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# Extended reality in pediatric healthcare: Beyond the HMD


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ALYN PARC
The Helmsley Pediatric & Adolescent Rehabilitation Research Center

אוניברסיטת חיפה
University of Haifa
جامعة حيفا

# Helmsley Pediatric & Adolescent Rehabilitation Research Center
# ALYN Hospital, Jerusalem, Israel

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.

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# Helmsley Pediatric & Adolescent Rehabilitation Research Center

## Research Domains

**Pediatric Orthopedic Rehabilitation**

Dr. Sharon Eylon

**Pediatric Neuropsychology & Rehabilitative Psychology**

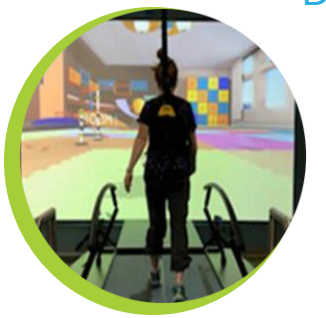
Dr. Neta Yitzhak

**Pediatric Neurological Rehabilitation**

Dr. Keren Politi

**Technology for Rehabilitation & Independent Performance**

Dr. Naomi Gefen



**Laboratory for Pediatric Motion Analysis & Biofeedback Rehabilitation**

Dr. Simon-Henri Schless

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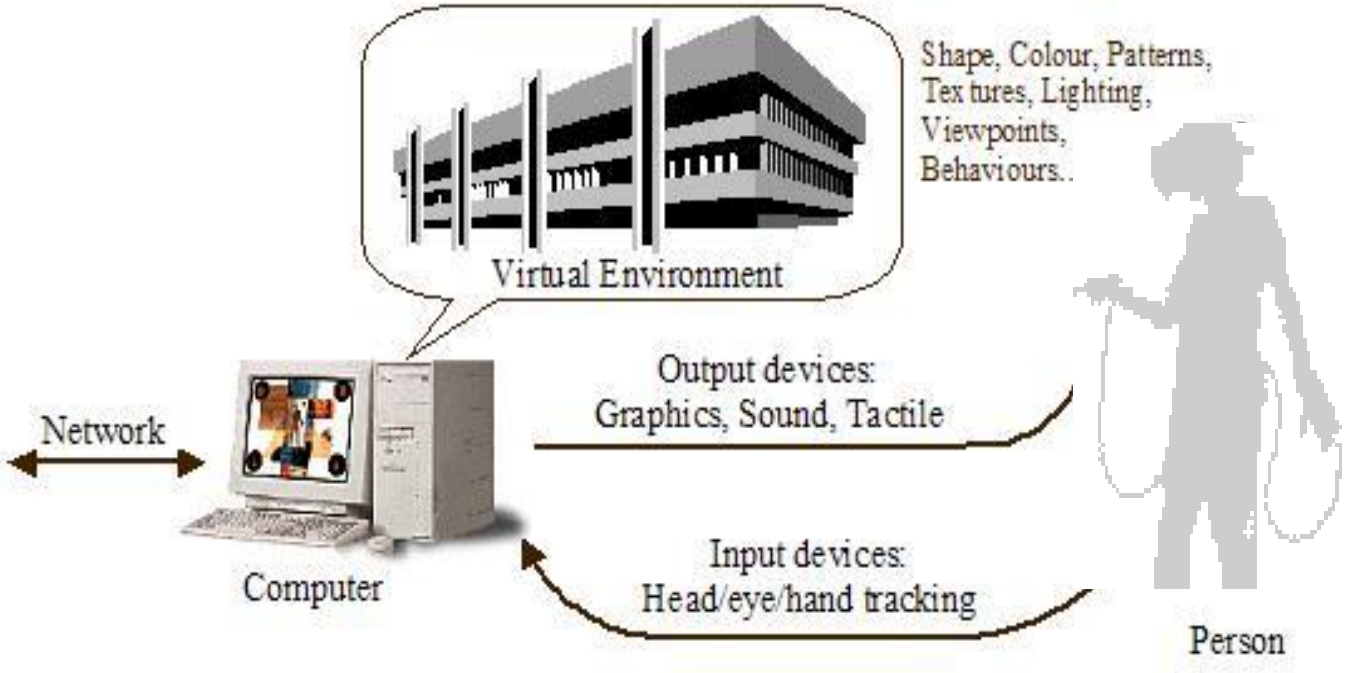
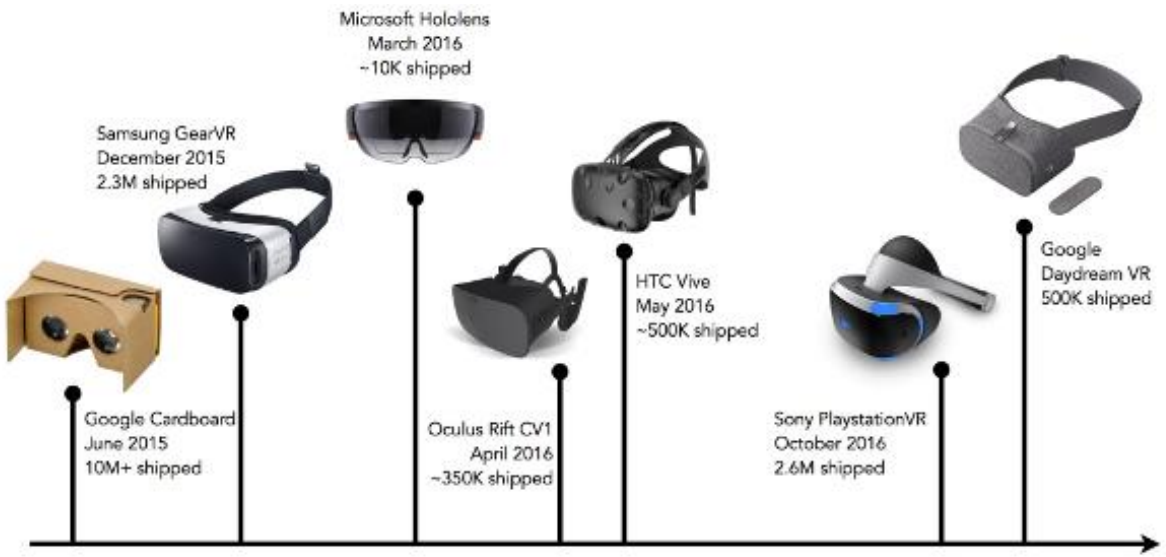
# Extended Reality Continuum

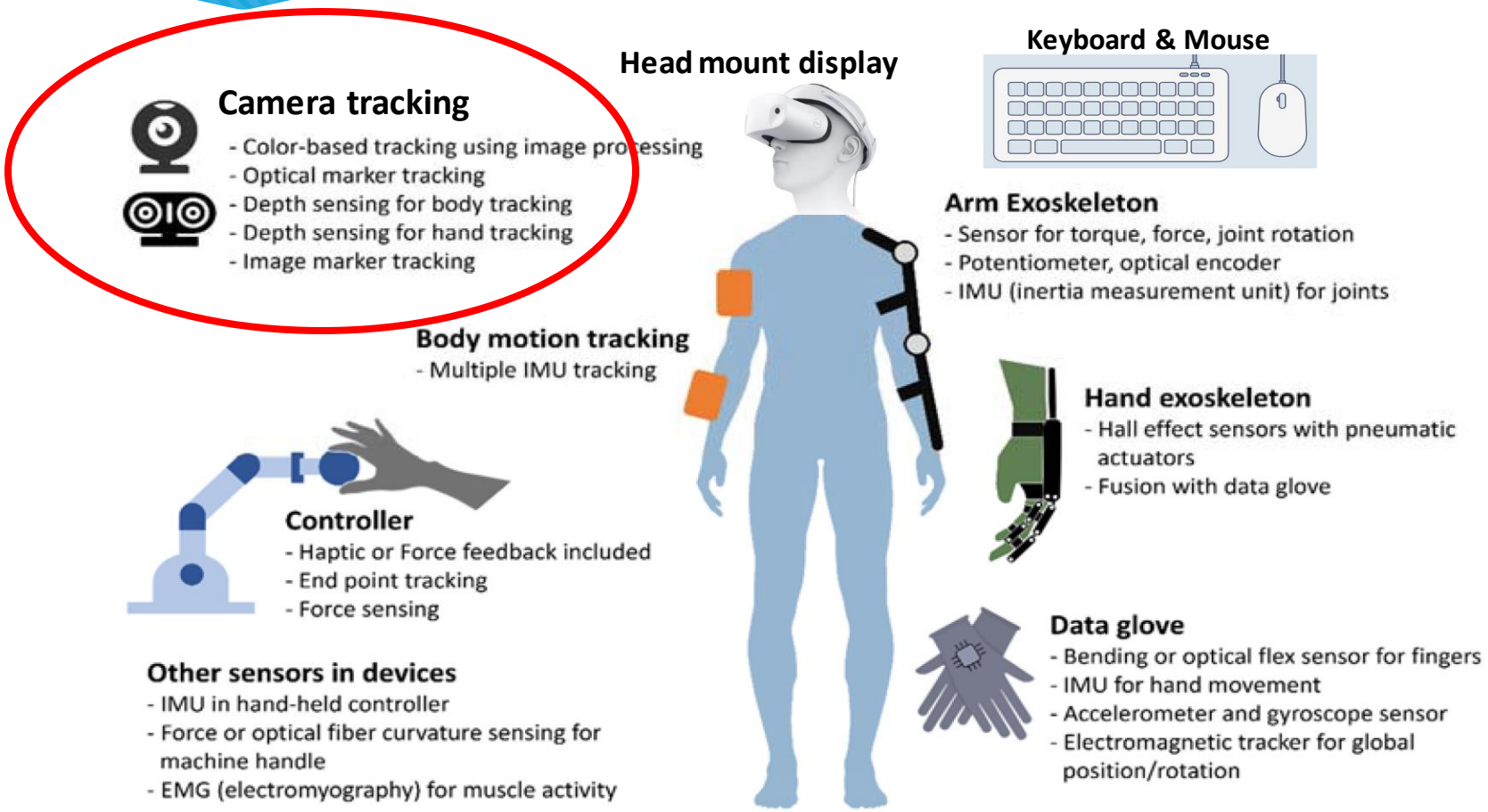
**Augmented Reality** ⟺ **Mixed Reality** ⟺ **Virtual Reality**



# 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

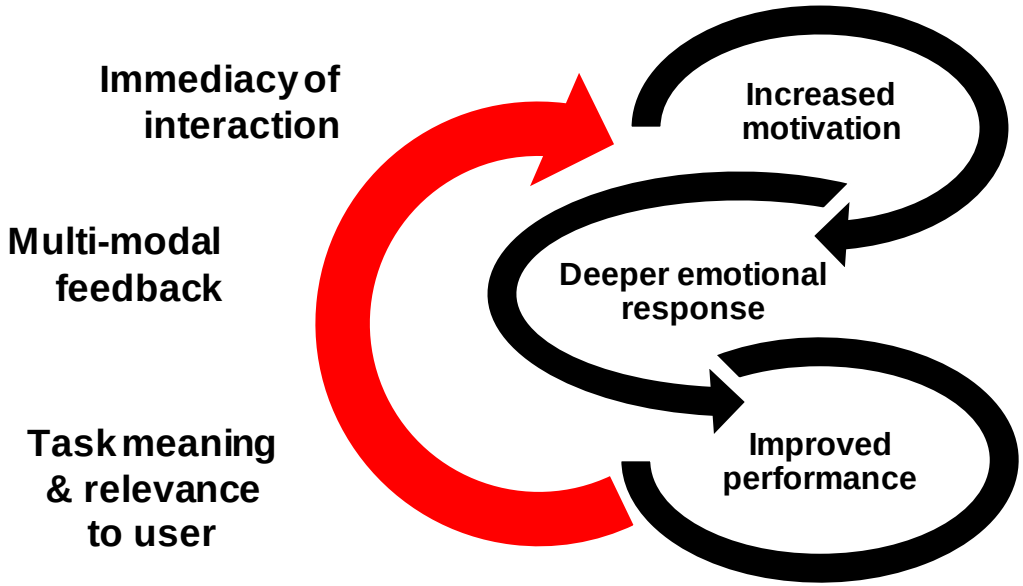
**But by then it is too late; physiological & behavioral responses have already occurred!**

# Virtual Presence

**Subjective perception of being present in a virtual environment**

**When is an HMD really needed for most rehabilitation goals?**

- Distraction
- Isolation
- Head movement control



# 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)

# Example of Motion Capture VR



# Example of Motion Capture VR

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# Virtual game personalization

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

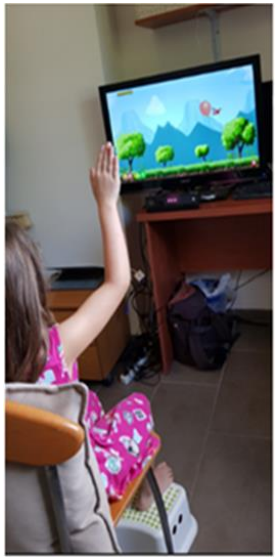
ISSN: (Print) (Online) Journal homepage: https://www.tandfonline.com/loi/iidt20

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

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

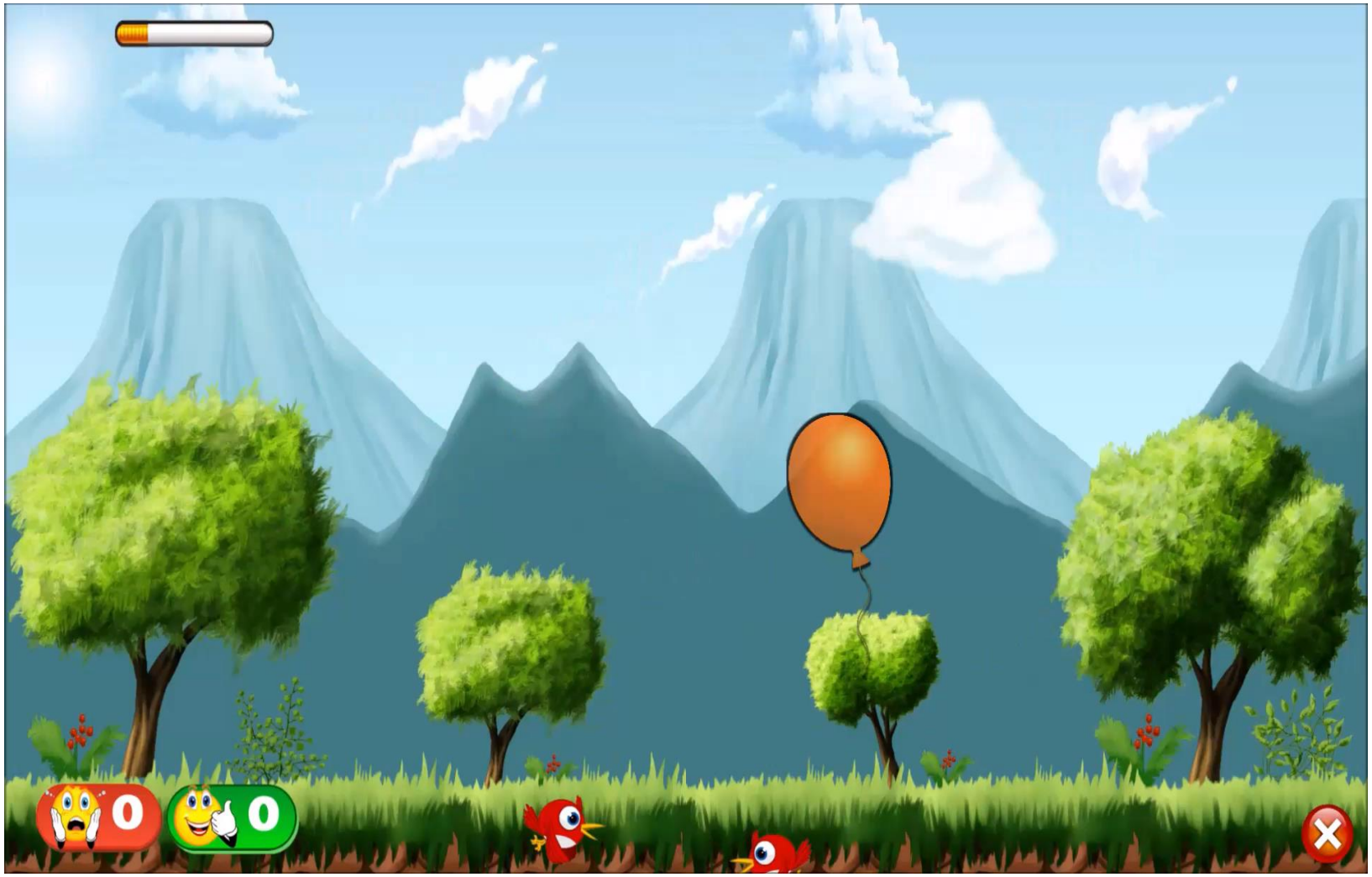
To cite this article: Sarit Tresser, Tsvi Kuflik, Irina Levin & Patrice L. Weiss (2021): Personalisation of a virtual gaming system for children with motor impairments: performance and usability, Disability and Rehabilitation: Assistive Technology, DOI: 10.1080/17483107.2021.1936222

**Typically developing (TD) child**

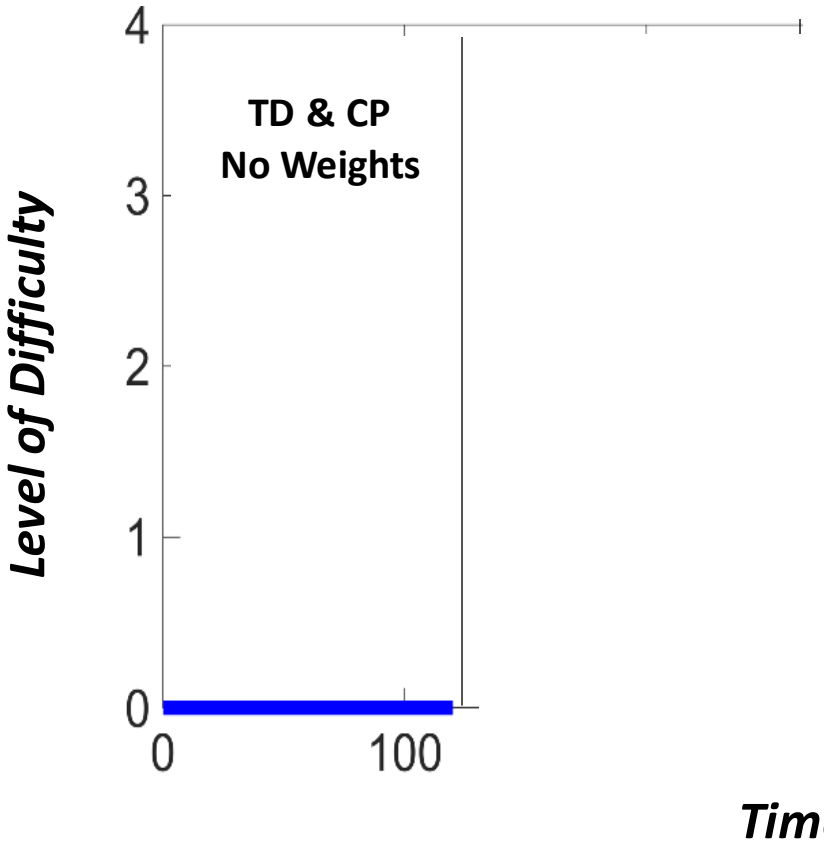


**Child with cerebral palsy (CP)**

# Virtual game personalization

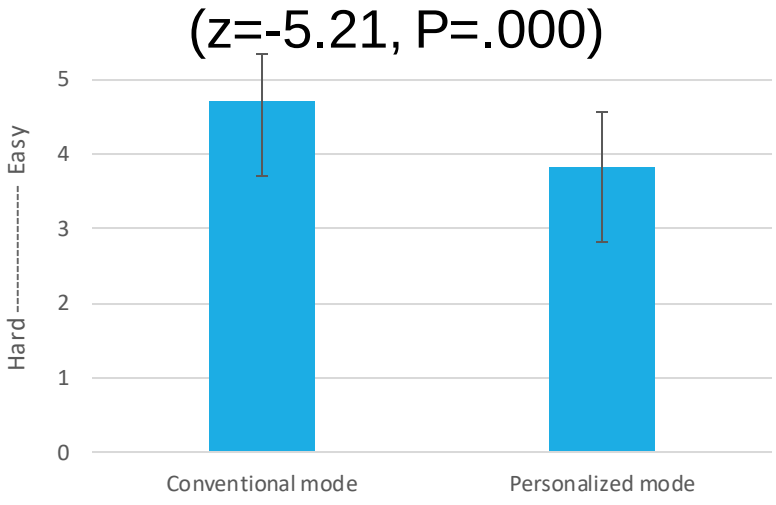


# Virtual game personalization

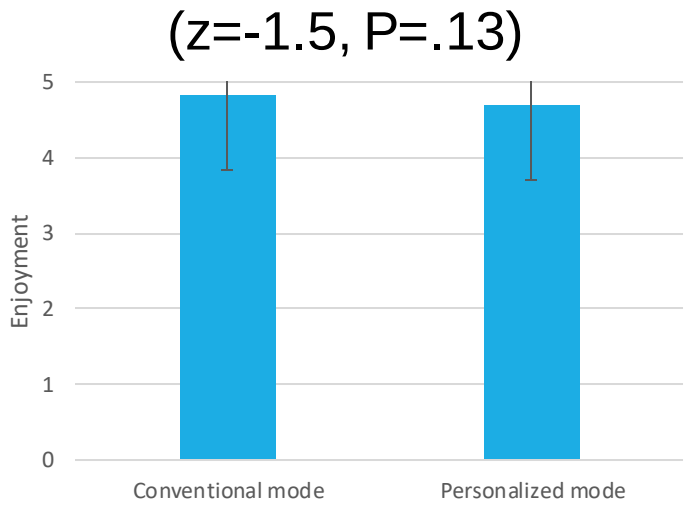



| Conventional | Personalized |
| --- | --- |

# Virtual game personalization




**Perceived effort**



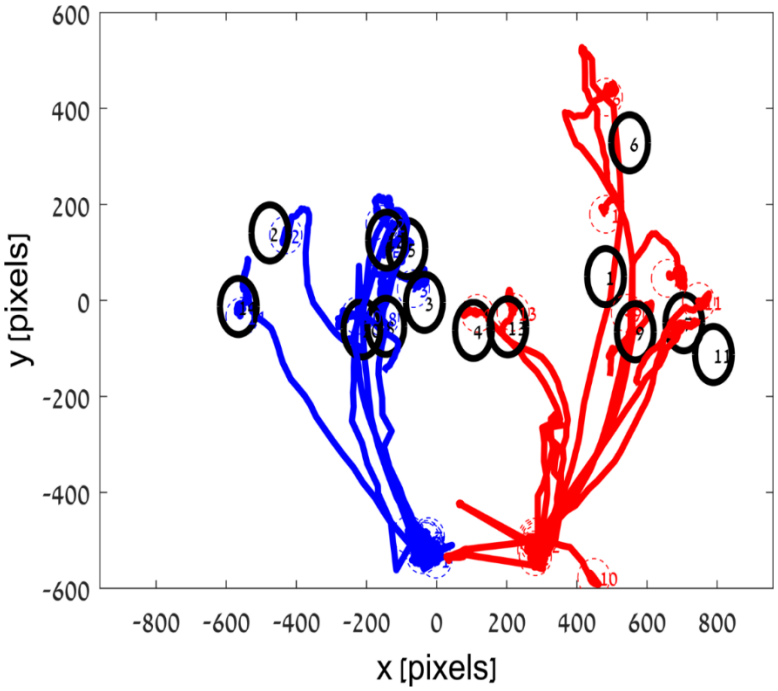

**Perceived enjoyment**

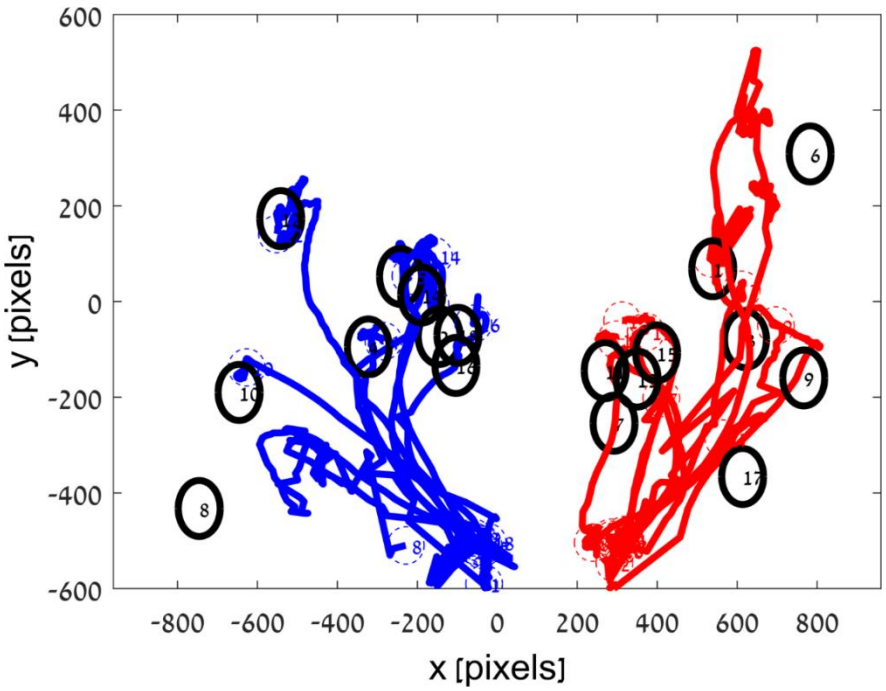
**Participants exerted more effort in the personalized game but enjoyed it to the same degree**

# 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

# 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,*]

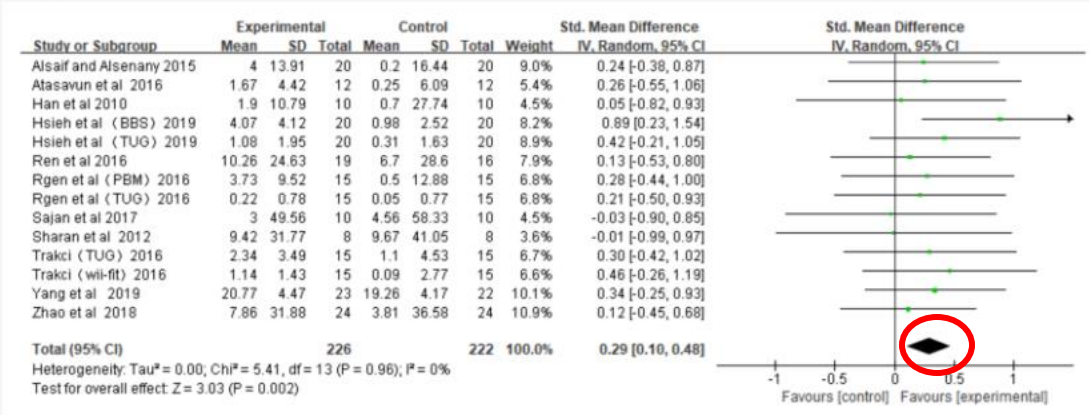
Int. J. Environ. Res. Public Health 2019, 16, 4161; doi:10.3390/ijerph16214161

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

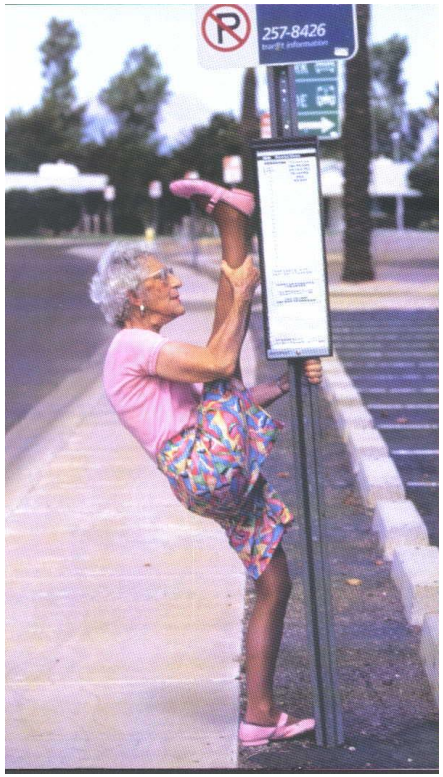
2. To examine influence of VR games on **intervention adherence**: session length, intervention frequency, intervention cycle, and total intervention time)

| 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.



# 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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