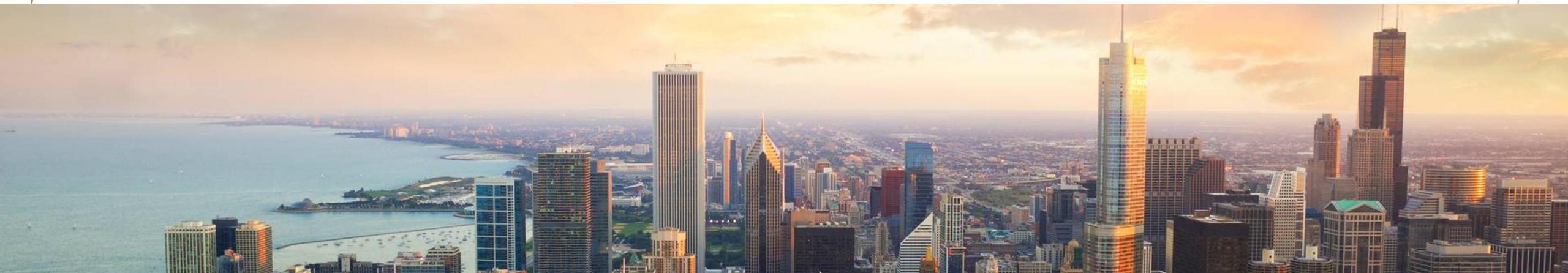
PROF. GRIGORE (GREG) BURDEA
RUTGERS UNIVERSITY

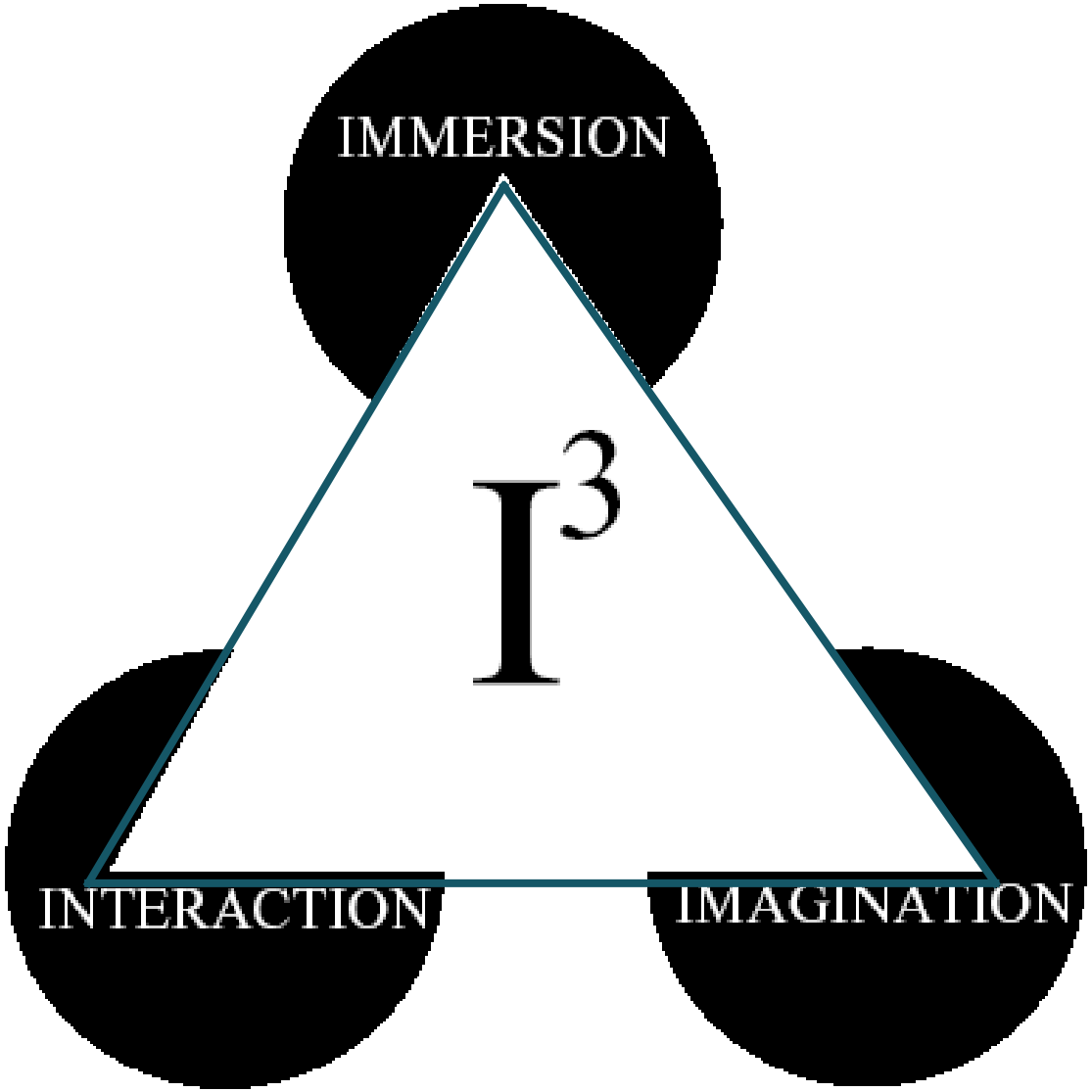
VIRTUAL REHABILITATION AT THE CROSSROADS–

DECEMBER 11, 2025
TIME: 3:00 PM
UNIVERSITY OF CENTRAL FLORIDA

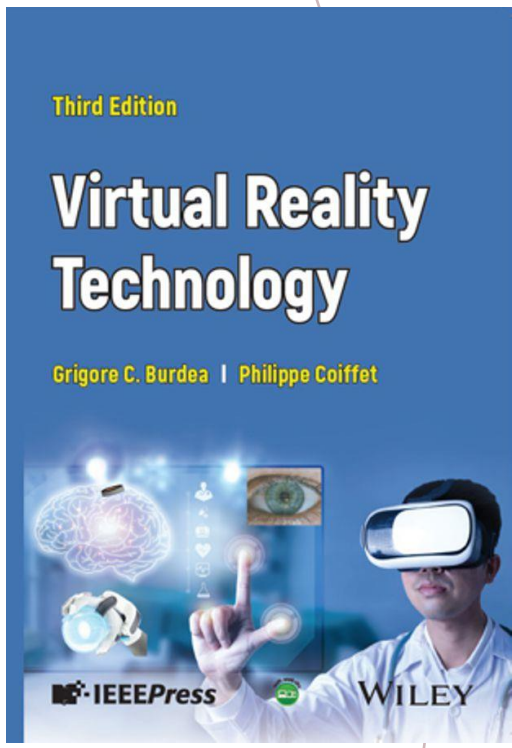
INTRODUCTION



VIRTUAL REALITY TRIANGLE



- More VR coverage in my new book



- podcast (2025)

https://youtu.be/dBH4D9rBD5k?si=LJ5B6kCFqxTcLF68

- The brain imagines what you do *not* see

- Virtual Rehabilitation is the use of VR/AR in rehabilitation and/or therapy

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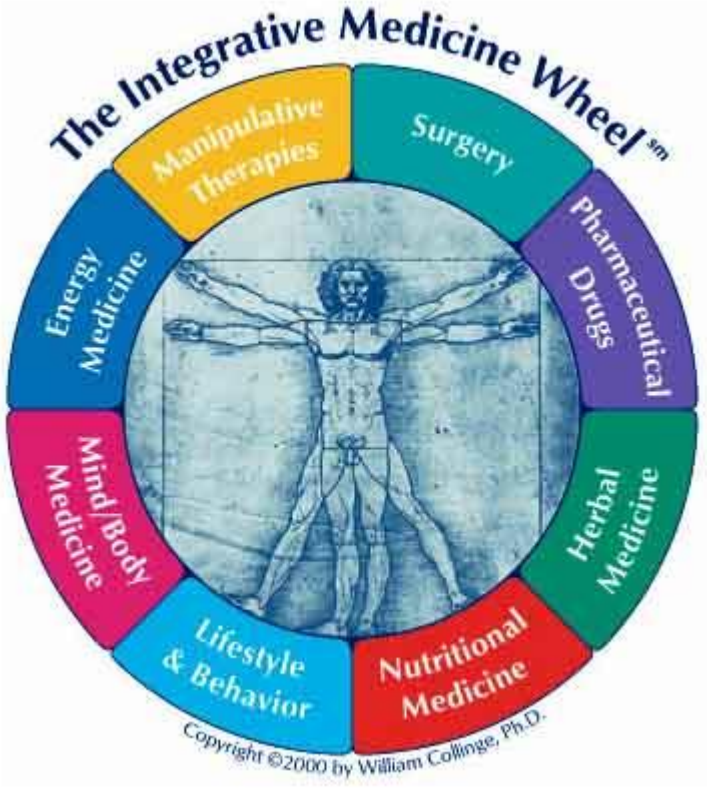


- *Integrative* Virtual Rehabilitation is treating the patient as a whole: motor, cognitive and emotive sides

- Tele-Rehabilitation is provision of rehabilitation or therapy by a remote clinician

https://share.google/images/UMT1ejUx61Pa4DrbU

https://evolvrehab.com/news/evolv-rehabkit-azurekinect-virtual-reality/

- *Home Self-Training* is the patient's independent exercising (at home) using a VR system, while the clinician follows asynchronously

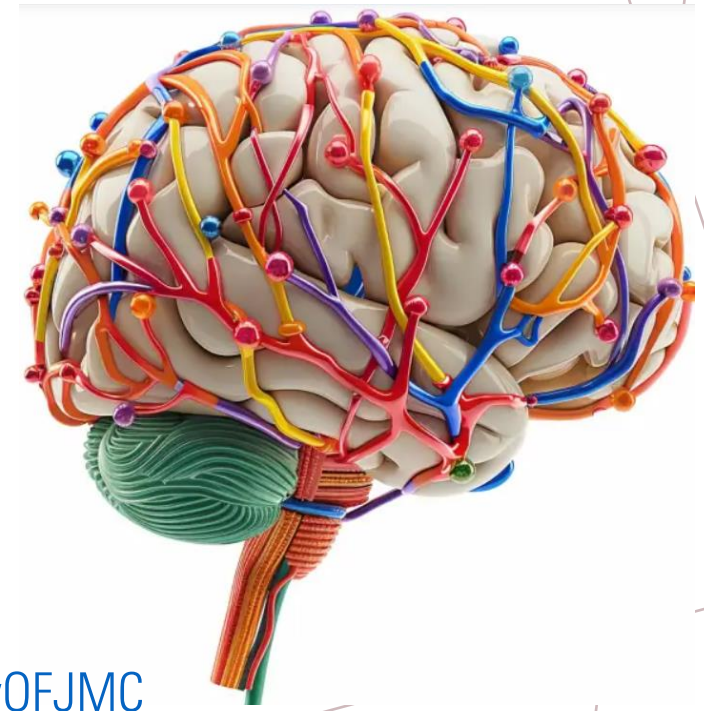
GAMIFICATION THERAPIES

- Use if “serious games” in rehab and/or therapy
- Simpler (“minimalistic”) so not to overwhelm ;
- Adapt so they are winnable by impaired patents;
- Variety and rewards.

https://share.google/images/Tk1roiGcIgFj4vsbJ

WHY IS VIRTUAL REHABILITATION WINNING?

- Motivating
- Highly repetitive (but in a good way!)
- Rewiring the brain
- Non-pharma
- Tech is moving to the home



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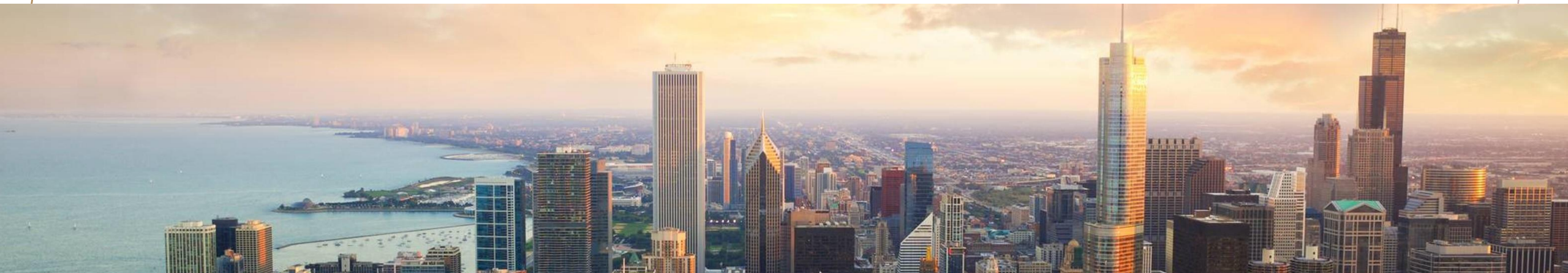
SOME EXAMPLES



THE GOLFER (2002)

2 weeks outpatient on Rutgers Master and CyberGlove

Was chronic post stroke

Could not move his thumb,

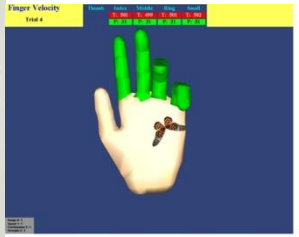
Could not button his shirt

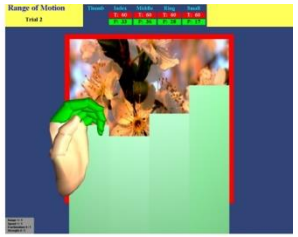
Play our games for hand rehab

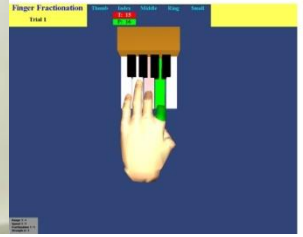
10 sessions

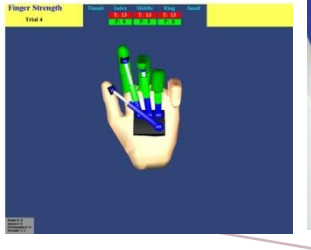
Started using thumb

Returned to golf









THE KID (2009)

13 years old had Cerebral Palsy

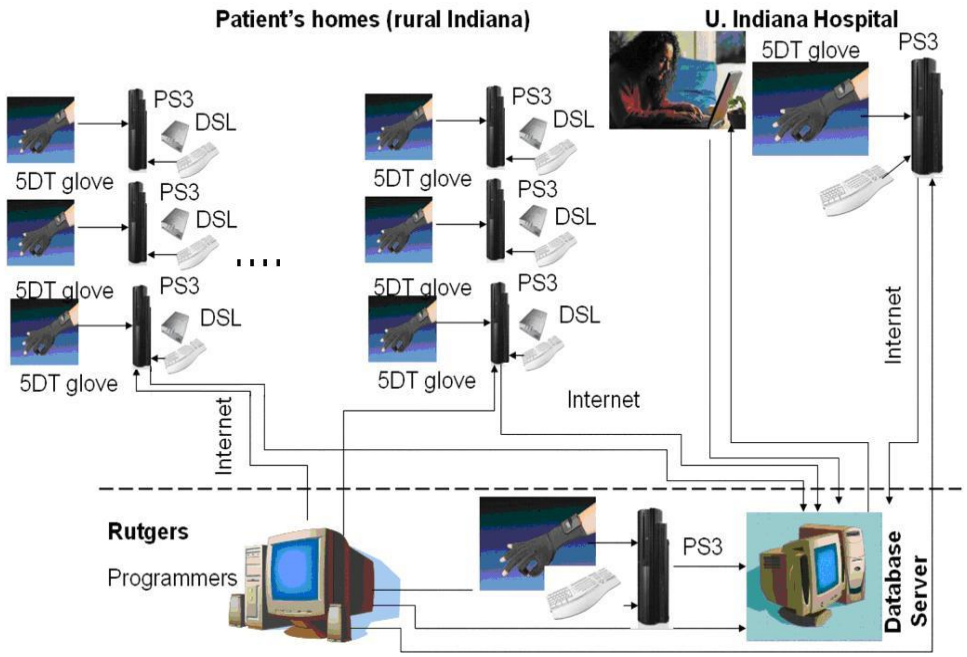
Could not use right hand,

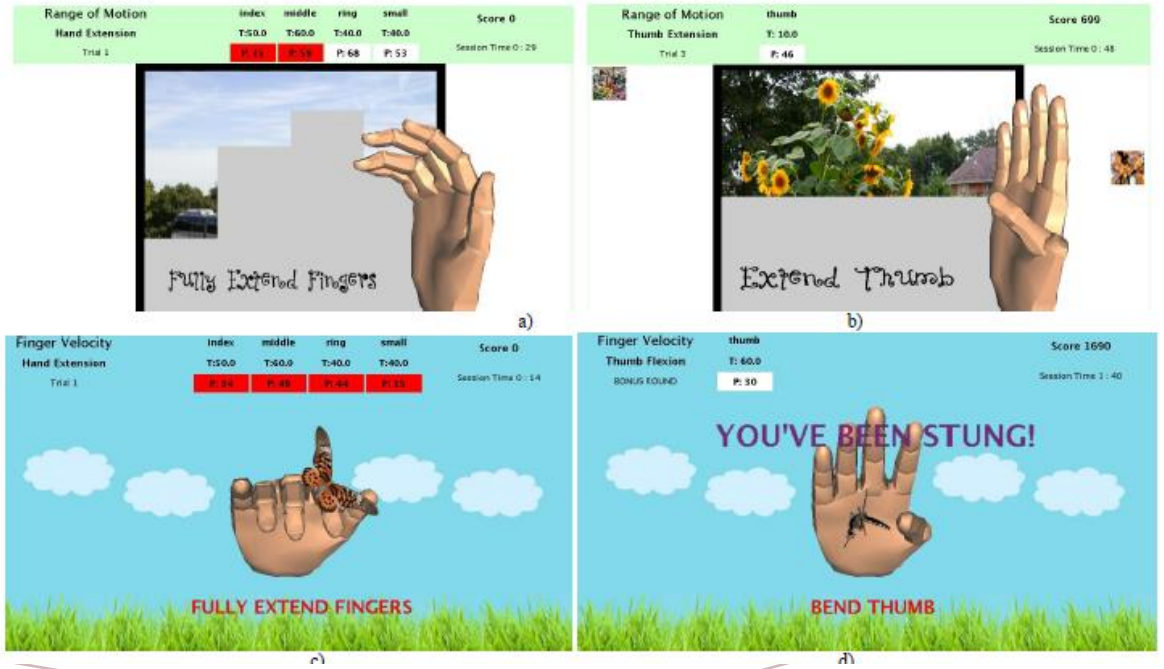
Lived in rural Indiana

(no therapists..)

10 months home rehab on PlayStation 3

We hacked it to install Linux and new games





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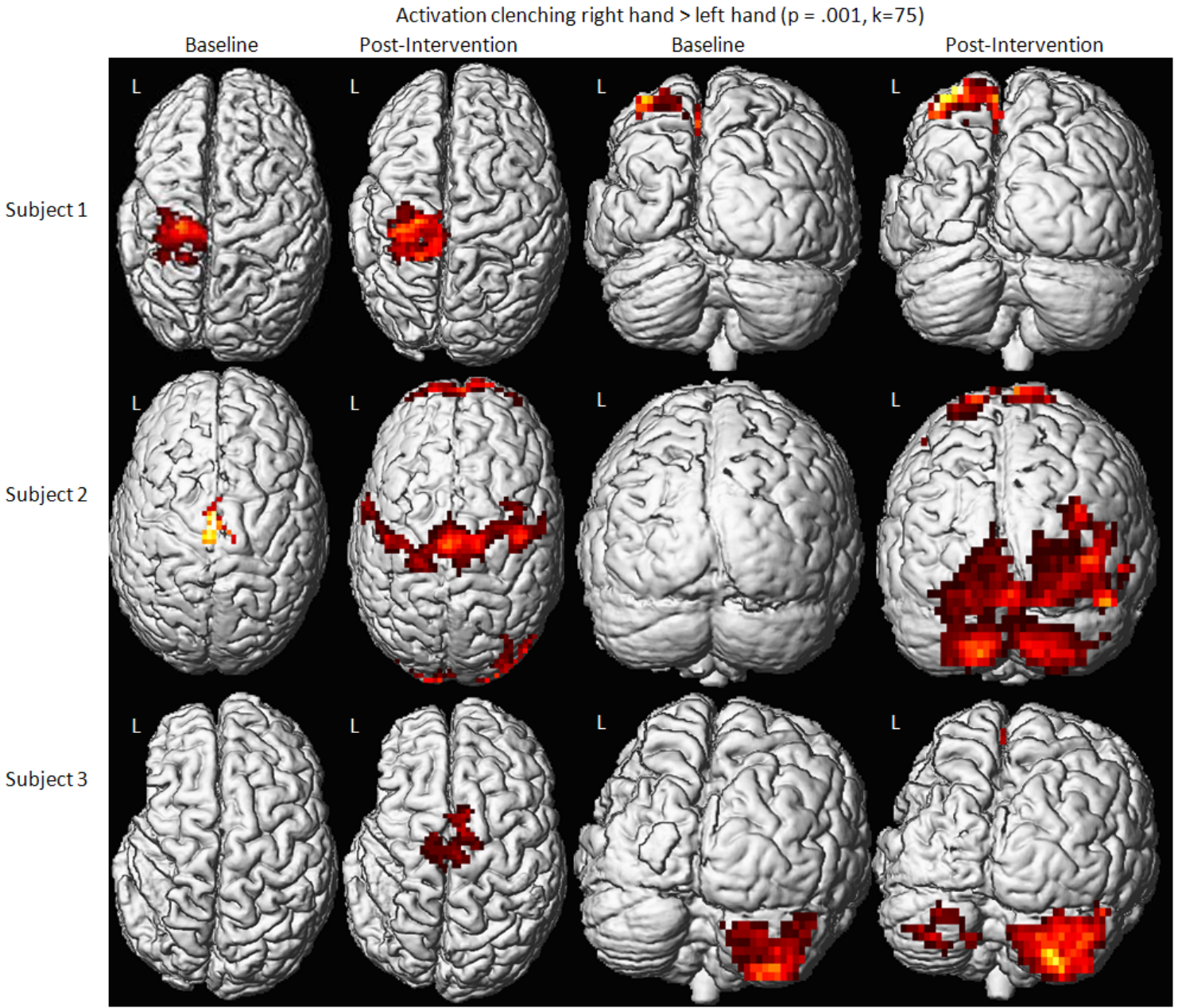


Brain rewiring

THE HIGH SCHOOL VALEDICTORIAN (2014)

Finished college, then started 3 companies

At 45 lost employment because of frontal lobe dementia

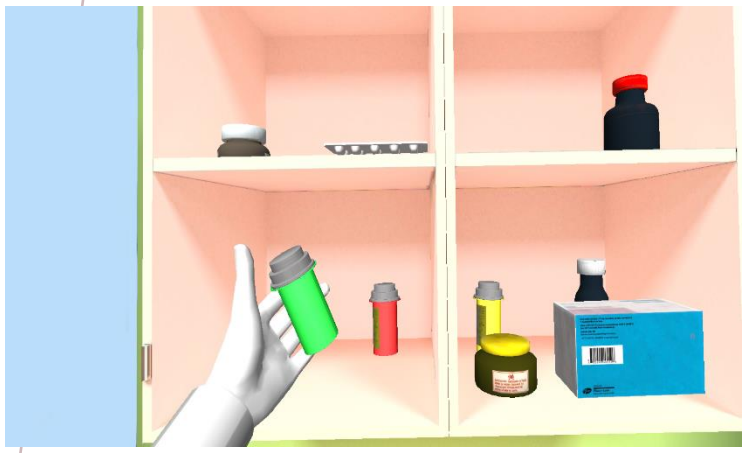
8 weeks outpatient on BrightBrainer

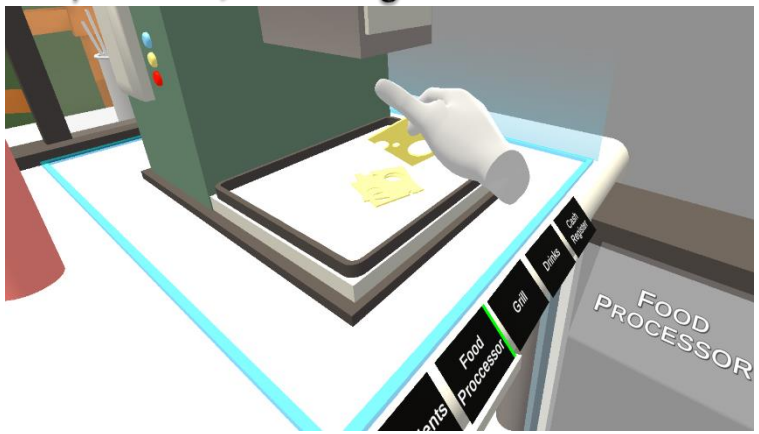
Played games with the Hydra

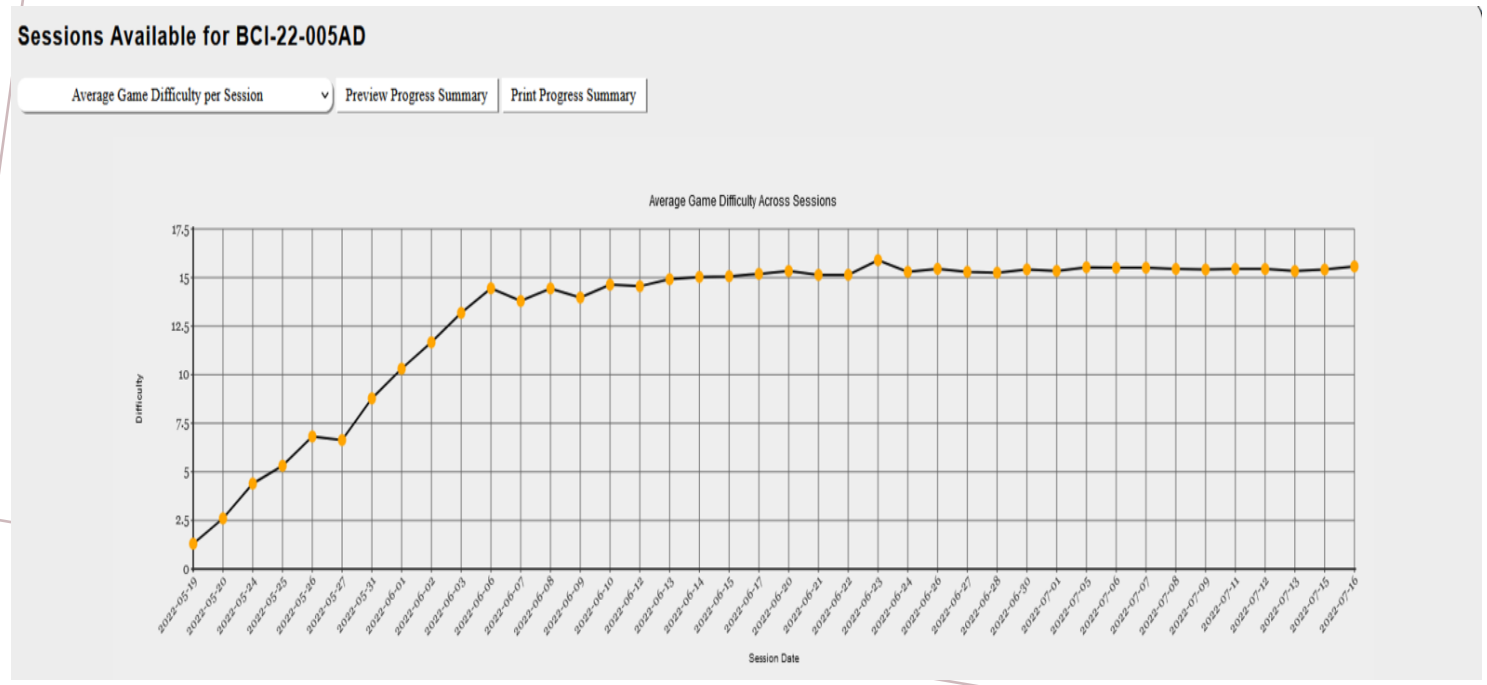
Gradually increasing difficulty

read again after years

Early Alzheimer's Self-training in the home (2023)
MoCA 17/30, 79 years old female

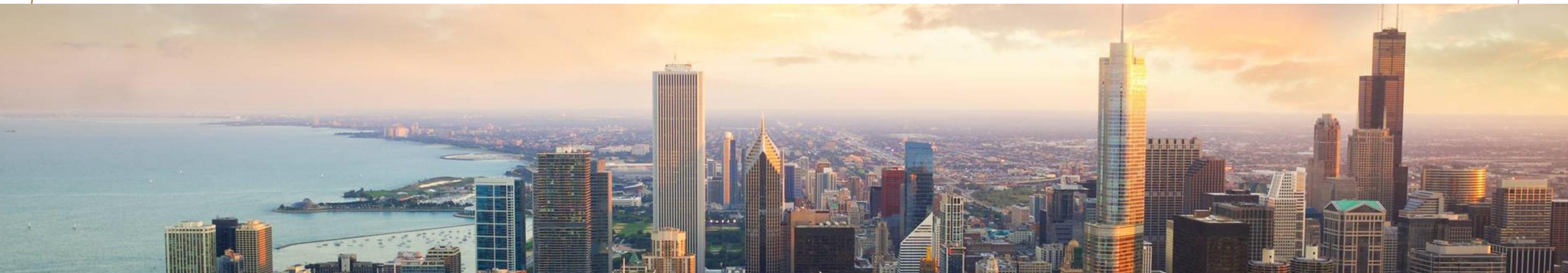






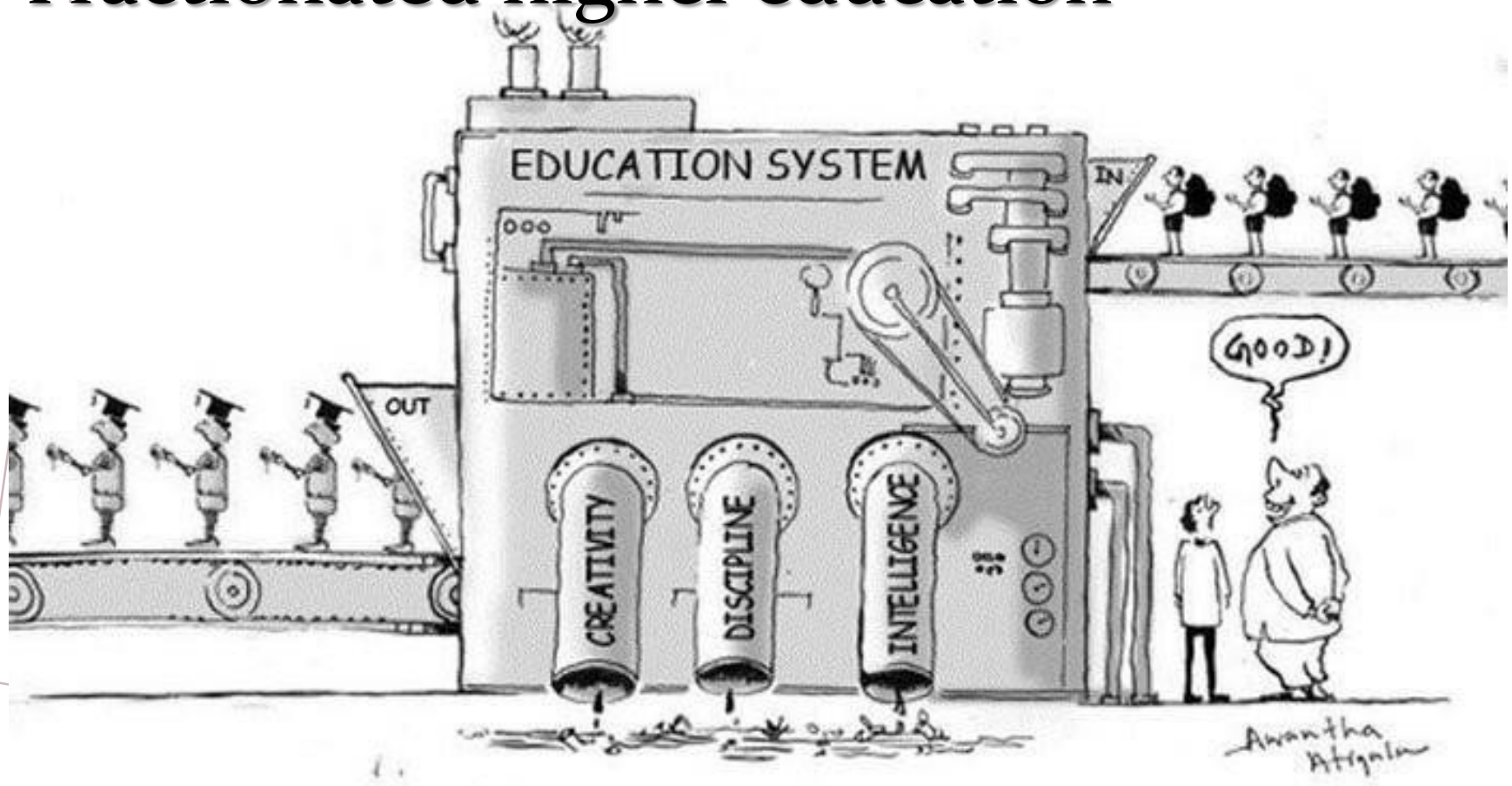
- Used a modified Quest
- Self-trained for 8 weeks, 5 days/week
- Increased game difficulty, duration
- Memory, attention and decision improved

CURRENT STATE



WHAT IS HOLDING UP CLINICAL USE?

- Clinician Techno-phobia and litigation
- Fractionated higher education



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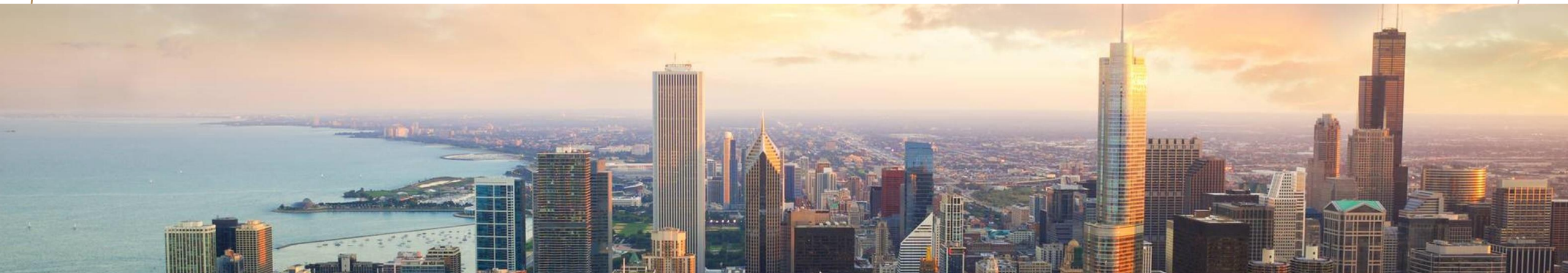
- Hard to set up Equipment

VIRTUAL REHABILITATION FUTURE



AI THERAPY AGENTS

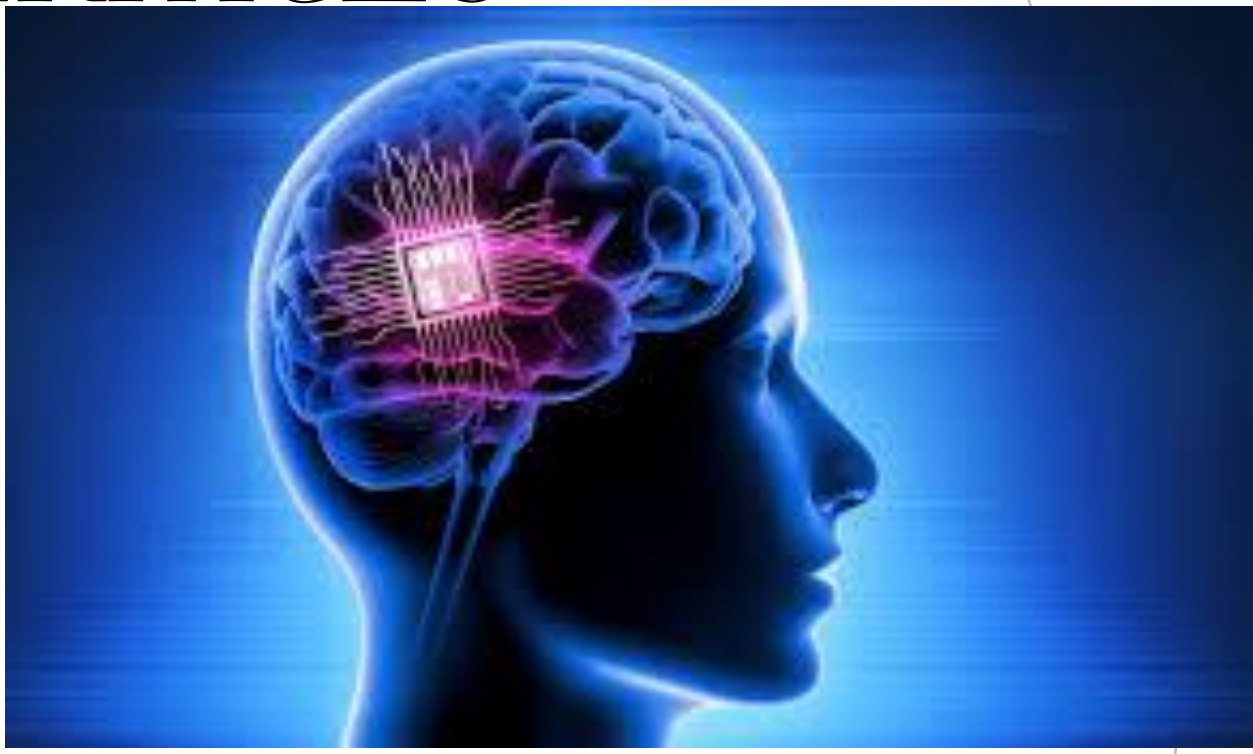
- Alleviate clinician shortage
- Increased access to care, lower cost

https://share.google/images/YHhx5u3QdhwuCU9zG

- AI can only mimic understanding. It lacks emotional depth of a human connection
- Not appropriate for rare cases

NEURAL INTERFACES

- A dedicated processor implanted and connected with multiple electrodes



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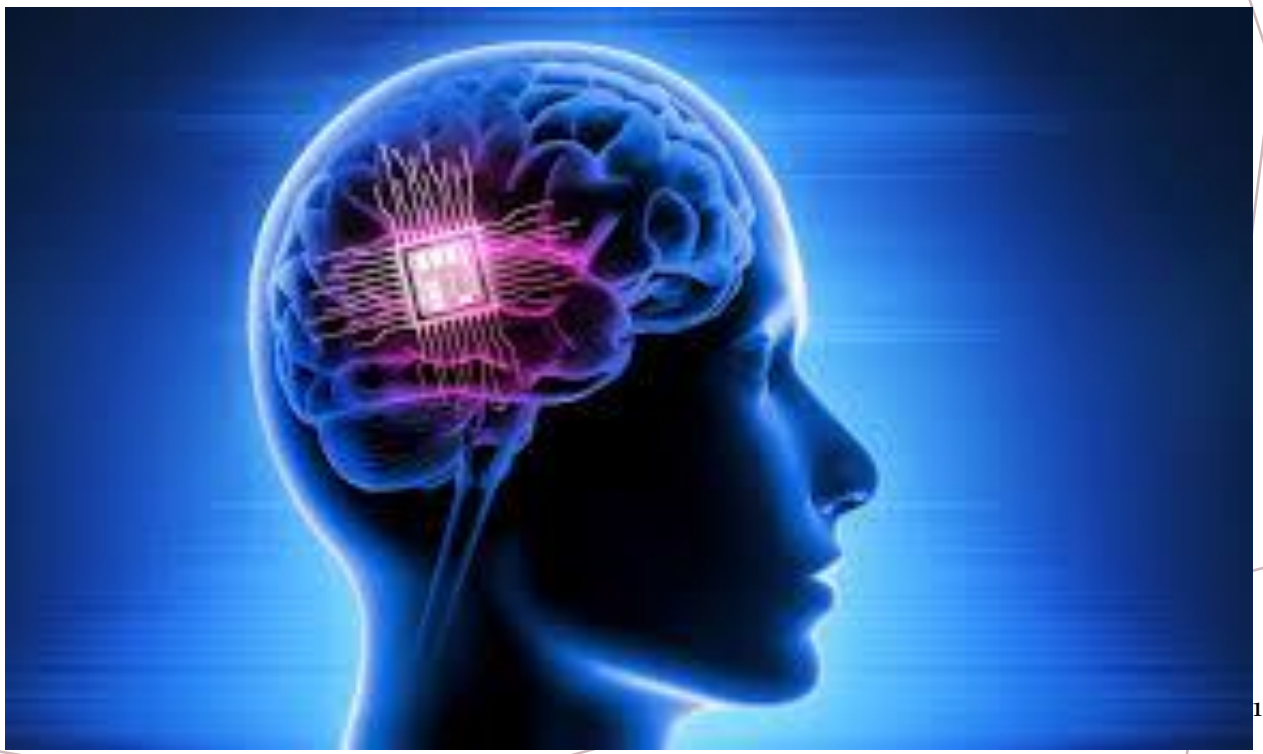
- Optical coherence tomography for real-time brain tracking and five axes of motion to access implant sites around a patient's head

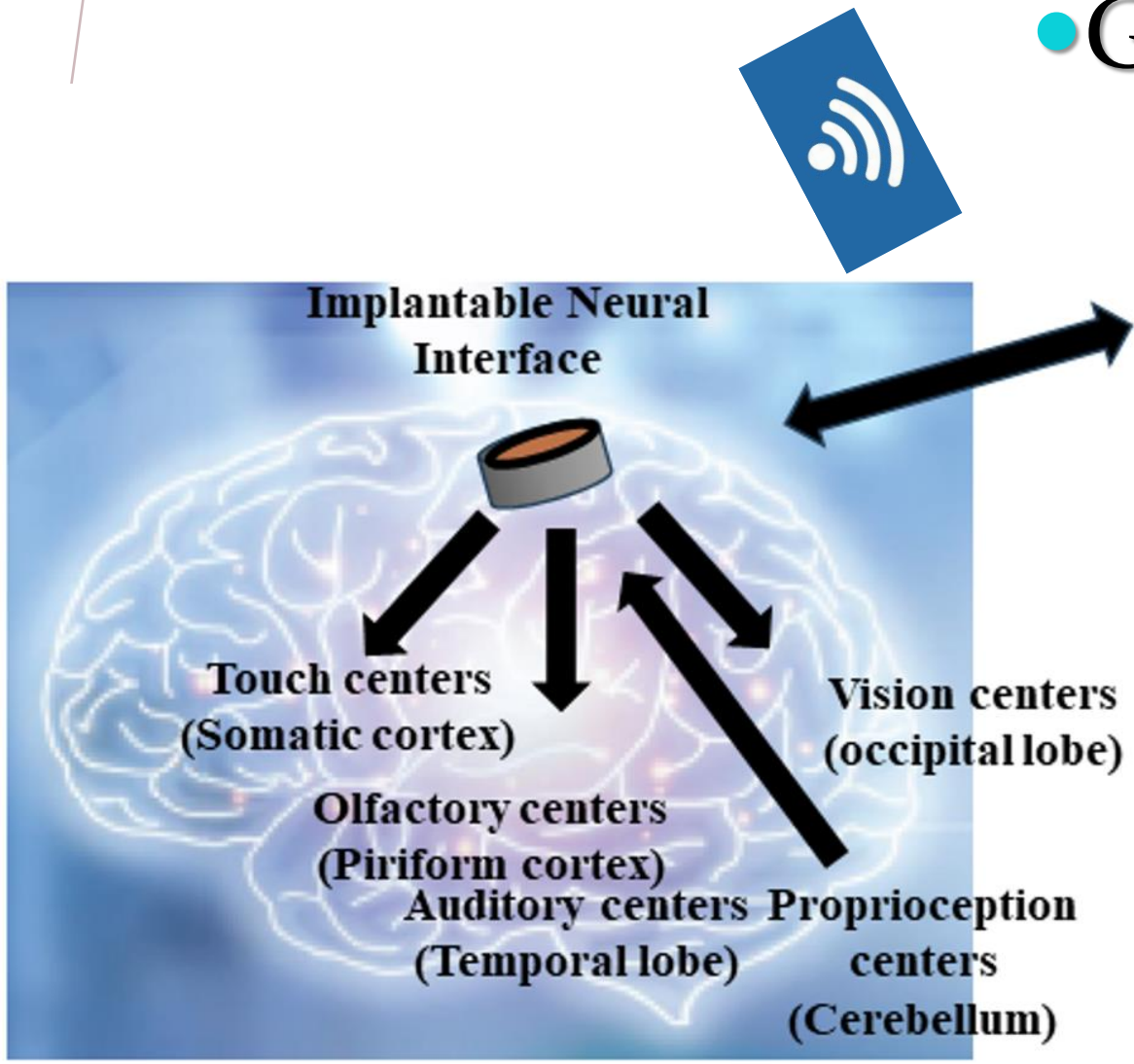
NEURAL INTERFACES

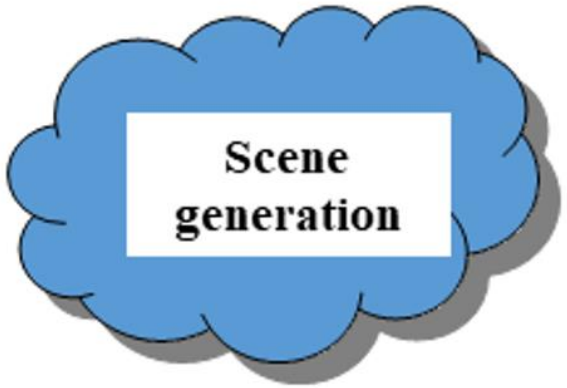
- Need to maintain contact in spite of brain movement
- Need to be biocompatible and conductive (gold, platinum, iridium)



NEURAL INTERFACES

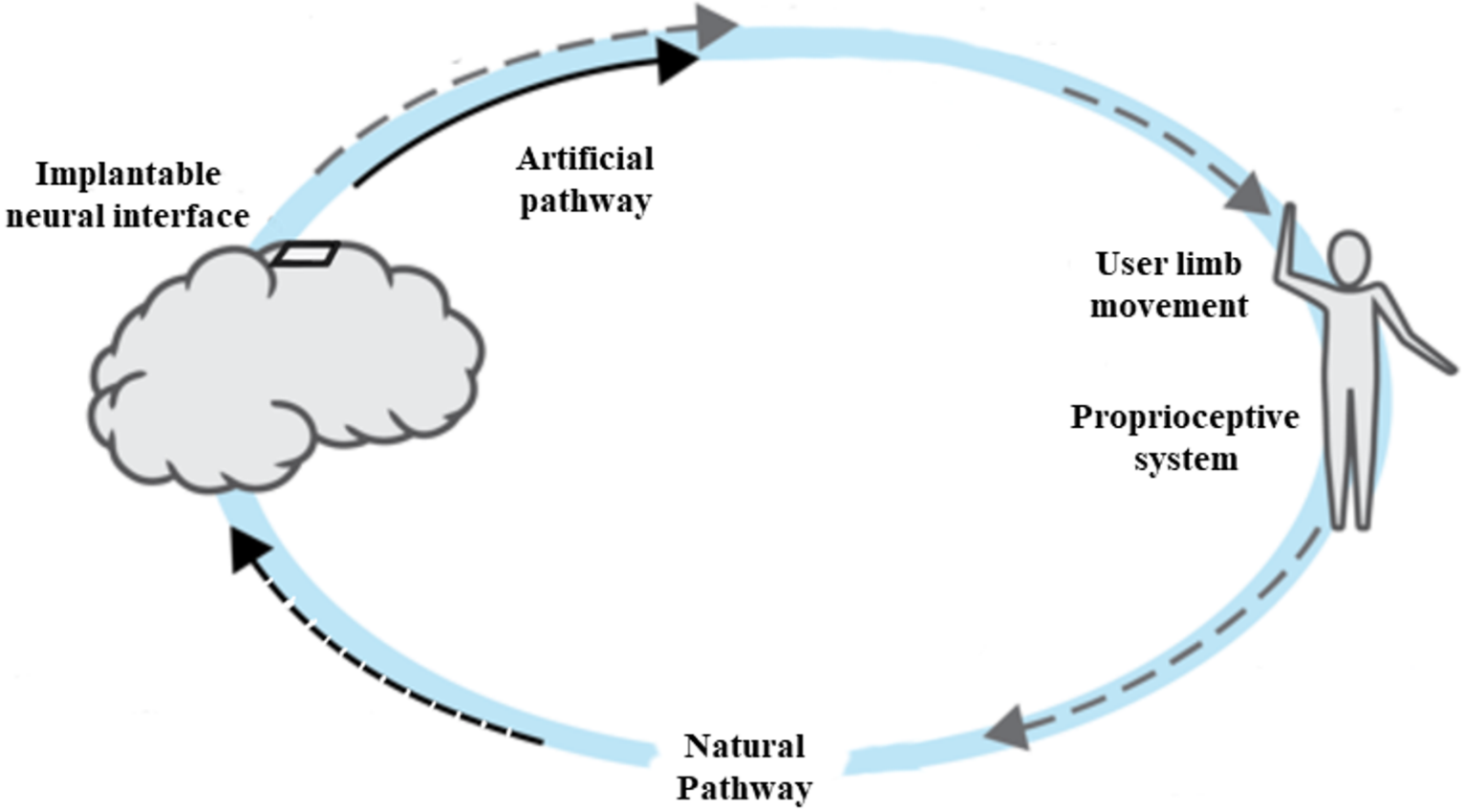
- Games rendered remotely

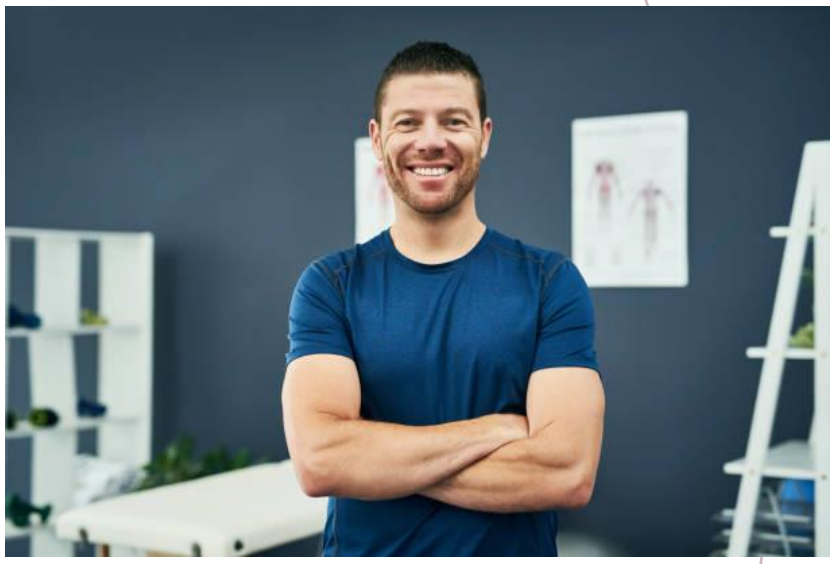




- Or rendered on Pi Phone

NEURAL INTERFACES





- Neuralink – by 2028 multiple implants, each with 25,000 connections, add AI

https://www.youtube.com/watch?v=FASMejN_5gs

CONTACT:
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THANK YOU.
QUESTIONS?