

Virtual Reality (VR) in Pediatrics: Innovative Perspectives With Special Reference To Clinical Applications and Pediatric Rehabilitation

Bittmann S, Moschüring-Alieva E, Luchter E, Weissenstein A,
Villalon G

Editor Note

Virtual reality (VR) is the term used to describe representation and perception in a computer-generated, virtual environment. The term was coined by author Damien Broderick in his 1982 novel "The Judas Mandala". The term "Mixed Reality" describes the mixing of virtual reality with pure reality. The term "hyper-reality" is also used. Immersion plays a major role here. Immersion describes the embedding of the user in the virtual world. A virtual world is considered plausible if the interaction is logical in itself. This interactivity creates the illusion that what seems to be happening is actually happening. A common problem with VR is "motion sickness." To create a sense of immersion, special output devices are needed to display virtual worlds. Here, "head-mounted displays", CAVE and shutter glasses are mainly used. Input devices are needed for interaction: 3D mouse, data glove, flystick as well as the omnidirectional treadmill, with which walking in virtual space is controlled by real walking movements, play a role here.

VR is used in simulation (pilot training), creation (mechanical engineering, architecture), entertainment (PC), education (teaching) and communication. Looking to the future, "inverse VR" will play a role in replacements for lost bodily functions. Likewise, the use of a virtual world for distraction will find application in pediatrics, especially in painful medical procedures. Especially in children, "VR" could be used for minor interventions,

short manipulations that would otherwise require anesthesia, or for vaccinations of children, who need to be relieved of panic fears of vaccination. All of this is future music. Even in doctors' offices. An innovative approach.

Disabled children are immersed in the virtual world by means of shutter glasses, in which they are given certain tasks to perform in order to intensively support

Department of Pediatrics, Ped Mind
Institute (PMI), Gronau, Germany

Corresponding Author: Stefan
Bittmann, Head of the Department of
Pediatrics and Ped Mind Institute (PMI)
Pediatrician, Hindenburgring, Gronau,
Germany.

Accepted Date: 22-04-2021

Published Date: 22-05-2021

Copyright © 2021 by Bittmann S. All rights reserved. This is an open access article distributed under the terms of the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original author and source are credited.

these cognitively impaired children. In Germany, these treatment approaches still play a completely subordinate role, but allow speculation about therapy approaches that could find widespread use in pediatric rehabilitation clinics in the coming years.

"Virtual reality" is now playing a big role in helping disabled children and working on motor functions that are significantly impaired by the condition. Virtual reality (VR) can be used in pediatric trauma brain

injury patients [1,7,14]. Moreover children can be treated in cases of pediatric burns [5]. In Parkinson disease it will be also used in elder patients [9,10]. Virtual reality can also help in pediatric vestibular rehabilitation [11], chronic pain syndroms in childhood [13], cerebral palsy in children [15] and analgesia during venous puncture in oncological pediatric diseases [17]. In conclusion, virtual reality is an innovative new therapy approach in children. Further research in this interesting field is necessary.

References

1. Shen J, Johnson S, Chen C, Xiang H. Virtual Reality for Pediatric Traumatic Brain Injury Rehabilitation: A Systematic Review. *Am J Lifestyle Med.* 2018 Feb 6;14(1):6-15. doi: 10.1177/1559827618756588. PMID: 31903073; PMCID: PMC6933564.
2. Cho C, Hwang W, Hwang S, Chung Y. Treadmill Training with Virtual Reality Improves Gait, Balance, and Muscle Strength in Children with Cerebral Palsy. *Tohoku J Exp Med.* 2016 Mar;238(3):213-8. doi: 10.1620/tjem.238.213. PMID: 26947315.
3. O'Neil O, Fernandez MM, Herzog J, Beorchia M, Gower V, Gramatica F, Starrost K, Kiwull L. Virtual Reality for Neurorehabilitation: Insights From 3 European Clinics. *PM R.* 2018 Sep;10(9 Suppl 2):S198-S206. doi: 10.1016/j.pmrj.2018.08.375. Epub 2018 Aug 16. Erratum in: *PM R.* 2018 Dec;10(12):1437. PMID: 30121365.
4. Lannicelli AM, Vito D, Dodaro CA, De Matteo P, Nocerino R, Sepe A, Raia V. Does virtual reality reduce pain in pediatric patients? A systematic review. *Ital J Pediatr.* 2019 Dec 30;45(1):171. doi: 10.1186/s13052-019-0757-0. PMID: 31888710; PMCID: PMC6937674.
5. Schmitt YS, Hoffman HG, Blough DK, Patterson DR, Jensen MP, Soltani M, Carrougher GJ, Nakamura D, Sharar SR. A randomized, controlled trial of immersive virtual reality analgesia, during physical therapy for pediatric burns. *Burns.* 2011 Feb;37(1):61-8. doi: 10.1016/j.burns.2010.07.007. Epub 2010 Aug 7. PMID: 20692769; PMCID: PMC2980790.
6. Banerjee-Guénette P, Bigford S, Glegg SMN. Facilitating the Implementation of Virtual Reality-Based Therapies in Pediatric Rehabilitation. *PhysOccupTherPediatr.* 2020;40(2):201-216. doi: 10.1080/01942638.2019.1650867. Epub 2019 Aug 16. PMID: 31416381.
7. Choi JY, Yi SH, Ao L, Tang X, Xu X, Shim D, Yoo B, Park ES, Rha DW. Virtual reality rehabilitation in children with brain injury: a randomized controlled trial. *Dev Med Child Neurol.* 2021 Apr;63(4):480-487. doi: 10.1111/dmcn.14762. Epub 2020 Dec 16. PMID: 33326122.
8. Golomb MR, McDonald BC, Warden SJ, Yonkman J, Saykin AJ, Shirley B, Huber M, Rabin B, Abdelbaky M, Nwosu ME, Barkat-Masih M, Burdea GC. In-home virtual reality videogame telerehabilitation in adolescents with hemiplegic cerebral palsy. *Arch Phys Med Rehabil.* 2010 Jan;91(1):1-8.e1. doi: 10.1016/j.apmr.2009.08.153. PMID: 20103390.
9. Wang B, Shen M, Wang YX, He ZW, Chi SQ, Yang ZH. Effect of virtual reality on balance and gait ability in patients with Parkinson's disease: a systematic review and meta-analysis. *ClinRehabil.* 2019 Jul;33(7):1130-1138. doi: 10.1177/0269215519843174. Epub 2019 Apr 24. PMID: 31016994.

10. Wang B, Shen M, Wang YX, He ZW, Chi SQ, Yang ZH. Effect of virtual reality on balance and gait ability in patients with Parkinson's disease: a systematic review and meta-analysis. *ClinRehabil*. 2019 Jul;33(7):1130-1138. doi: 10.1177/0269215519843174. Epub 2019 Apr 24. PMID: 31016994.
11. Weingarten K, Macapagal F, Parker D. Virtual Reality: Endless Potential in Pediatric Palliative Care: A Case Report. *J Palliat Med*. 2020 Jan;23(1):147-149. doi: 10.1089/jpm.2019.0207. Epub 2019 Jun 6. PMID: 31170022.
12. Alves CC, Silva ALS. Pediatric Vestibular Rehabilitation: A Case Study. *PediatrPhysTher*. 2019 Oct;31(4):E14-E19. doi: 10.1097/PEP.0000000000000654. PMID: 31568389.
13. Griffin A, Wilson L, Feinstein AB, Bortz A, Heirich MS, Gilkerson R, Wagner JF, Menendez M, Caruso TJ, Rodriguez S, Naidu S, Golianu B, Simons LE. Virtual Reality in Pain Rehabilitation for Youth With Chronic Pain: Pilot Feasibility Study. *JMIR Rehabil Assist Technol*. 2020 Nov 23;7(2):e22620. doi: 10.2196/22620. PMID: 33226346; PMCID: PMC7721555.
14. Shen J, Xiang H, Luna J, Grishchenko A, Patterson J, Strouse RV, Roland M, Lundine JP, Koterba CH, Lever K, Groner JI, Huang Y, Lin ED. Virtual Reality-Based Executive Function Rehabilitation System for Children With Traumatic Brain Injury: Design and Usability Study. *JMIR Serious Games*. 2020 Aug 25;8(3):e16947. doi: 10.2196/16947. PMID: 32447275; PMCID: PMC7479584.
15. Chang HJ, Ku KH, Park YS, Park JG, Cho ES, Seo JS, Kim CW, O SH. Effects of Virtual Reality-Based Rehabilitation on Upper Extremity Function among Children with Cerebral Palsy. *Healthcare (Basel)*. 2020 Oct 10;8(4):391. doi: 10.3390/healthcare8040391. PMID: 33050396; PMCID: PMC7711757.
16. Olivieri I, Meriggi P, Fedeli C, Brazzoli E, Castagna A, Roidi MLR, Angelini L. Computer Assisted REhabilitation (CARE) Lab: A novel approach towards Pediatric Rehabilitation 2.0. *J PediatrRehabil Med*. 2018;11(1):43-51. doi: 10.3233/PRM-160436. PMID: 29630562; PMCID: PMC6027946.
17. Atzori B, Hoffman HG, Vagnoli L, Patterson DR, Alhalabi W, Messeri A, Lauro Grotto R. Virtual Reality Analgesia During Venipuncture in Pediatric Patients With Onco-Hematological Diseases. *Front Psychol*. 2018 Dec 20;9:2508. doi: 10.3389/fpsyg.2018.02508. PMID: 30618938; PMCID: PMC6307499.