

Computer Games and Virtual Worlds: New Modalities of Rehabilitation and Therapy

Walt Scacchi

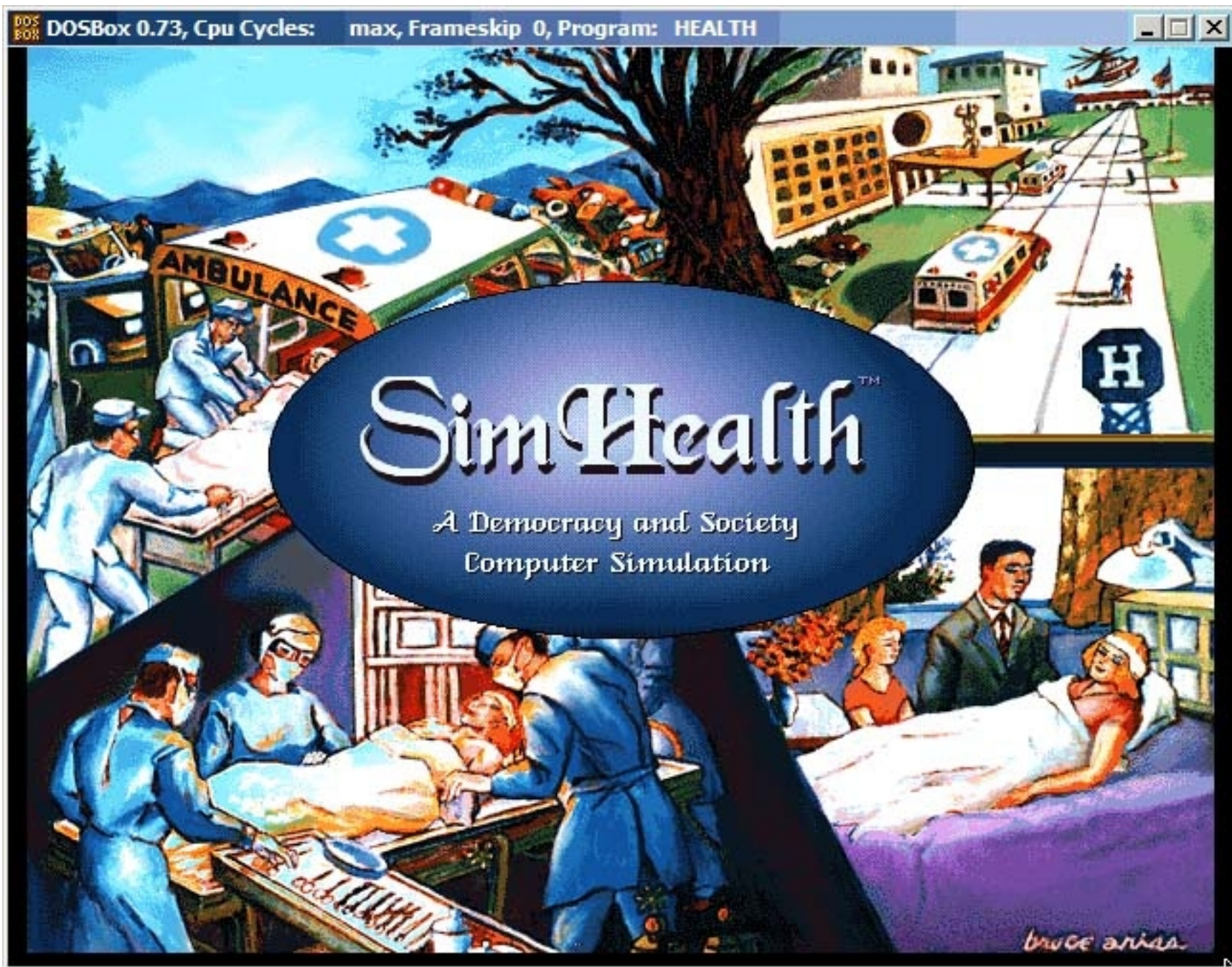
Institute for Software Research
and
Center for Computer Games and Virtual Worlds
University of California, Irvine

Orange County Stroke Rehab Network
Continuing Education Workshop
5 November 2011

Overview

- Games for Health
- Game play devices with possible therapeutic applications
- Games for assisted therapeutic rehabilitation and physical performance training
- Games and tele-rehabilitation
- Recommendations

SimHealth – A National Health Care System Game



Wellness game from Health Care Insurer

FAMSCAPE

BETA

Already Registered? [Login Now](#)

Welcome

What is FamScape

How it Works?

Help

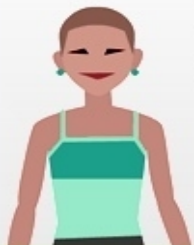
Play life well.

FamScape is a rewarding social game that motivates families to achieve healthy living goals.

[Start FamScape Now](#)



Free To Join



There is no cost to start your FamScape experience. Invite and interact with your family and friends.

[Join Now](#)

Connected Worlds



FamScape bridges the real and digital worlds. Goals you meet in the real world are reflected online.

[Start Playing](#)

Real Rewards



Earn a variety of in-game and real-world rewards. The more you play, the more you can achieve!

[Learn More](#)

News

[Humana joins with iCan to offer new individual healthcare plans](#) Humana Inc. (NYSE: HUM) has teamed with the iCan Benefit Group to offer a ne

Quest for the Code: (from Starbright Foundation)

Game for learning about asthma

Learning objectives:

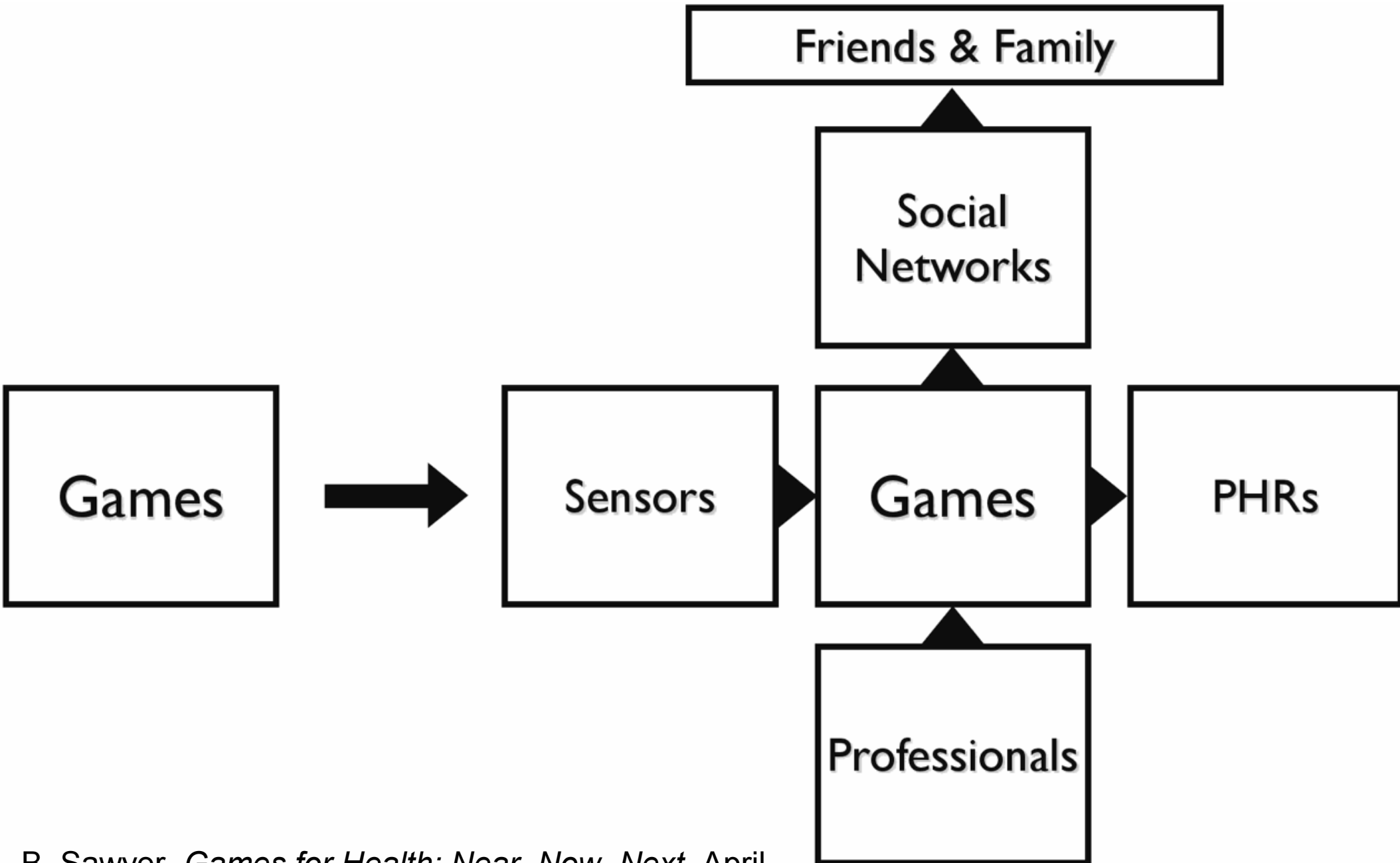
- Early warning signs and symptoms
- Identifying and avoiding asthma triggers
- Myths about asthma
- How asthma affects the lungs
- Proper use of asthma medication devices
- Long-term control medicine and quick-relief medicine
- Measuring and monitoring peak flow
- How to answer questions from peers about asthma



How Computer Games can Help in Rehabilitation and Therapy

Motivate	Support	Sustain
Game creates compelling premise you desire to engage...	Game Interface is Symbiotic Aid to Help you Achieve Success	Game arc or iterative play creates sustained engagement model
Challenge Story Competition	Process of Play Character Guidance Multiplayer Cohesion	Score Story Progression Decision Immersion
Why I Start	Why I Enjoy Playing	Why I Keep Playing

The Future of Games for Health?



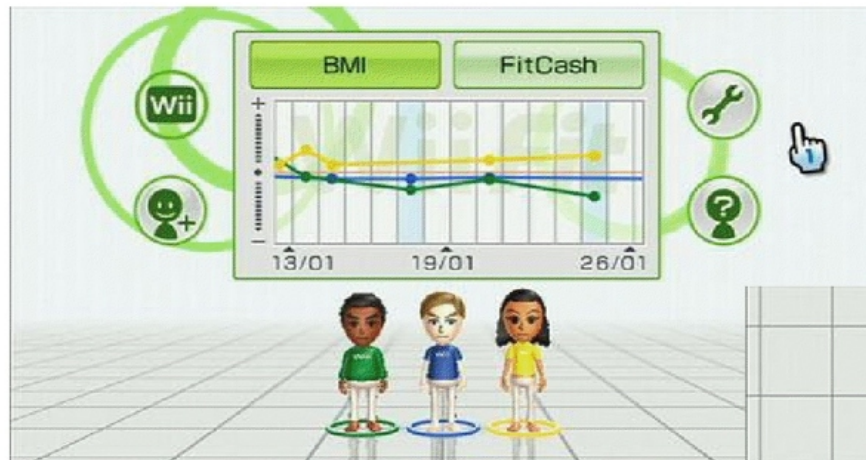
Games for Health with sensor devices: *Nintendo Wii*



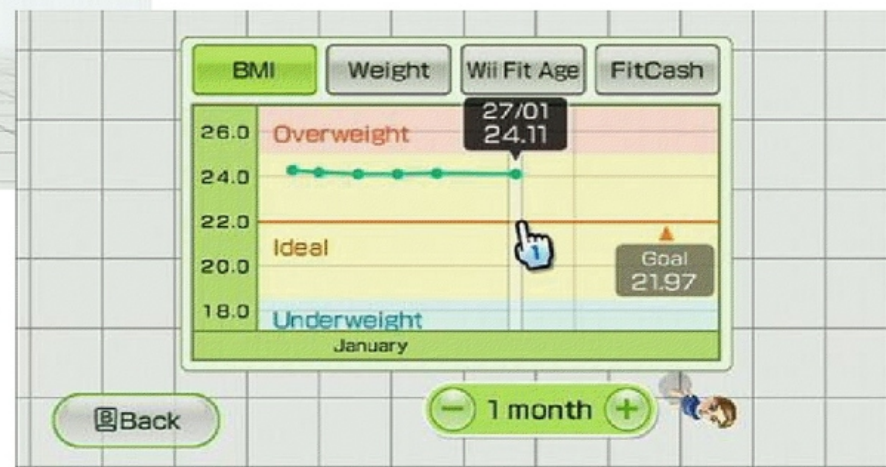
Michael Nagle for The New York Times

Miyamoto first got the idea for Wii Fit when, several years ago, he started weighing himself every day. "I went through a period where I started to become aware of my own health and fitness," he explains. In order to track his progress, he kept meticulous graphs and charts next to his bathroom scale, recording what he ate that day and what activities he was involved in. And, over time, his weight went down and his energy went up. "Seeing these kinds of changes visually in front of you is fun and entertaining!" He had so much pride in his charts, saying, "Even now, I still have the graphs in my bathroom, and they are more valuable to me than your favorite save game data."

- ugo.com



Wii Fit



Games for Health

- **Four focus areas for enabling human behavior change for health**
 - **Increasing physical activity and performance**
 - **Mobility/dance exercise; overcoming obesity; increasing agility**
 - **Nintendo *Wii Sports* and *Wii Balance Board***
 - **Improve self-managed health care**
 - **Training or learning games for facilitating patient self-care and understanding purpose of self-care protocols**
 - **(Healthy) Lifestyle improvement**
 - **Diet; mitigating easily transmitted diseases/ailments**
 - **Facilitating therapy**
 - **Technology-mediated therapy (games often focus more on evaluating potential of new technology in therapy)**
- **New game play devices are expanding the possibilities for games for health**

Game play devices with possible therapeutic applications

- Simulated devices
 - *Guitar Hero guitar; Rock Band drum set*
- Haptic wheels, trackballs, and joysticks
- Force-feedback play controllers (racing game wheels, pneumatic bladders)
- Multi-sensor play controllers (including video capture, infra-red, accelerometers, neurological sensors, electro-goniometers (SEMG), etc.)
 - *Wii Remote and nunchuk*
- Multi-jointed, body-worn sensors as play controllers
 - *Data gloves*



- *GypsyMIDI*



Game play devices with possible therapeutic applications

Endoscopic surgery training “joysticks”

- **Simball 4D joystick** adapted to therapeutic game play for stroke rehabilitation

- <http://www.g-coder.com/content/view/7/6/>



3D, real-time video motion capture enabling *mixed reality game play* spanning physical and virtual worlds

- **Microsoft Kinect** (dance demo)
- **In-game characters can interact with people through gestures and motion-tracked body movements**

<http://www.youtube.com/watch?NR=1&v=-jhpYsIVygs>



Games for sports and assisted performance training

- **Wii Sports** (best selling game for Nintendo (better than *Super Mario Bros.*); 76M copies sold worldwide through January 2011)

- Boxing
- Bowling
- Golf
- Tennis
- Baseball



What's next?



“Gowning” training game, developed at UCI GameLab

working in a cleanroom

Suit made of
ultra clean material

Battery pack for
air filter system

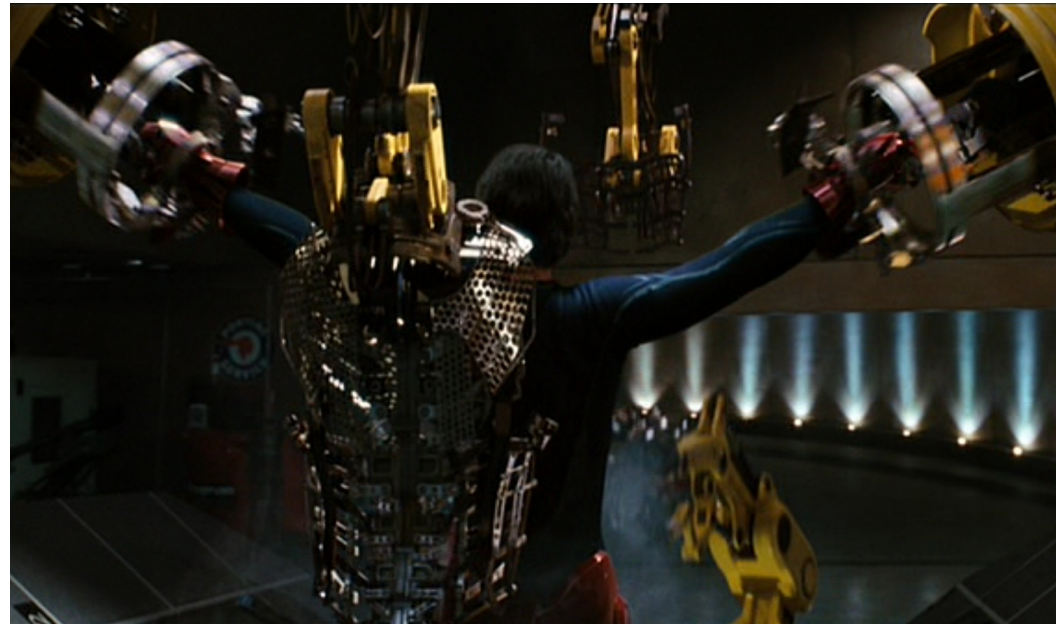
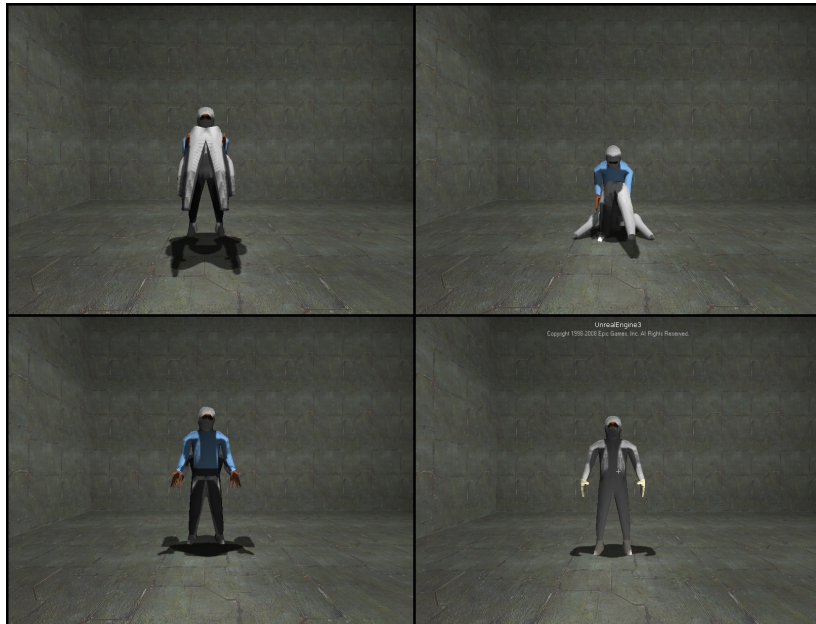
2 pairs of gloves
nylon & latex

2 pieces
of foot gear
disposable
shoe covers &
outer booties

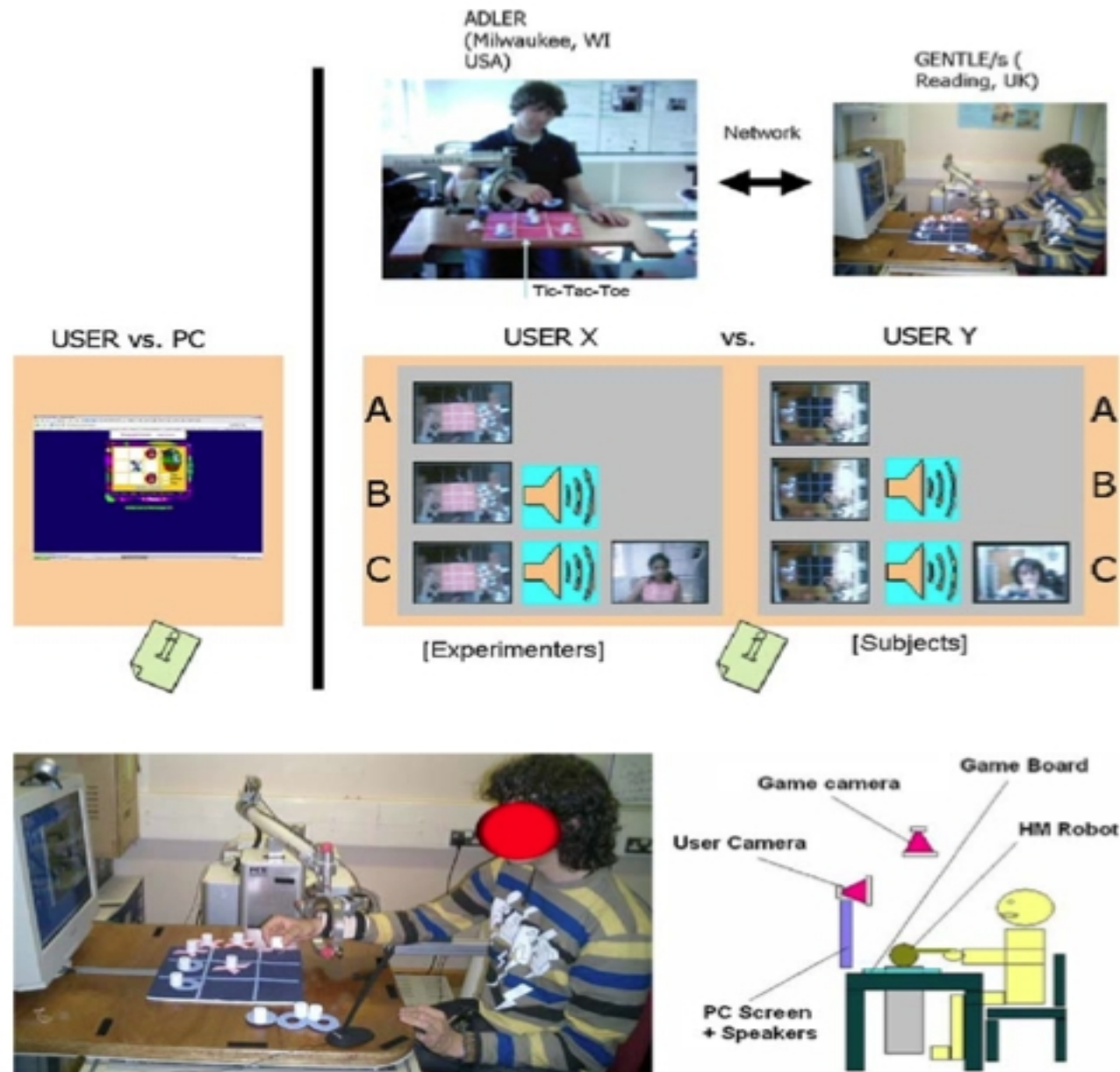
Helmet
includes
air filter
unit

Will also
wear
hairnet
& safety
glasses

Belt



Game-based tele-rehabilitation



Game-based virtual worlds and tele-rehabilitation

- Virtual worlds (like *Second Life*) can be used to support various kinds of tele-medicine and tele-robotics applications/tasks



- “Tele-Rehabilitation” tasks supported can include:
 - Remote observation, tele-consultation, role-playing and identity switching through avatars, device data collection, device software updates, collaborative product/prototype development, and more

Some findings on Games for Health/Therapeutic Applications

- The design and utility of a game to realize therapeutic value is not obvious.
- E. Flores, G. Tobon, et al., Improving Patient Motivation in Game Development for Motor Deficit Rehabilitation, *ACM 2008 Intern. Conf. Advances in Computer Entertainment*, 381-384.

Table 1. Gaming design criteria for stroke rehabilitation programs serving elderly users

Criteria for Stroke Rehabilitation	Criteria for Elderly Entertainment
<ul style="list-style-type: none"> Adaptability to motor skill level Meaningful tasks Appropriate feedback Therapy-Appropriate ROM Focus diverted from exercise 	<ul style="list-style-type: none"> Appropriate cognitive challenge Simple objective/interface Motivational Feedback Element of social activity Appropriateness of genre Creation of new learning following guidelines of experts Sensitivity to decreased sensory acuity and slower responses

		Pong	Driver's SEAT	Whack-a-mouse	Tetris	Computer Chess	Trivial Pursuit
CRITERIA	Stroke Rehab	Adaptability to motor skill level	✓	✓	✓		
		Meaningful tasks	✓	✓			
		Appropriate feedback		✓			
		Therapy-appropriate ROM		✓			
		Focus diverted from exercise	✓	✓	✓	✓	✓
	Elderly Entertainment	Appropriate cognitive challenge			✓	✓	✓
		Simple objective/interface	✓	✓	✓	✓	✓
		Motivational Feedback	✓	✓	✓	✓	✓
		Element of social activity	✓			✓	✓
		Appropriateness of genre	✓	✓	✓	✓	✓
		Creation of new learning				✓	✓
		Sensitivity to decreased sensory acuity	✓	✓	✓	✓	✓
		Sensitivity to slower responses	✓	✓	✓	✓	✓

Recommendations for Therapeutic Games

- Preventative games and game play
- Therapeutic games
 - Physical therapy:
 - Wii-Habilitation games (Wii Fit)
 - Youth and elder games for socio-physical therapy
 - Occupational therapy:
 - Take advantage of the “Proteus Effect”
- Look for games integrated with motion capture devices
 - Nintendo Wii
 - Microsoft Kinect
 - Sony Playstation Move
- Therapeutic application domains with practical near-term applications
 - Stroke rehabilitation – upper arm activities
 - Movement and balance therapies – lower body, walking activities
 - Speech – especially across languages

Recommendations for Future Therapeutic Games

- **Prototype and refine multi-skill, multi-level games that can be rapidly tailored for individual capabilities, supported by therapeutic protocols**
 - Via games pre-programmed to support diversity of play
 - Games whose user controls are integrated with therapeutic devices
 - Alternatively, assess existing games to determine their potential usage
 - Nintendo *Wii Sports*?
- **Develop game-based virtual worlds that provide life-situation tasks for personal accomplishment and improved socialization opportunities**
 - Exoskeleton gowning and user-device service tasks
 - Multi-player games for that mix players/avatars with varying physical capabilities (including those that may be virtually induced)

Recommendations for Future Therapeutic Games

- **Design, prototype, and refine an online virtual world or massively multi-player online therapeutics learning game (MMO-TLG) world**
 - **A virtual world that provides different support services and learning opportunities for all parties involved in facilitating use of assistive therapeutics applications.**
- **Investigate, design, and refine alternative therapeutic rehabilitation schemes using assistive robotics integrated with online game environments**
 - **Collect empirical measurements/observations to show performance change**

Some References

Baranowski, T., Buday, R., Thompson, D. I., & Baranowski, J. (2008). Playing for real: video games and stories for health-related behavior change. *American J. Preventive Medicine*, 34(1), 74-82.

Lieberman, D.A. (2006). *Dance Games and Other Exergames: What the Research Says*. <http://www.comm.ucsb.edu/faculty/lieberman/exergames.htm> , Accessed September 2010.

SimHealth is a game from 1994 that simulates the United States health care system, and allows players to make national-scale decisions about health care spending decisions [<http://en.wikipedia.org/wiki/SimHealth>].

Microsoft Kinect (camera-based) personal fitness and motion analysis, see *Your Shape: Fitness Evolved 2012*, <http://yourshapegame.ubi.com/fitness-evolved-2012/en-US/>

Videos (on YouTube) shown with presentation:

- *Using Wii Balance Board for Stroke Rehabilitation*, <http://www.youtube.com/watch?v=7rAVYawJ2JU>
- *Wii for rehabilitation and balance*, http://www.youtube.com/watch?v=uXEto__N_4
- *Webcam Games For Upper-limb Stroke Rehabilitation*, http://www.youtube.com/watch?v=1_QH1a0AziA