Games for Rehabilitation

Sheryl Flynn PT, PhD
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Tuesday, June 29 from 3:00-4:15pm.

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Using video games for rehabilitation purposes combines innovative computer technology with contemporary rehabilitation and neuroplasticity theories. With technological advances video games can now be played with little active movement and minimal fine motor control. These games are motivating and fun while simultaneously pushing the brain and body to recover. The purpose of this presentation is to provide the audience with 1) provide a review of relevant literature in support of video games for rehabilitation, 2) discuss current off the shelf video games and controllers appropriate for rehabilitation, and 3) provide explicit examples of use of games in the clinic.

I. Review of relevant literature in support of video games for rehabilitation
   1. Video Games for Rehabilitation Reviews
      a. Weiss P, et al. JNER. 2004;1(1):12.
      b. Sveistrup H. JNER. 2004;1:10-18.
      c. Deutsch & Mirelman Topics in Stroke Rehab 2007
      d. Henderson et al Topics in Stroke Rehab 2007
      e. Adamovich et al, Neurorehabilitation 2009
      f. Special Issue of Physical Therapy Reviews (PTR) October 2009
   2. Evidence
      a. Physiology/Energy Expenditure in Adolescent
         i. Graves (2008) *Bri J of Sports Med*
         ii. Graves (2008) *Eur J Appl Physiol*

iii. Murphy et al Int J Pediatr Obes. 2009 Apr 3:1-10.
iv. Graf et al Pediatrics. 2009 Aug;124(2):534-40. Epub 2009 Jul 13.
v. Unnithan et al Int J Sports Med. 2006 Oct;27(10):804-9.
vi. Tan et al Int J of Sports Med 2002; 23: 125-129.
vii. *Epstein et al Ann Behav Med 2007;33(2):124-131*

b. Balance, Strength and Flexibility
   i. Nitz (2009) Climacteric
   ii. The Validity of the WiiFit™ Single Limb Stance Test for Use as an Assessment Tool in Typically Developing Children Ages 4-10; a Pilot Study *M. Schlueter; A. Myers; J. Schlick; A. McAlister; S. A. Ross*

c. Balance and Mobility Post Stroke
   i. Sugarman IVR 2009
   ii. Deutsch IVR 2009
   iii. *S. L. Fritz; E. Rivers; A. Merlo-Rains; B. M. Duncan* Examining the effect of commercially available video game systems, the Nintendo Wii and Sony PlayStation 2, on balance and mobility in individuals with chronic stroke.
   iv. *J. C. Wang; B. Crowner* Effects of the Wii and Wii Fit on Outcomes in an Individual with Chronic Stroke
   v. Yavuzer G, Senel A, Atav MB, Stam HJ "PlayStation EyeToy Games" improve upper extremity related motor functioning in subacute stroek: A randomized controlled clinical trial J Phys Rehabil Med
   vi. Flynn S, Palma P, Bender A (2007) Feasibility of Using the Sony PlayStation 2 Gaming Platform for an Individual post stroke: A Case Report. JNPT
   vii. Saposnik G, Teasell R, Mamdani M, Hall J, McIlroy W, Cheung D, Thorpe KE, Cohen LG, Bayley M; for the Stroke Outcome Research Canada (SORCan) Working Group. Effectiveness of Virtual Reality Using Wii Gaming Technology in Stroke Rehabilitation. A Pilot Randomized Clinical Trial and Proof of Principle Stroke (2010) May 27 Epub ahead of print.

d. Pediatrics
   i. Deutsch et al Use of a Low-Cost, Commercially Available Gaming Console (Wii) for Rehabilitation of an Adolescent With Cerebral Palsy *PTJ* 88(10) 1196-1207.
   ii. *T. L. Millard; D. M. Hayes; J. Martin; B. Woods; A. Weigel* Using the Nintendo Wii Fit and Body Weight Support (BWS) to Promote Improvement in Oxygen Uptake Efficiency Slope (OUES) and Economy of Movement in an Adolescent with Cerebral Palsy: A Case Report
   iii. *K. Nelson; S. Pladera; K. Seidl; J. A. Furz*The Effects of a WiiFit Intervention on Balance Performance of a Child With Cerebral Palsy

iv. Michiel J. A. Jannink, Gelske J. van der Wilden, Dorine W. Navis, Gerben Visser, Jeanine Gussinklo, Maarten Ijzerman (2007) CyberPsychology and Behavior A Low-Cost Video Game Applied for Training of Upper Extremity Function in Children with Cerebral Palsy: A Pilot Study
v. Lotan, Yalon-Chamovitz, Weiss(2009) Improving physical fitness of individuals with intellectual and developmental disability through a Virtual Reality Intervention Program Res Dev Disabil. 2009 Mar-Apr;30(2):229-39. Epub 2008 May 13

e. Older Adults
   i. Rand D, Kizony R, Weiss PT The Sony PlayStation II EyeTOy: Low Cost virtual reality for use in rehabilitation 2008, JNPT

f. *Brain Injury*
   i. *K. E. Scholl; K. Shields*Incorporating the Use of the Nintendo Wii to Achieve Functional Outcomes in a Patient with a Brain Injury: A Case Report
   ii. *M. Garrett; D. O'Connell; L. Duncan; A. Smith* The Effect of Wii Game on Psychomotor Fitness in an Adolescent Male with Hypoxic Ischemic Encephalopathy (HIE).
   iii. *L. L. Eisenzopf; Y. Salem; E. M. Godwin* Use of Wii fit game for an adolescent with post-traumatic brain injury.

g. Burns
   i. Haik J, Tessone A, Nota A, Mendes D, Raz L, Winkler E, More E, Goldan O, Regev E, Orenstein A, Hollombe(2006) The Use of Video Capture Virtual Reality In Burn Rehabilitation: The Possibilities. J Burn Care Res

h. *Adverse Eents*
   i. Robinson RJ *Wii Knee: Emer Radiol*. 15(4):255-7, 2008
   ii. Wells JJ Hit by her brother: , *J Trauma*. 2008 Nov;65(5):1203

i. Gender Studies
   i. Hunters vs Gatherers: *Psychological Reports*. 102(3):745-54, 2008

j. User Study
   i. Comparing Platforms: Lange B Phys Ther Reviews 14(5):355-363, 2009
   ii. Reliability and Validity of the Nintendo Wii Fit™ *L. Z. Gras; E. Hine; A. Hummer*
   iii. Hoysniemi J ACM Computers in Entertainment 2006;4(2):1-30

k. Promised Evidence
   i. Auburn U Elderly http://www.youtube.com/watch?v=NYZGixqKTIU
   ii. Ole Miss- Families and Physical Activity http://www.youtube.com/watch?v=4JPOzY9Zssw
   iii. Teaching your Mom http://vimeo.com/6619561

l. Participation and Screen Time

i. Paez et al . Pediatr Phys Ther. 2009 Fall;21(3):245-53.
ii. Maloney et al Obesity. 2008 Jul 3.

m. Comparison between traditional and video game based therapy
i. Brumels et al Clinical Kinesiology 2008

n. Modified or non-commercial DDR
i. Smith et al Br J Sports Med. 2009

II. Discuss current off the shelf video games and controllers appropriate for rehabilitation

A. Gesture Based
a. Hand Controllers
i. Nintendo Wii-mote/Nunchuck
ii. Move Project (Sony PS3)

b. Wii Fit board(Nintendo)

c. Sensorless Motion Capture
i. EyeToy (Sony PS2)
ii. Project Natal (Microsoft Xbox 360)

B. Standard controllers
a. Key Board
b. Mouse
c. One Switch
d. Novint Falcon

C. Dance Pads
a. Soft Dance Pads
i. Game Cube
ii. Wii
iii. PlayStation, PlayStation 2, PlayStation 3, Xbox
iv. PC/Computer interface (StepMania)- uses special adapters
b. Hard Dance Pads

        i. Dance Platform connected to arcade games
        ii. iDance
    c. Solid State Pads
        i. Use sensors to detect players location, not pressure

D. Plug and Play
    a. UDance
    b. TV Plug-N-Play iSport Interactive Game
    c. TV Plug-N-Play Blue Advanced Two-Player Dance PadDance Dance Party Mix 16-Bit Graphics TV Twin Pro Two-Player Plug-N-Play Dance Pad with AC Adapter
    d. Xtreme Fit
    e. Plug n Play Interactive Fitness Kick Boxing Game
    f. TV Whac-A-Mole Game

E. Guitar Hero/DJHero

F. Tony Hawk Ride

G. Footgaming (http://www.footgaming.com/)

H. Just Dance

I. Future Games/Exergames/RehabGames
    a. Wii Cyber Bike
    b. EyeToy PS3EyeToy PS3
    c. Microsoft Project Natal
    d. Honda Bicycle Simulator

J. Virtual Reality - Gaming Systems for the Clinic and Home
    a. Virtual Reality Augmented Bicycle Kit
    b. PS3 and Telerehab

III. Explicit examples of use of games in the clinic.

A. Multiple Videos/Pictures for discussion- most videos and pictures are available for viewing on www.games4rehab.org Use tag word RESNA.

FYI- Ways to keep current

www.games4rehab.org
http://www.widgetbox.com/widget/medpage-today-breaking-medical-news
http://www.sciencedaily.com/
http://www.wiiblog.net/
http://www.ablegamers.com/
http://www.technologyreview.com/
http://www.resna.org/
http://www.gaming4health.com/
http://www.changemakers.com/
http://www.macfound.org/site/c.lkLXJ8MQKrH/b.3599935/k.66CA/MacArthur_Foundation_Home.htm
http://www.gamesforhealth.org/index3.htmlhttp://www.seriousgames.org/
http://www.gamercize.net/

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Deutsch JE, Merians AS, Adamovich S, Poizner H, and Burdea GC, "Development and application of virtual reality technology to improve hand use and gait of individuals post-stroke," *Restorative Neurology & Neuroscience*, vol. 22, pp. 371-86, 2004.

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Henderson A, Korner-Bitensky N, and Levin M, "Virtual reality in stroke rehabilitation: A systematic review of its effectiveness for upper limb recovery," *Topics in Stroke Rehabilitation*, vol. 14, pp. 52-61, 2007.

Henderson A, Korner-Bitensky N, and Levin M, "Virtual reality in stroke rehabilitation: a systematic review of its effectiveness for upper limb motor recovery," *Topics in Stroke Rehabilitation*, vol. 14, pp. 52-61, 2007.

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