ePTRI

European Paediatric Translational Research Infrastructure

Innovative Technology-based Interventions: Virtual Reality for Paediatric Rehabilitation

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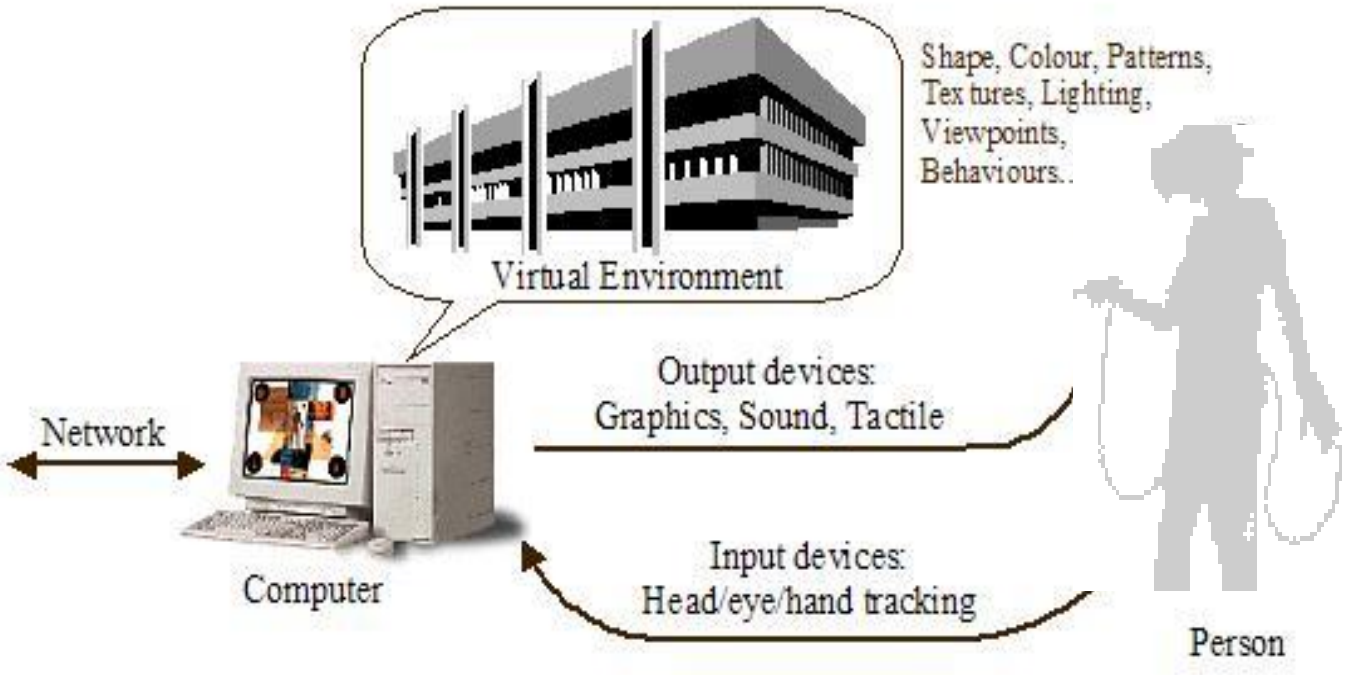
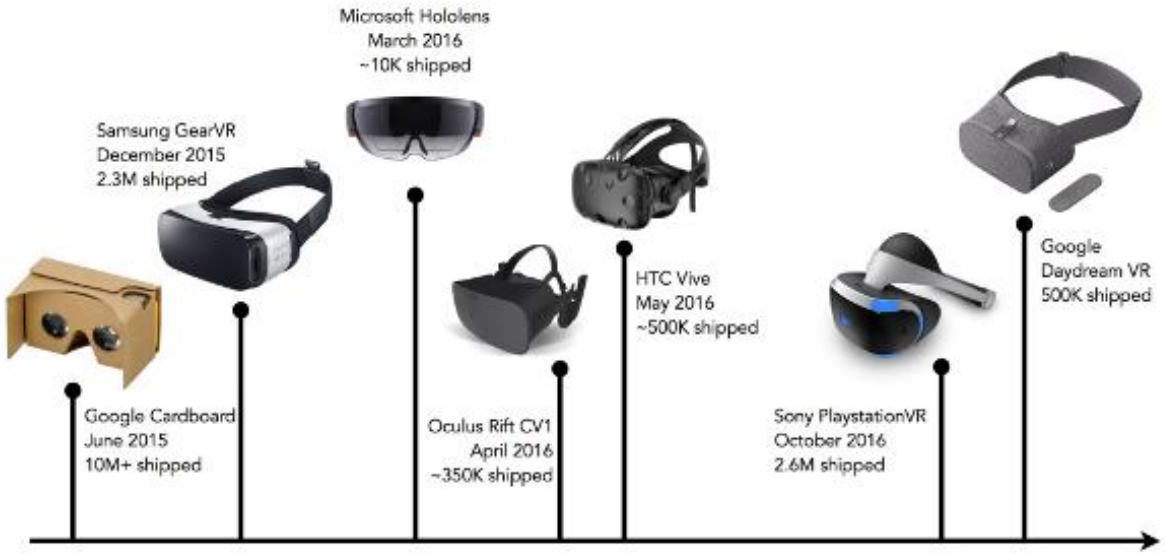
ALYN Hospital, a 120-bed center that serves children with physical medical and complex challenges and provides a wide array of rehabilitation services with the goal of promoting healthy, independent lives as adults; many children receive care on an ambulatory basis.

Extended Reality Continuum

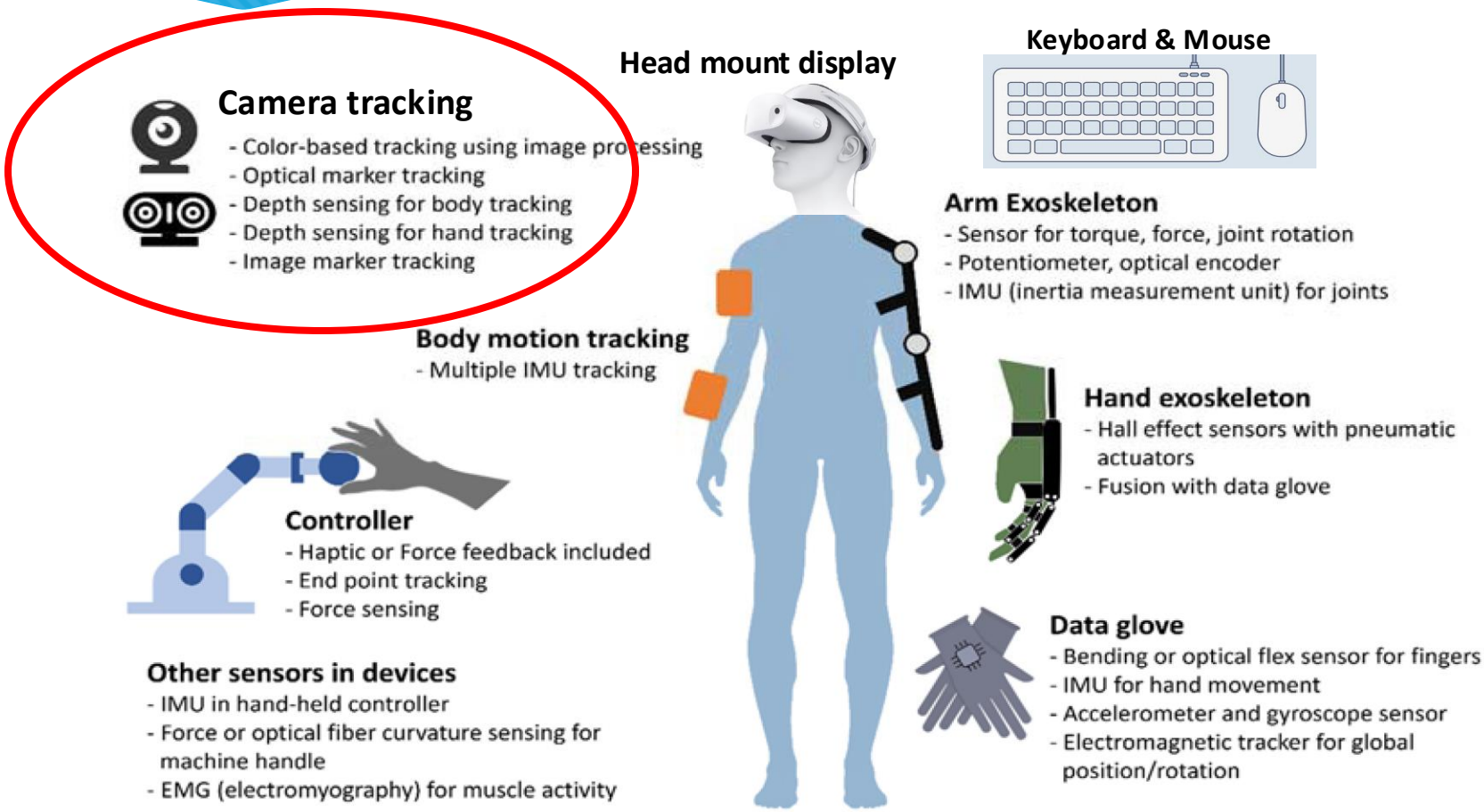
Augmented Reality ⟺ **Mixed Reality** ⟺ **Virtual Reality**



Head-mounted Displays



And its MANY alternatives!



Immersion

- Objective property of a system (hardware e.g., HMD, camera)
- higher or lower immersion as the extent to which a VR system can support natural sensorimotor contingencies for perception

(Sheridan,1992; 2018; **Slater,2010;** Bailenson et al., 2003; Loomis et al., 1999)

Virtual Presence

VR does **NOT** aim for user to believe the virtual world is real

- Presence is **NOT** about belief
- No one, standing close to a virtual precipice (even with a racing heart and great anxiety, **believes** in the reality of what they are perceiving
- Presence is an **"illusion of being there"**, even though you know, for sure that you are **NOT**
- It is a perceptual **NOT** a cognitive illusion

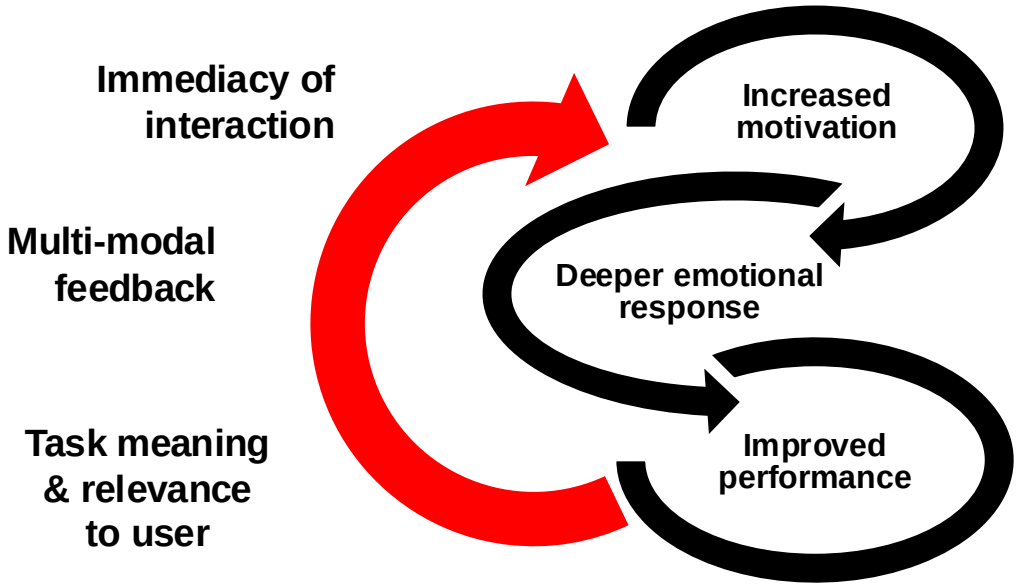
But by then it is too late; physiological & behavioral responses have already occurred!

Virtual Presence

When is an HMD really needed for most rehabilitation goals?

- Distraction
- Isolation
- Head movement control

Subjective perception of being present in a virtual environment



Key Principles for Rehabilitation of motor & cognitive impairment

- task-specific practice
- high intensity, repetitive exercise
- activities that can be graded to be demanding but feasible
- varied, meaningful & purposeful environmental contexts
- increased patient empowerment and participation

(Carr & Shepherd 1987; Winstein 1991; Dean et al. 2000; Lamontagne & Fung, 2005, Weiss, Keshner, Levin, 2014)

Advantages of Virtual Reality for Rehabilitation

Graded levels of difficulty

Ability to repeat different but equivalent tasks

Feedback of results

Increased motivation

Feedback of performance

Safe & protected settings

Documentation of therapy

Example of Motion Capture VR

Example of Motion Capture VR

Virtual game personalization
Basic AI: Heuristic rule-based

User Modeling and User-Adapted Interaction (2021) 31:829–865
https://doi.org/10.1007/s11257-021-09296-6

Check for updates

Personalized rehabilitation for children with cerebral palsy

Sarit Tresser[1] · Tsvi Kuflik[1] · Irina Levin[1] · Patrice L. Weiss[1]

Received: 12 December 2020 / Accepted in revised form: 28 May 2021 / Published online: 17 June 2021

Disability and Rehabilitation: Assistive Technology

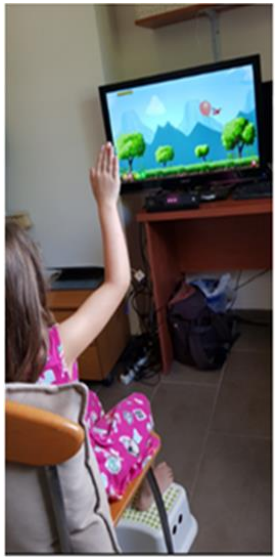
ISSN: (Print) (Online) Journal homepage: https://www.tandfonline.com/loi/iidt20

Personalisation of a virtual gaming system for children with motor impairments: performance and usability

Sarit Tresser, Tsvi Kuflik, Irina Levin & Patrice L. Weiss

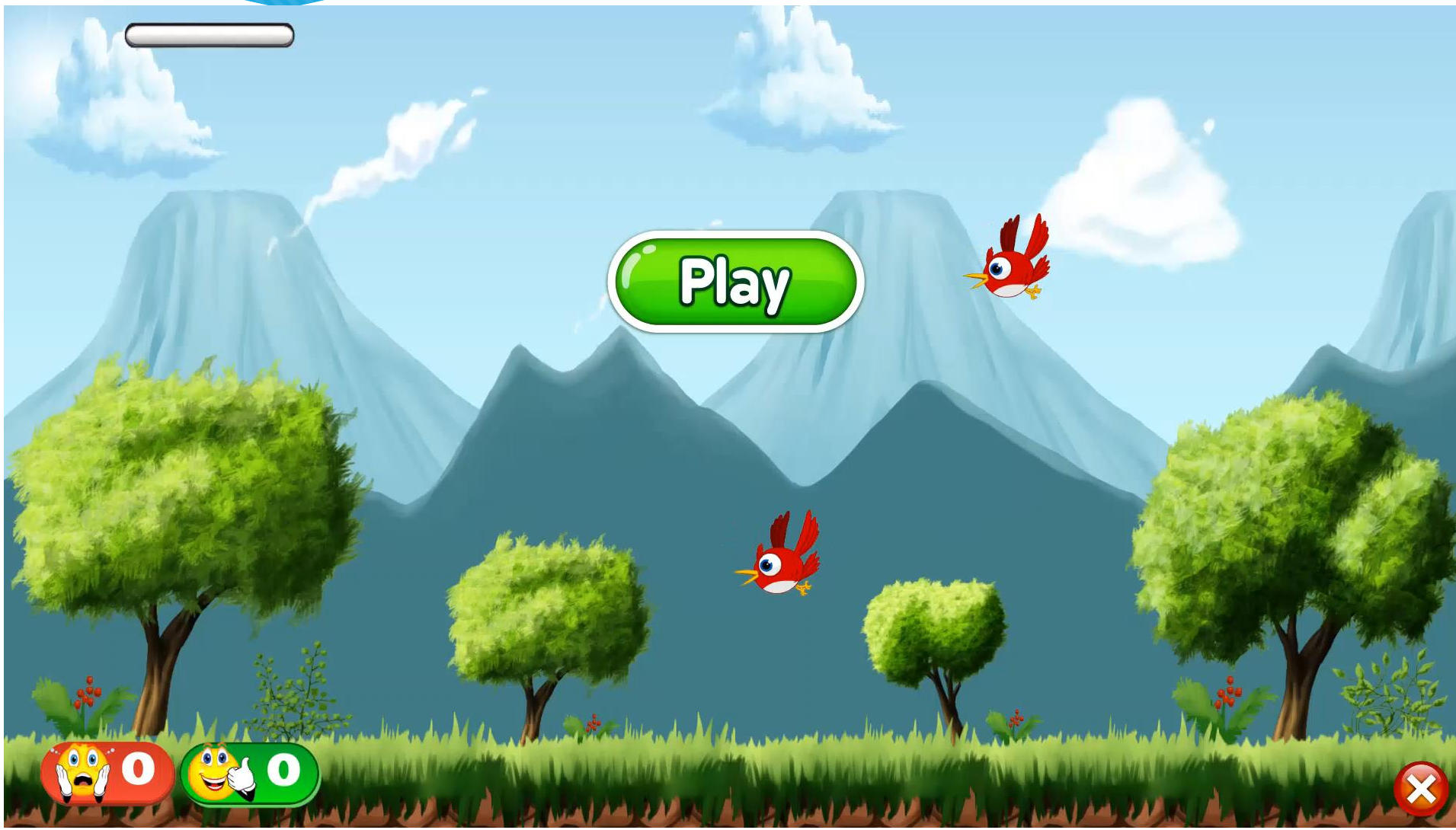
To cite this article: Sarit Tresser, Tsvi Kuflik, Irina Levin & Patrice L. Weiss (2021): Personalisation of a virtual gaming system for children with motor impairments: performance and usability, Disability and Rehabilitation: Assistive Technology, DOI: 10.1080/17483107.2021.1936222

Typically developing (TD) child

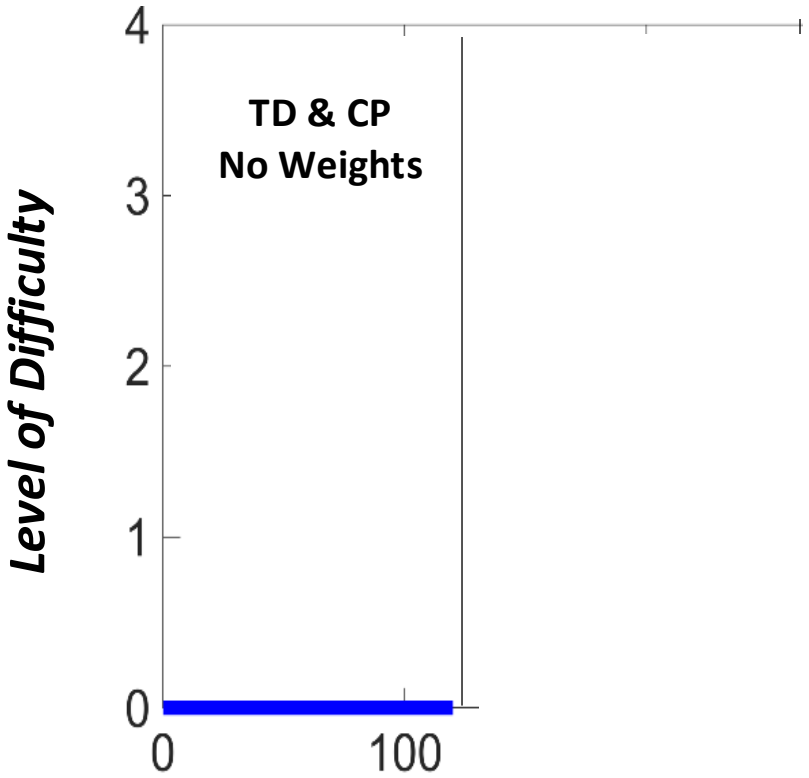


Child with cerebral palsy (CP)

Virtual game personalization

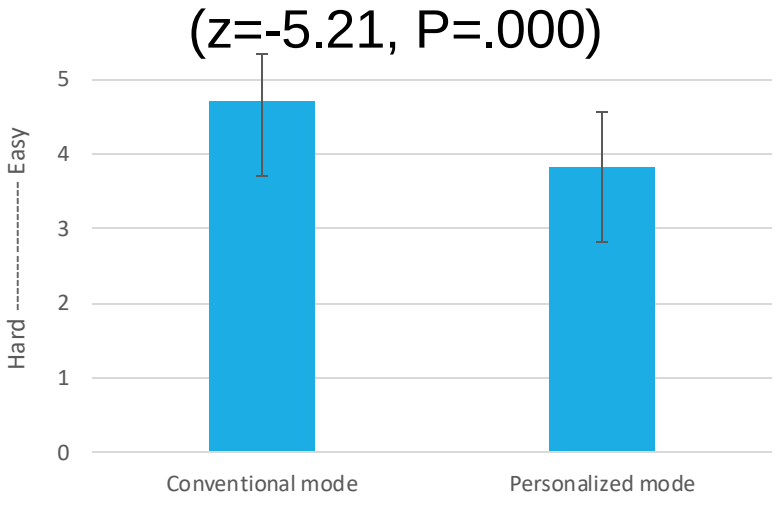


Virtual game personalization

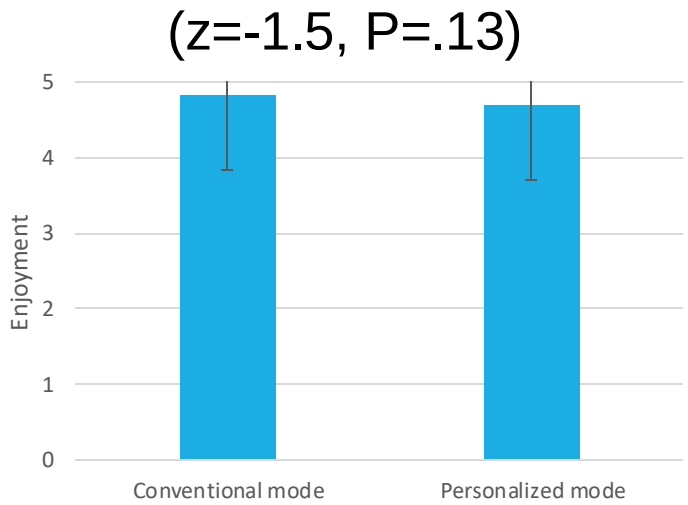


Conventional	Personalized

Virtual game personalization



Perceived effort



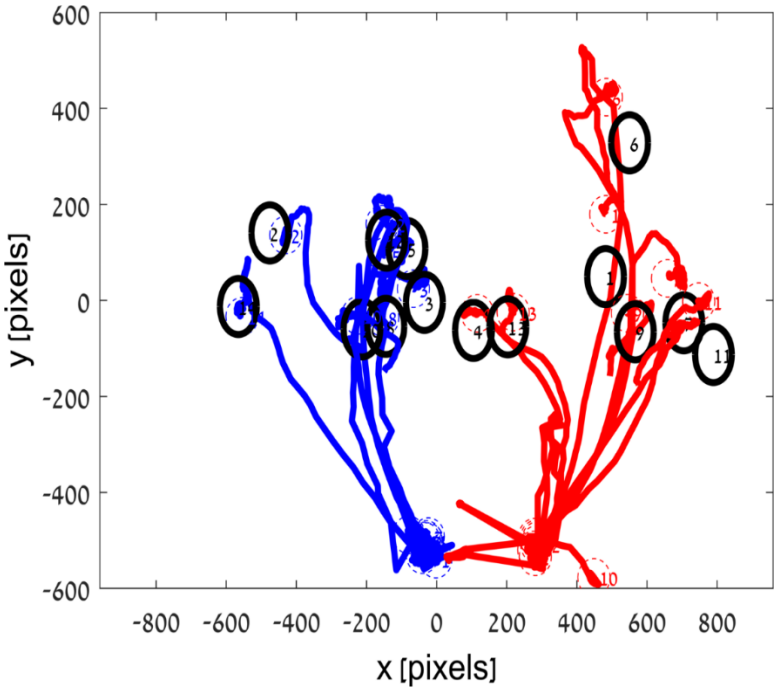
Perceived enjoyment

Participants exerted more effort in the personalized game but enjoyed it to the same degree

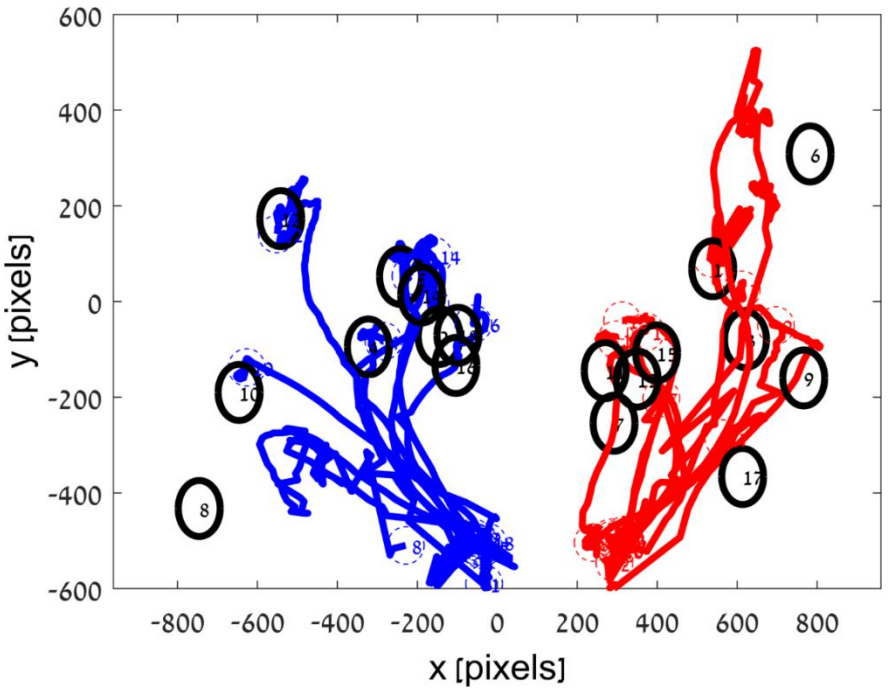
Virtual game personalization

Movement duration was found to be significant larger when playing the personalized game with weights compared to without

(t= -2.35, P=0.022*)



Personalized game without weights



Personalized game with weights (TD group) & CP without weights)

Meta-analysis of camera tracking VR

International Journal of *Environmental Research and Public Health*

MDPI

Review

The Rehabilitative Effects of Virtual Reality Games on Balance Performance among Children with Cerebral Palsy: A Meta-Analysis of Randomized Controlled Trials

Jinlong Wu [1], Paul D. Loprinzi [2] and Zhanbing Ren [1,*]

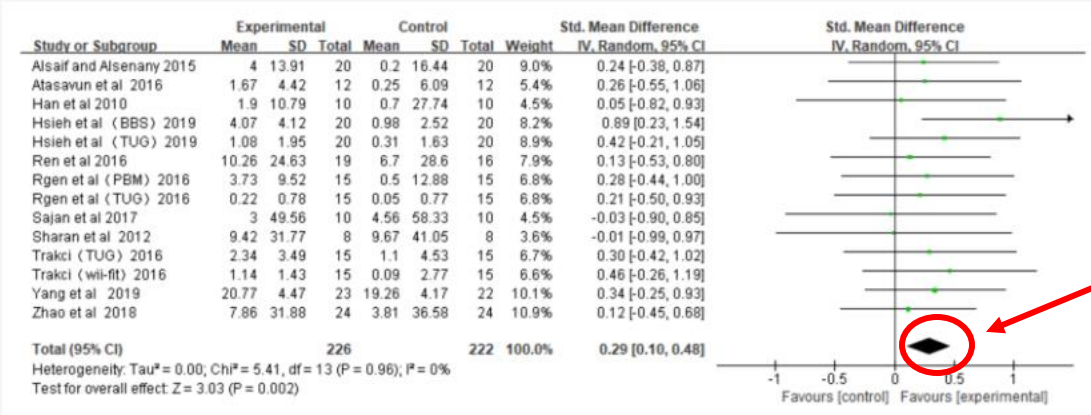
Int. J. Environ. Res. Public Health 2019, 16, 4161; doi:10.3390/ijerph16214161

1. To explore effect of VR games on **enhancement of balance** of children with CP

2. To examine influence of VR games on **intervention adherence**: session length, intervention frequency, intervention cycle, and total intervention time)

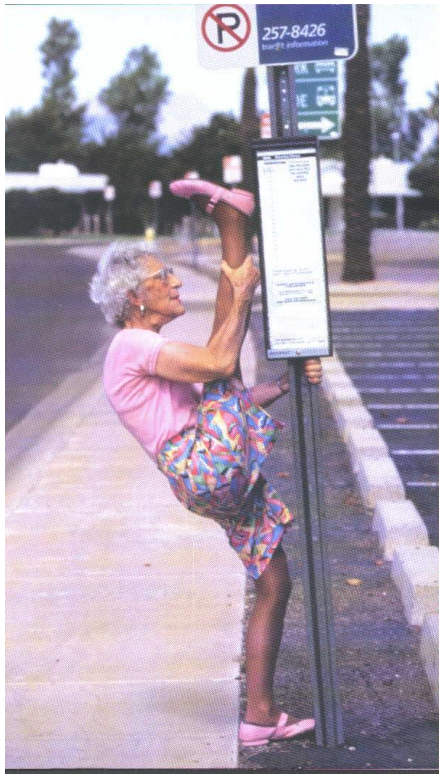
VR Platforms
Nintendo wii fit balance board
Nintendo wii-fit
Nintendo wii fit balance board
Nintendo wii-fit
Nintendo wii-fit
QH situational interactive rehabilitation training system produced by OPEM
Nintendo wii-fit
Nintendo Wii-fit remote control game
Active video games on the Xbox Kinect platform

Figure 3. The effect of VR games on the balance of children with cerebral palsy.



Forest Plot

Consider VR applied to rehabilitation as a Stretch Target



A target which is currently out of reach, but not out of sight

It may require the breaking of previous boundaries and constraints

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