

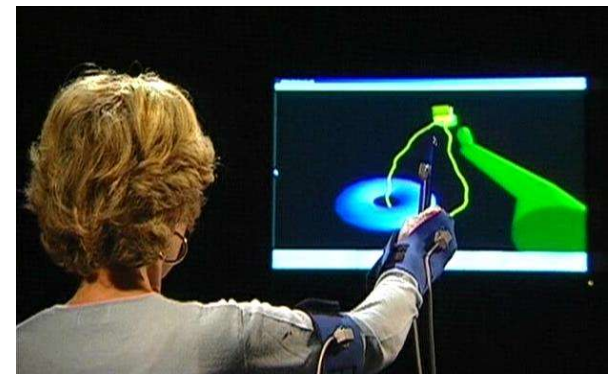
Virtual Reality Technology for Disability Solutions

Also Presenting....

Cognitive Therapy, Neuro Rehabilitation, & Physical Therapy

Walter Greenleaf, PhD

Ivana Steigman, MD / PhD



Personal Journey ... of Frustration

Starting at
Stanford

1984



Brief History Of Virtual Reality

First general purpose VR systems built in 1984

Over 25 years of research and development



1984

History Of Virtual Reality

Virtual Reality and Disabilities Conference

California State University, Northridge
Virtual Reality and Persons with Disabilities

PROCEEDINGS

Harry J. Murphy, Editor



Los Angeles Airport Marriott Hotel
March 18-21, 1992

ORTHOPAEDIC PHYSICAL THERAPY CLINICS OF NORTH AMERICA
New Technologies in Physical Therapy

Vol. 1, March 1992
1069-1516/92 \$0.00 + .00

Applications of Virtual Reality Technology to Therapy and Rehabilitation

INCLUDING PHYSICAL THERAPY AND DISABILITY SOLUTIONS

Walter J. Greenleaf, PhD

Virtual reality (VR) is an emerging technology that allows individuals to experience three-dimensional visual, auditory, and tactile environments. Highly specialized sensors and interface devices allow the individual to become *immersed* as well as navigate and interact with objects in a computer-generated environment. Most people associate VR with video games; however, researchers and clinicians in the medical community are becoming increasingly aware of its potential benefits for persons with disabilities and for individuals recovering from injuries.

VIRTUAL REALITY ENVIRONMENTS AND INTERFACES

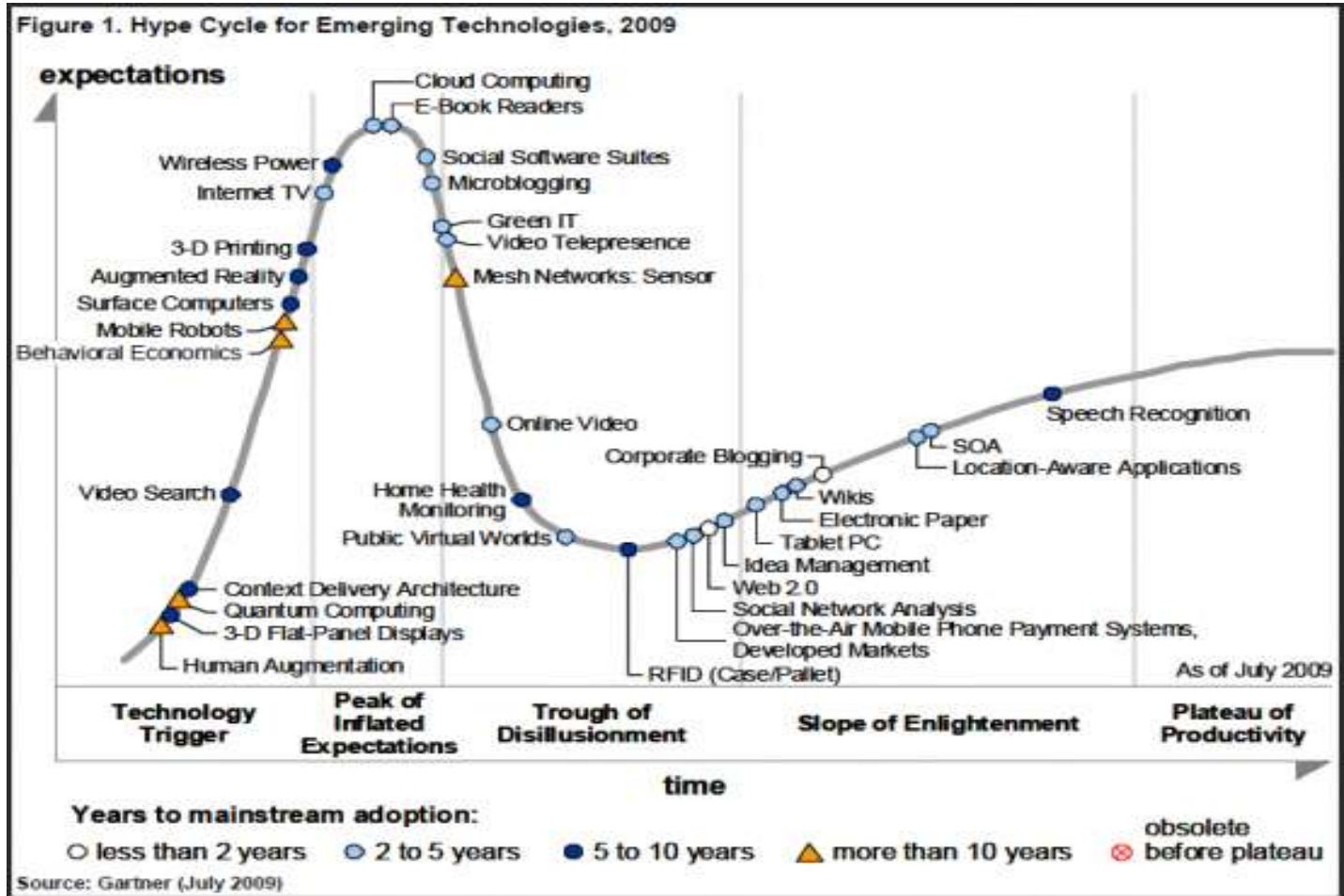
The computer-generated environment, or *virtual world* as shown in Figure 1, consists of a three-dimensional graphics program that relies on a spatially organized, object-oriented database in which each object in the database represents an object in the virtual world. A separate modeling program is used to create the individual objects for the virtual

From Greenleaf Medical Systems, Palo Alto, California

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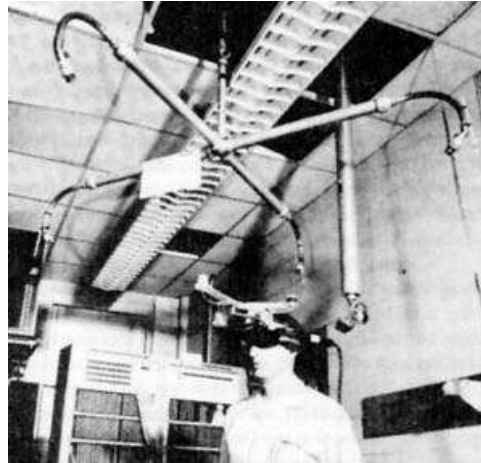
Virtual Reality Technology is Just Now Emerging

Virtual Reality technology has been over hyped



Brief History Of Virtual Reality

Previously,
Virtual reality
technology
was too
expensive
and too
cumbersome
for wide
spread
adoption



Why Use Virtual Environments?

Improve
the
therapeutic
process

Engaging

Facilitate active participation

Overcome cognitive and emotional barriers

Allow clinicians to go deeper, faster

Extend clinical reach

Quantitative measurement

Standard assessment tools

Enhanced clinical records

Required Features

Current
virtual reality
systems
are
fast
realistic
sophisticated
....
and
much more
affordable

Realistic

Engaging / interactive

Easy to use, including voice

Record and playback from multiple points of view

HIPPA compliant

Private conferences when in groups

Generate standard cues and scenarios

Staircase exposure

Affordable

Virtual Reality and Psychological Healthcare

In traditional behavioral healthcare, patients and therapists typically meet in a small office, face-to-face, once a week

Behaviors are explored by the recall of past events, discussion of future possibilities, and the practice of new skills via imaginary role play



The patient is then on their own until the next appointment to continue to think about themes and try new strategies in the real world.

Virtual environments are used clinically to treat several important behavioral health problems

- Phobia and anxiety disorders
- Post-traumatic stress disorder (PTSD)
- Developmental disabilities
- Conduct disorders
- Drug and alcohol abuse
- Anger management
- Eating disorders
- Impulsive disorders
- Learning disabilities
- Neuro-cognitive disorders



InWorld: A Multi-User Simulated Environment for Behavioral Healthcare



InWorld uses flat-screen multi-user interactive virtual environments to facilitate behavioral therapy.

Key features of InWorld Systems include rich real-time interaction tools such as Voice-Over Internet Protocol (VOIP) for keyboard-free interactions in any language that's appropriate, as well as playback and imbedded assessment tools

InWorld not only has graphic tools for rich real-time interaction, but also for dynamic after-action review (AAR). Clinicians and patients can review a session on-screen and control the viewing perspective in real-time

Additionally, there is the capability to perform in-ear coaching, where the therapist can invisibly observe real-time action and provide discrete coaching directly to the ear-set of any of the other users



InWorld: A Multi-User Simulated Environment for Behavioral Healthcare

InWorld Systems Provide the Ability to:

- *Engage the patient cognitively*, and thus make therapy engaging, as well as increase compliance
- Conduct group therapy sessions
- Monitor progress using a wide array of assessment tools
- Allow clinicians to build rapport with patients in a neutral environment that can de-stigmatize therapy



- Teach interpersonal and cognitive skills
- Desensitize patients to environmental triggers
- Create and support patient social networks
- Practice skills with clinical trainees and provide an immediate opportunity for testing in a simulated social or clinical setting

InWorld: A Multi-User Simulated Environment for Behavioral Healthcare

InWorld Systems Provide the Ability to:

- Enhance counseling by meeting family members in the simulated environment, using the recordings of past individual therapy sessions as conversation starters, and reducing the burden of time and distance
- Improve clinical supervision of staff through review of virtual sessions
- Conduct all aspects of therapy and supervision locally, or, at a distance



InWorld Features

Virtual Worlds

- Choice of virtual environments
- Immersive
- Custom worlds



Representation via Avatars

- Engage rapidly
- Talk naturally
- Build rapport
- Active participation
- Supports anonymity
- Easy to move
- Easy to personalize



Role-play

Individual therapy

Couples therapy

Clinical focus

- Drug addiction
- Trauma
- Sexual abuse
- Sexual offensive behavior
- Domestic violence
-and this is just the beginning

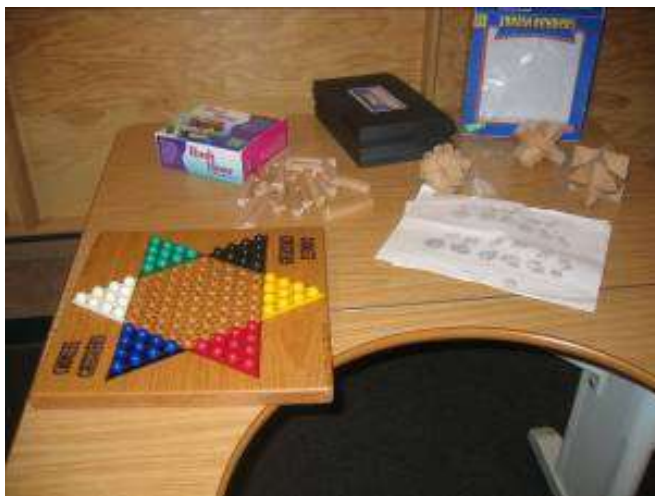
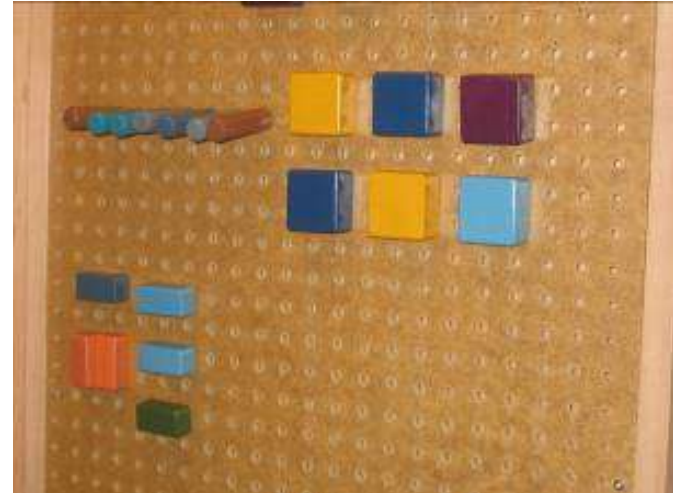


Advantages to Working InWorld

- Immersive, rapid engagement
- Several perspectives
- Easy recording & replay
- In-ear coaching
- Remote and in office access
- Overcomes cognitive & emotional barriers
- Supports anonymity & reduces stigma



Current Rehabilitation Technology



Traditional Therapeutic Environment

In the traditional therapy session, the patient works one on one with a therapist to address shoulder flexion and abduction, pincer grasp, forearm supination and pronation and other movement foci.



Problems with Conventional Therapy

Limited ability

- for systematic delivery and control of stimuli
- to vary intensity level in a flexible and dynamic way
- to precisely capture motor response in real time
- to motivate completion of therapy process

VR Environments for Neuro-Rehab

Ability to adjust the speed, complexity, and physical difficulty of the world

Ability to provide functional activities

Ability to objectively index improvement

Ability to stair-case progress

Ability to close the feedback loop

Ability to be patient by providing computer assisted rehab

Ability to engage the user cognitively – to make rehabilitation fun, and increase compliance

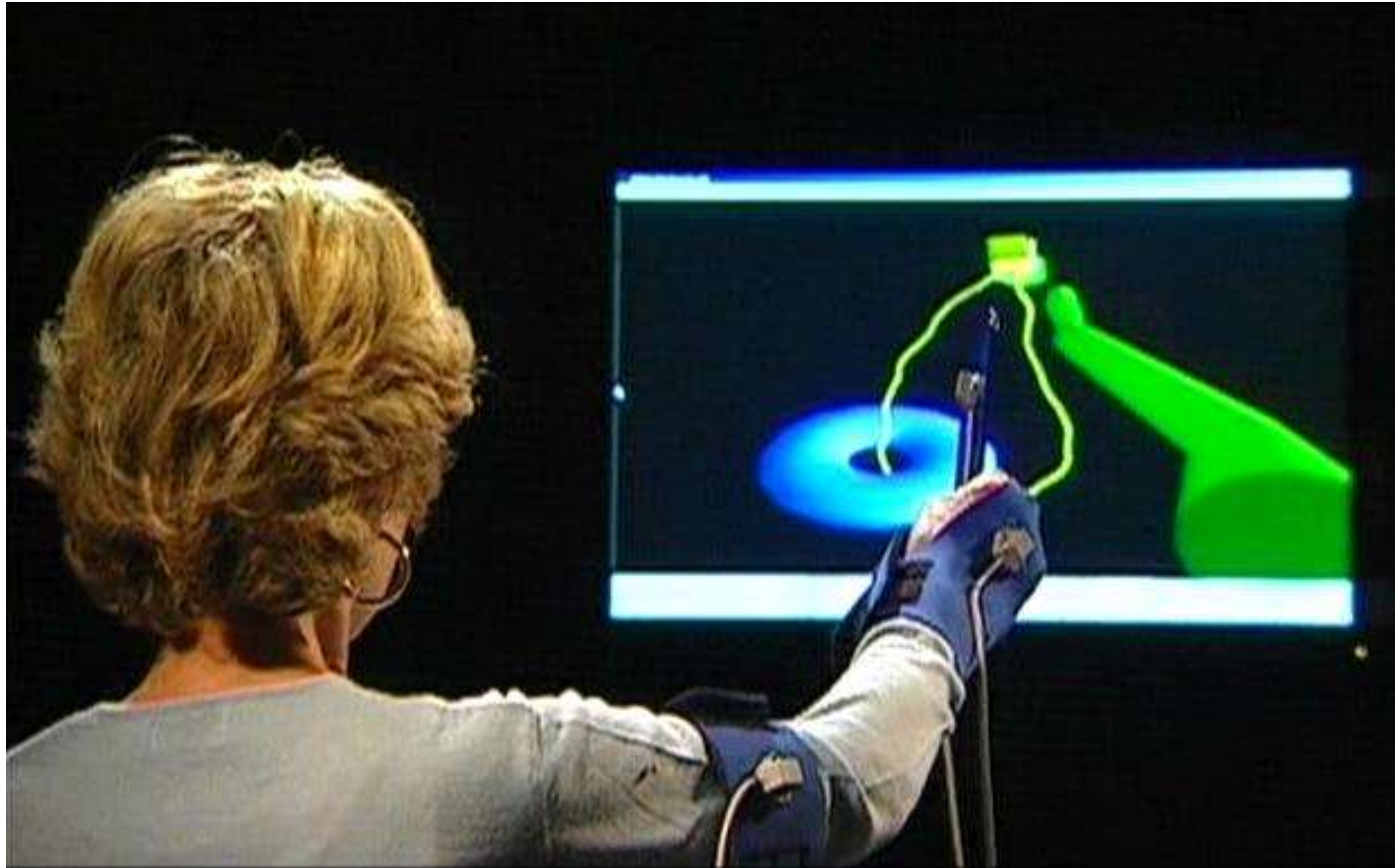
Virtual Environment Training

The setup consists of a 3D electromagnetic motion tracking system with six degrees of freedom

The motion sensor (receiver) is positioned on an object grasped by the patient, or it is attached to a glove worn by the patient

The spatial data are graphically reconstructed in real time by the software

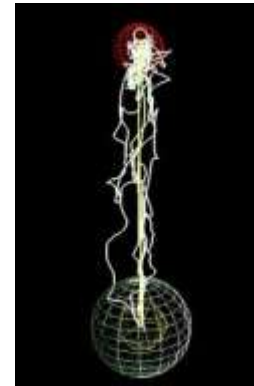




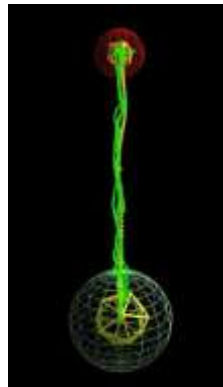
Results:

Trajectories Morphology

BEFORE



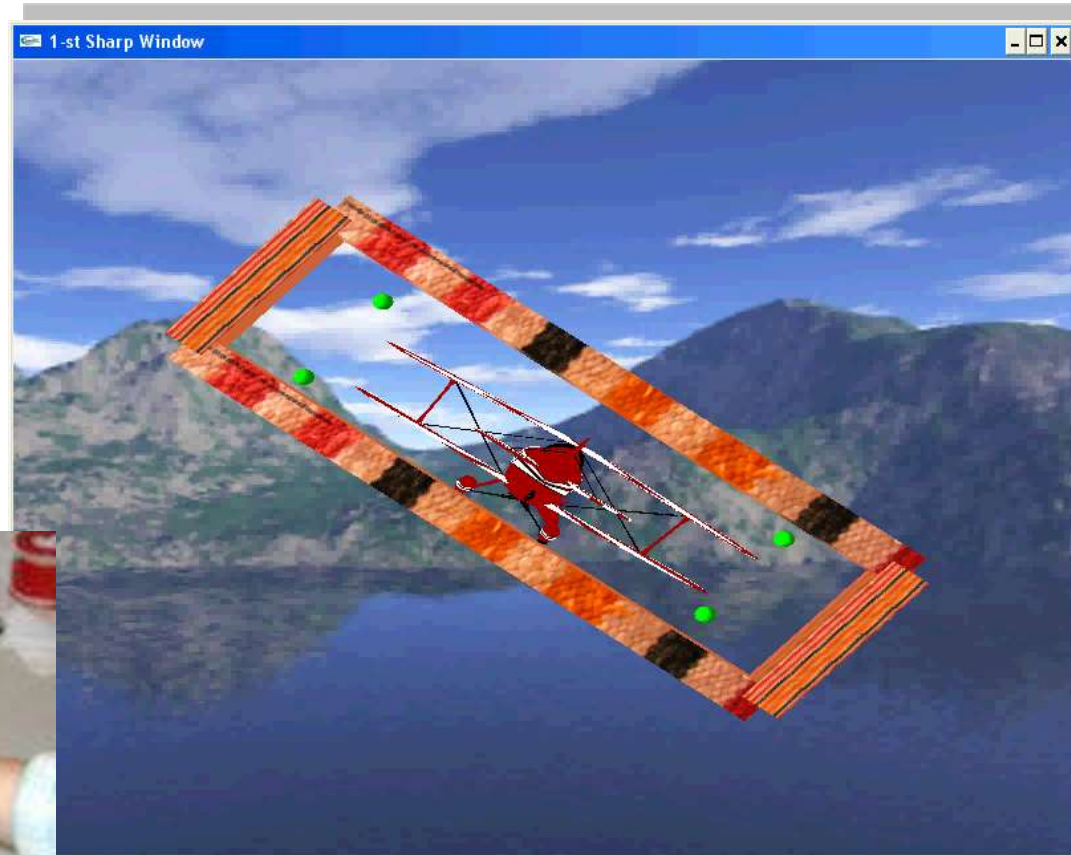
AFTER



Clinic Based Motor Rehab Applications

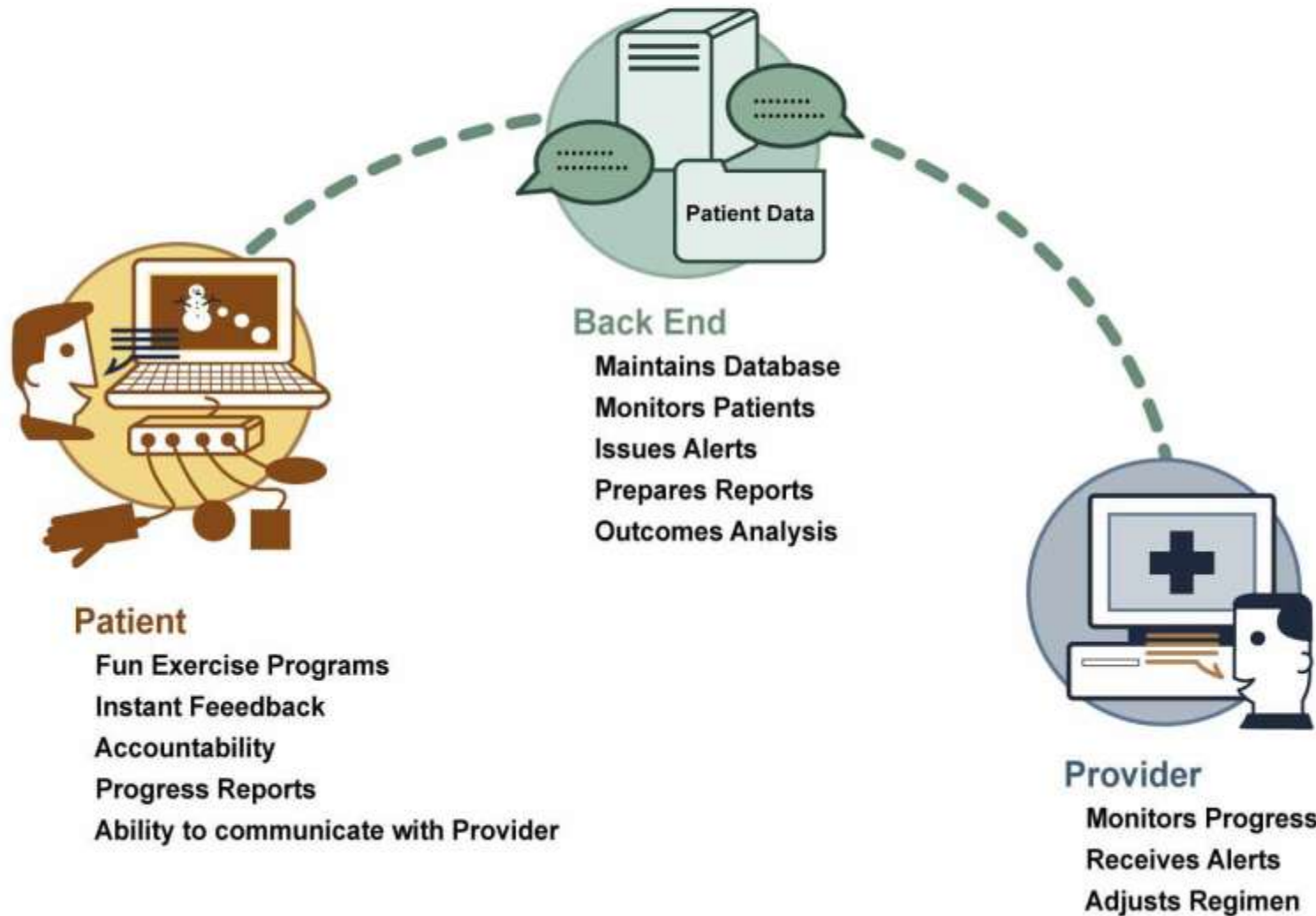
Pronation and Supination

The Flying Plane game targets pronation and supination, using a PHANTOM OMNI, a comparatively inexpensive force-feedback device.



Our Solution •

Dynamic Rehab System





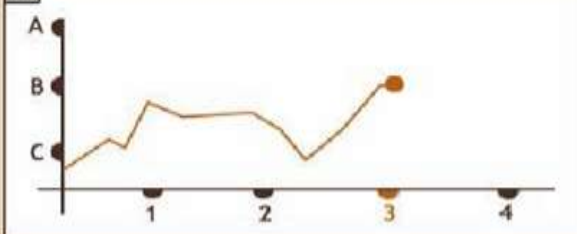
Mary You have EMAIL from the Chat Group



Please repeat this exercise program
1 time every day:
(average time 15 min)

- use the glove with the left index finger and rotate the finger 100 degrees.

move the index finger up and down in a 80 degree range for 10 times.



Patient video



Clinic video



status



12.6 lbs

InWorld Systems

Provide the ability to:

- **Teach inter-personal and cognitive skills**
- **Practice skills in a simulated social setting**
- **Conduct group therapy sessions**

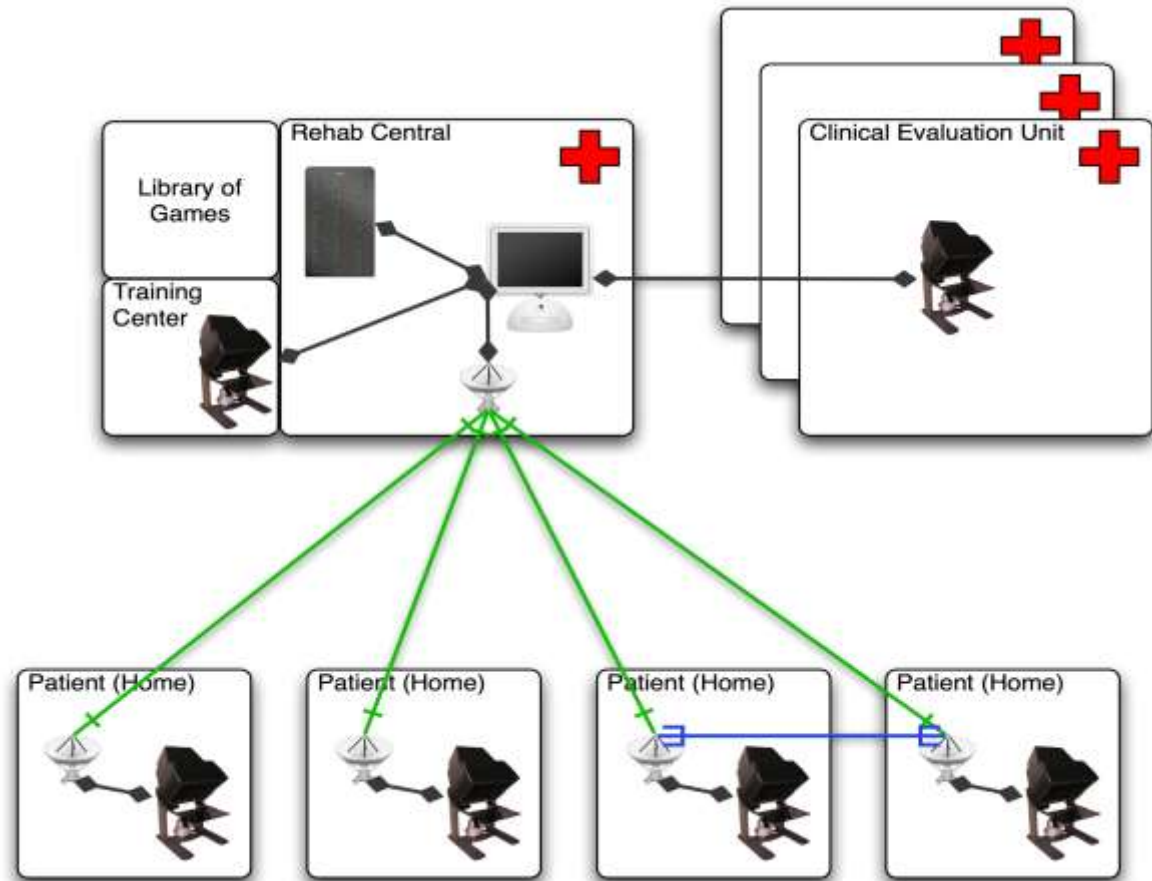


- ***Engage the patient cognitively***
- **Desensitize patients to environmental triggers**
- **De-stigmatize therapy**

Virtual Reality Environment for Amputee Support Program



Distributed Rehabilitation





CHECKPOINT

Checkpoint times: 0.0.10.33

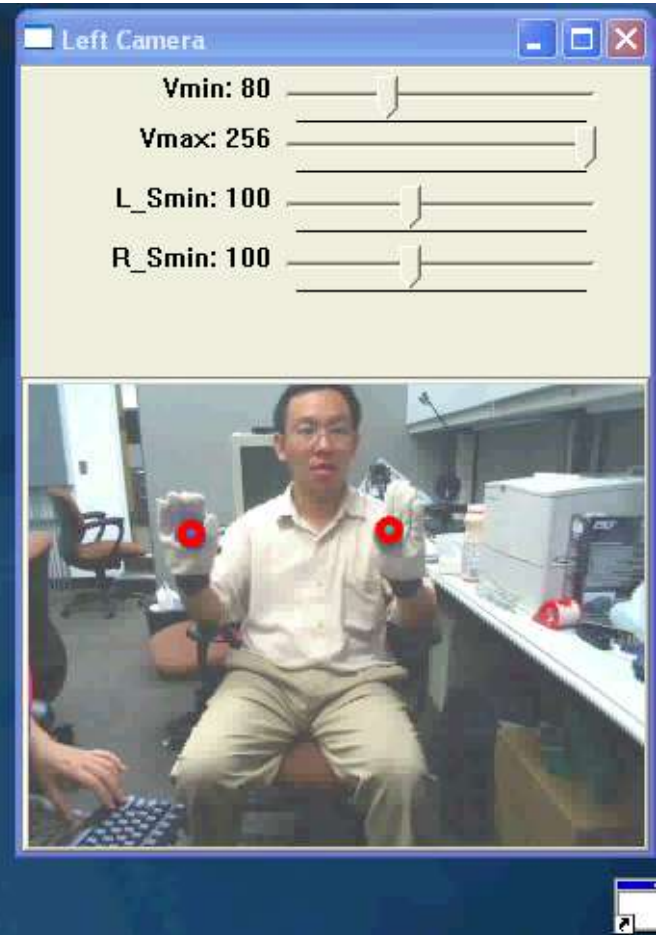
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Checkpoints: 2/15
Step: 14

Wiihabilitation



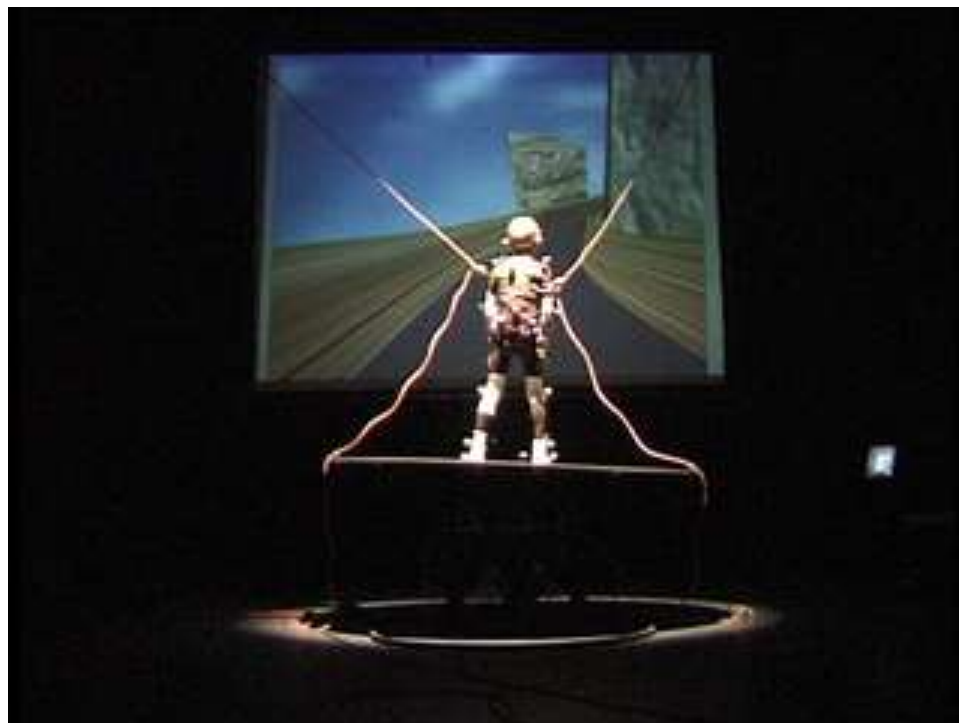
3D Computer Vision-Based Applications



Bimanual Coordination



MoTek System



Questions, Issues?



Thank You



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