

Computer-aided AI-Powered Game-Based Rehabilitation/Telerehabilitation Platform :

**Increase engagement, accessibility and accountability
of Rehab programs for people with Chronic Neurological disorders/Injuries**



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Organize Space of Game Interactions into Two Interrelated Categories

Physical Space

How different body movements/forces, and natural object movements can be readily transformed into 'therapeutic' input devices with high fidelity and responsiveness – thus, Repetitive Task Practice (RTP) .

Hand-arm
function



Gaze
control



Core
balance



Dual-task
walking



Multi-tasking



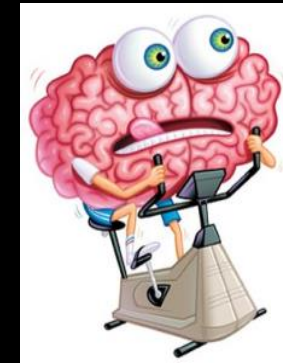
**“Slave”
&
Interact**

Gaming



Digital (Game) Space

Based on nature and the complexity of knowledge structures and information processing, including distractors and choices in which the player is engaged.

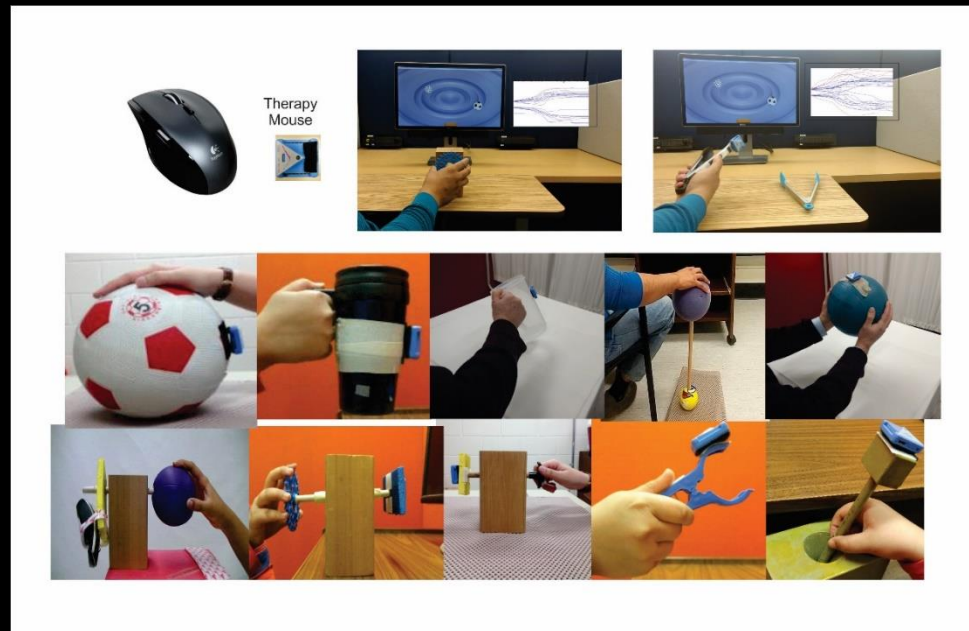


RTP Gaming System Application for Manual Dexterity

RTP gaming System uses an inertial based (IB) Mouse - miniature wireless (plug-n-play) device that is instantaneous angular position & functions identical to a optical computer mouse

Because the miniature Therapy mouse can be easily attached with Velcro to many objects then during game one can systematically Increase the physical and functional demands of the object manipulation task for example:

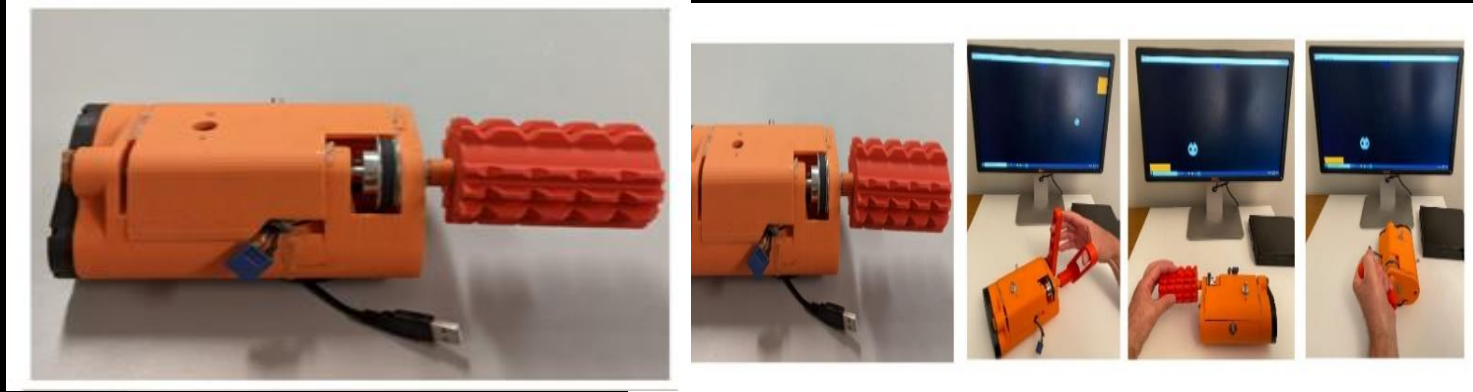
- Different physical properties (weight, shape, size, surface friction, etc.).
- Functional tasks for 2-finger, 3-finger, whole hand, and for, wrist-elbow-shoulder



The IB mouse is a “Passive” game input device and cannot provide movement assistance for patients with limited active range of motion and poor movement control.

Thus we have developed a low-cost, portable, multi-purpose rehabilitation manipulandum device (RMD) equipped with smart monitoring and assistive technologies.

The RMD (complimentary to the IB-mouse) provides “Assisted” game-based practice of a broad range of manipulation tasks

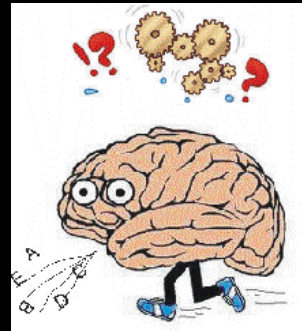


- many snap-on 3D printed handles to exercise manual dexterity functions involving thumb-finger movements, wrist & elbow-shoulder.

“smart” movement Assistance (during game play, will amplify limited and small voluntary movements of those severely affected.

fMRI compatible version (encoder and actuators)

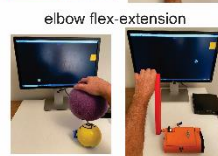
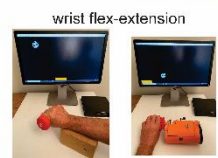
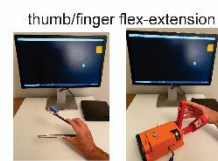
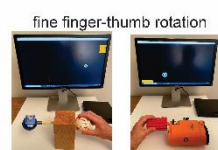
Interactive devices are play-n-play so can use common/modern computer games for training for example:



Game-based Rehabilitation Platform

Targeting Manual Dexterity

Task-specific Exercise



Engaging Goal-directed



Plug
N
Play



PHYSICAL EXERCISE SPACE

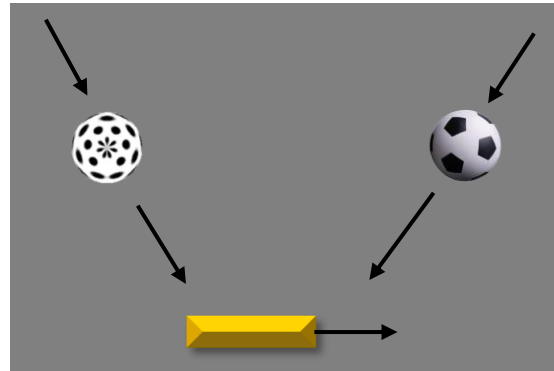
- Options for many “exercise objects & handles with:
- Different physical properties (weight, size, & changing surface friction).
- Increase degrees-of-freedom (i.e. multiple axis of rotation/TORQUE).
- Tasks that require 2-finger, 3-finger, whole hand or bimanual tasks and ones that require a combination of wrist and/or elbow & shoulder motion.

Game SPACE Training program can be progressed by

- Adjusting movement precision by changing game targets and paddle size.
- Adjusting movement speed of game objects.
- Decreasing mouse sensitivity to increase movement amplitude.
- Increasing sensitivity to accommodate fine movements.
- Adding many different cognitive activities

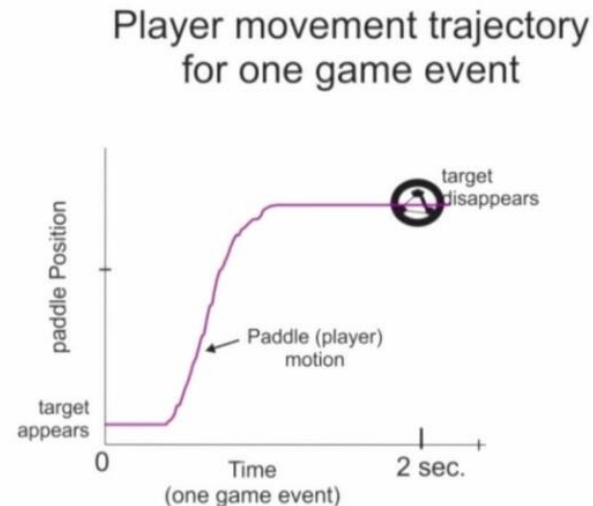
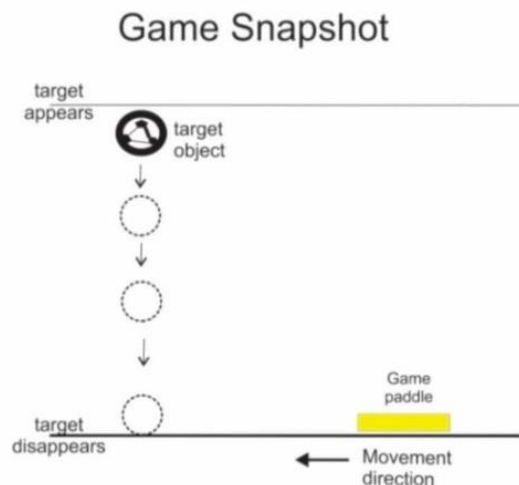
Automated Assessment Embedded into Training Programs

RTP Game – Target Game Module Assess Cognitive Game Performance during Dual- Tasking



Example Game Configuration

- The soccer ball is a game “target” object.
- The dotted sphere is a “distractor” object.
- Goal: move the paddle to catch the target and avoid the distractor.
- The duration of each game event is 2 seconds.



Outcome Measures

- Success rate
- Response time
- Movement time
- Movement accuracy
- Movement variation

RTP Looking for partners interested in projects that extend developments of our Platform:

- **increase engagement in personalized rehab programs (i.e.)Longterm programs)**
- **increase accessibility transition high effectiveness therapy program from Lab / supervised in-clinic to function in the home, community centers, & to rural and remote communities.**
- **AI analysis to take demographic clinical and comprehensive /complex performance data)our telemonitoring) to help therapist/prescribe the rehab program, and to Maximize therapeutic effectiveness)guide / self adapting and progress the therapy program)**
- **Strengthen accountability electronic outcome measures , content manager secure cloud services and ultimately population-based analysis**