concerns, including data privacy and the potential psychological effects of immersive experiences, must be carefully considered to ensure that VR empathy training remains a safe and responsible tool. Addressing these concerns will help maximize the benefits of VR while mitigating potential risks for users.

It is important to acknowledge the limitations of this study. Notably, our review may be constrained by the exclusion of valuable products that were not freely available or lacked a free demo, potentially impacting its comprehensiveness. However, product availability was a key inclusion criterion for us, as future practitioners and researchers are likely to prioritize products they can test without restrictions. While some unavailable products might become accessible in the future, this seems unlikely. Whenever we identified products that met all inclusion criteria except availability, we reached out to developers or researchers testing them to request access. In most cases, these efforts were unsuccessful, and we received no indication that the products would become available later. As a result, future practitioners and researchers will likely face the same challenge—they will either have to purchase a product blindly (i.e. without prior testing) or to choose a product from those included in our review because only these products allow for unrestricted evaluation before purchase.

5 Conclusion

The expanding market for VR applications in empathy training underscores the technology's potential impact. This paper contributes a preliminary market analysis, identifying five main types of VR software: video content, VR experiences, empathy training applications, and content creation platforms. While VR offers immersive and engaging ways to foster empathy, its effectiveness depends on factors such as interactivity, instructional design, and user engagement. This is a work-in-progress, and the next step is to analyze the instructional design of educational applications to help educators make informed decisions when selecting VR tools for empathy training. Additionally, accessibility remains a challenge, as high-quality VR experiences often require expensive hardware and technical expertise, potentially limiting their widespread adoption.

The diverse VR software examined showcases its potential across fields like education, healthcare, therapy, enterprise, and social work. Further interdisciplinary collaboration is needed to refine best practices, improve accessibility, and develop guidelines for ethical and evidence-based VR applications in empathy training. Future research should explore the nuanced relationships between engagement, immersion, and empathy stimulation, while establishing standardized classifications and assessment tools for optimal effectiveness.

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