

# Computer Games and Virtual Worlds for Health, Assistive Therapeutics, and Performance Enhancement

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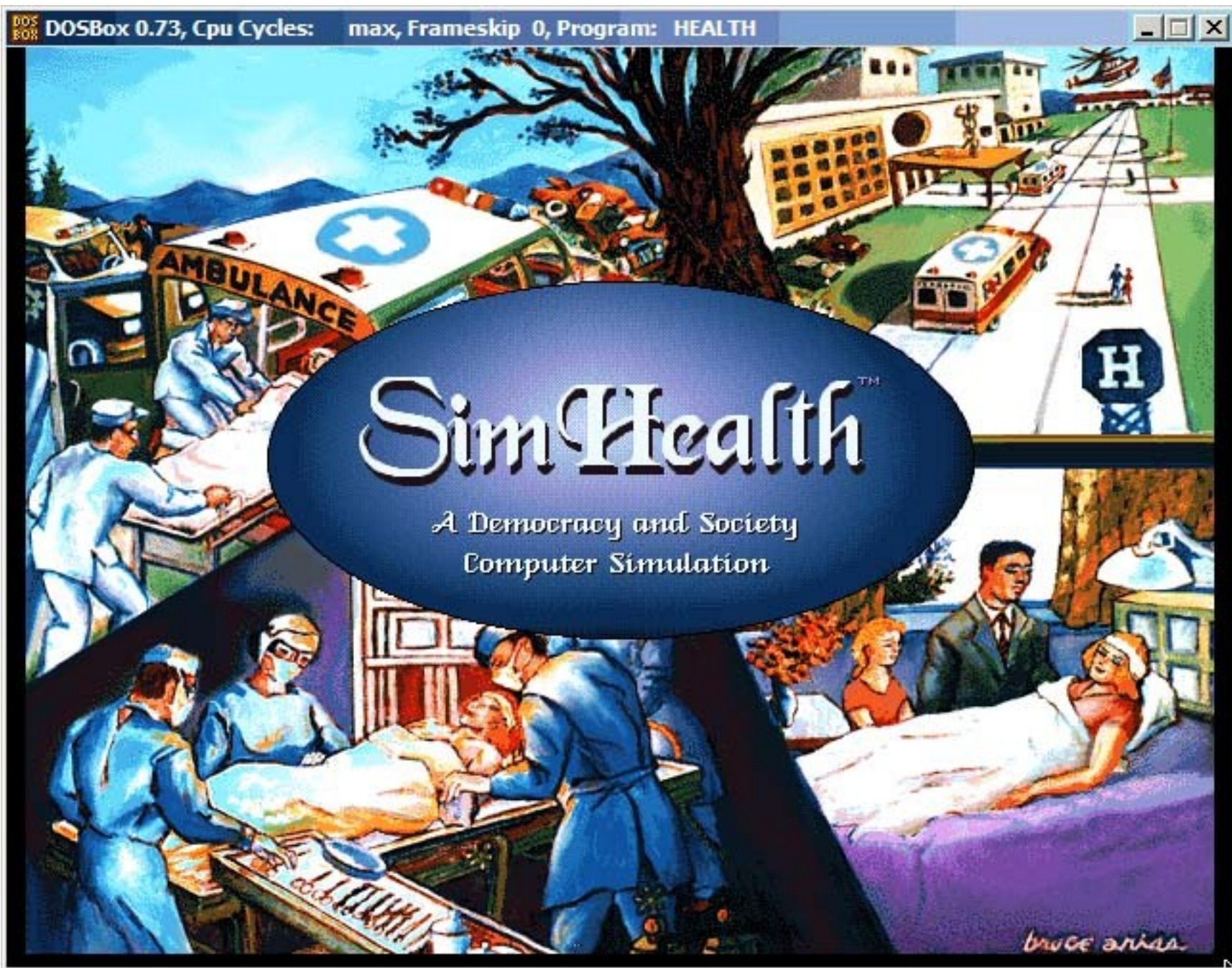
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# Overview

- Games for Health
- Game play devices with possible therapeutic applications
- Games for assisted therapeutic rehabilitation and physical performance training
- Game-based therapy/rehabilitation protocols
- 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: 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





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

		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	✓	✓	✓	✓	✓

# 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 human players through gestures and body movements

- [http://www.youtube.com/watch?v=g\\_txF7iETX0](http://www.youtube.com/watch?v=g_txF7iETX0)



# 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

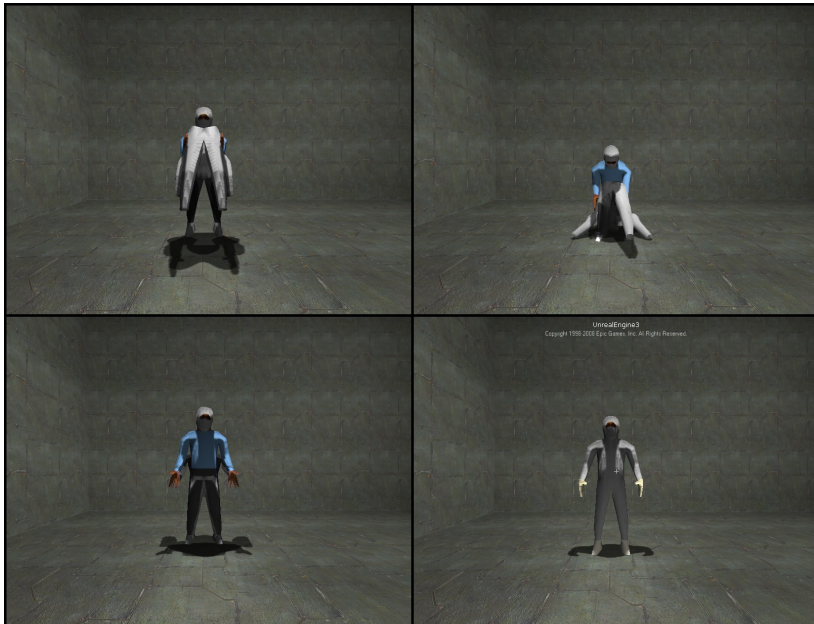
2 pairs of gloves  
nylon & latex

2 pieces  
of foot gear  
disposable  
shoe covers &  
outer booties

Helmet  
includes  
air filter  
unit

Will also  
wear  
hairnet  
& safety  
glasses

Belt





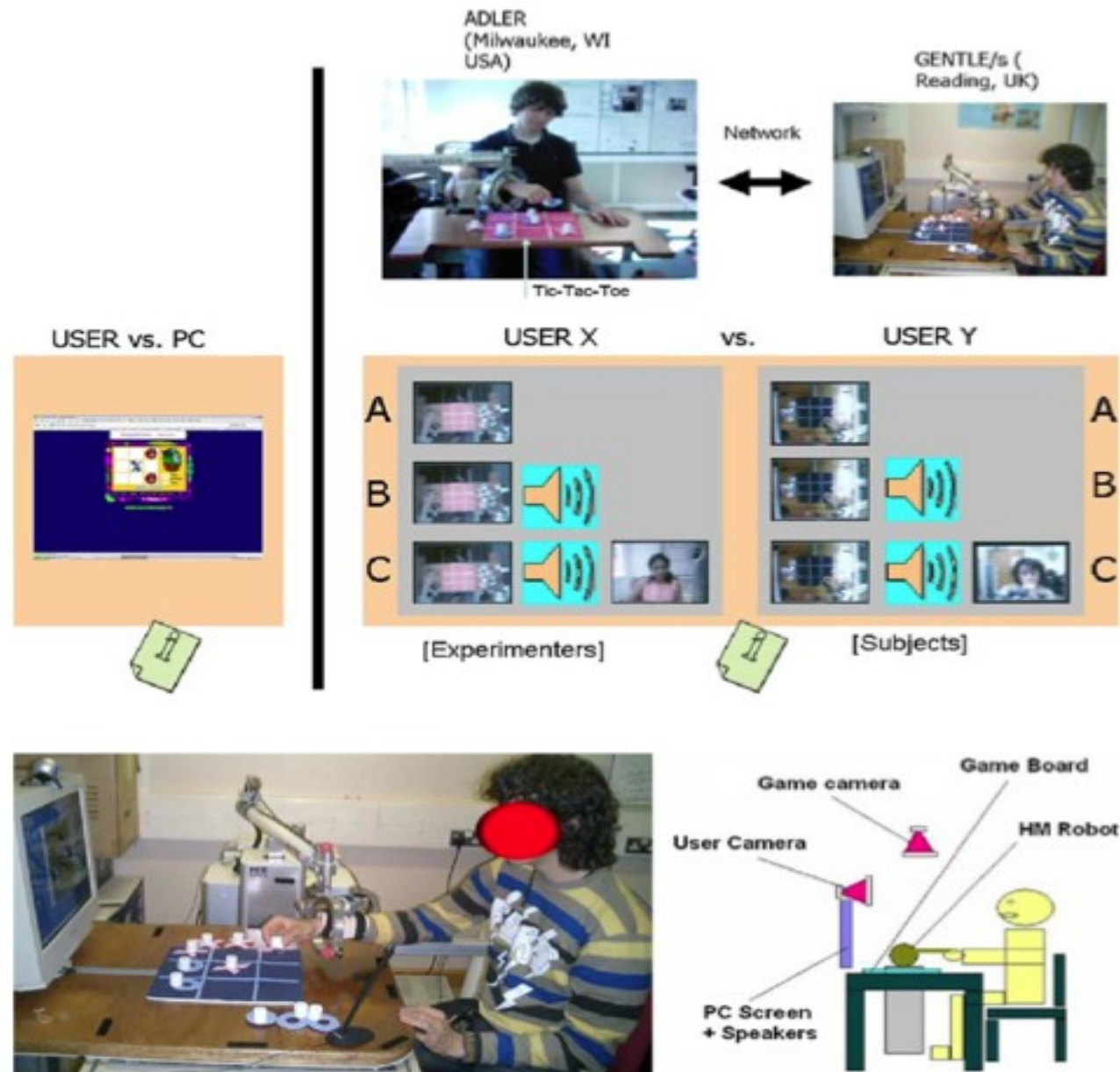
# Game-based virtual worlds and tele-rehabilitation

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



- **“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

# Game-based tele-rehabilitation



# Game-based therapy/rehabilitation protocols

- From an outsider's perspective, therapeutic or rehabilitation protocols denote *specifications* for how to achieve some outcome state(s), given inputs, constraints, and set of operations.
  - Such protocols can be represented computationally, when formalized, and thus the protocols can be treated as “software processes”
  - Software processes can be enacted through interactive (Web) applications, and empirically measured, assessed and replayed.
  - Medical protocols can thus be viewed as software, and such software can be designed to operate within other software, such as a computer game, or game-based virtual world
  - Thus, we can investigate, design, and refine such protocols with online games!
  - Similarly, we have the potential to design and refine (sports) performance improvement protocols in ways that can be integrated within computer games and associated game play devices



# Recommendations for Therapeutic Games

- **Prototype and refine multi-skill, multi-level games that can be rapidly tailored for individual capabilities, supported by therapeutic protocols**
  - Via games that are 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 Therapeutic Games

- Investigate, design, and refine alternative therapeutic rehabilitation schemes using assistive robotics integrated with online game environments
  - Specify medical protocols as computational specifications
  - Collect empirical measurements/observations to show performance change
- 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.

## 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>].