

# Haptic/Audio Based Exergaming For Individuals Who Are Visually Impaired

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# Health Problems and VI

- ★ Great risk of developing serious health problems
- ★ Lower levels of physical activity [Rimmer '08]
- ★ Higher Suicide rates [Lam '08]
- ★ Higher obesity rates [US Dept Health '00]

# Barriers Faced When Exercising

- ★ Severely Visually Impaired Face Barriers When Exercising
  - » Social [Longmuir '00]
  - » Safety [Lieberman '01]
  - » Self-Imposed [Stuart '06]



# Adapted Sports

## ★ Sensorimotor vs Cerebellar



Beep Baseball



Guided Running

# Exergames

- » Promote physical activity
- » Sedentary video games - fine motor skills
- » Exergames - gross motor skills
- » Around since 1982



# Benefits of Exergames

- » Can be played at home
- » Achieve MVPA [Madsen '07]



# VI Exergames

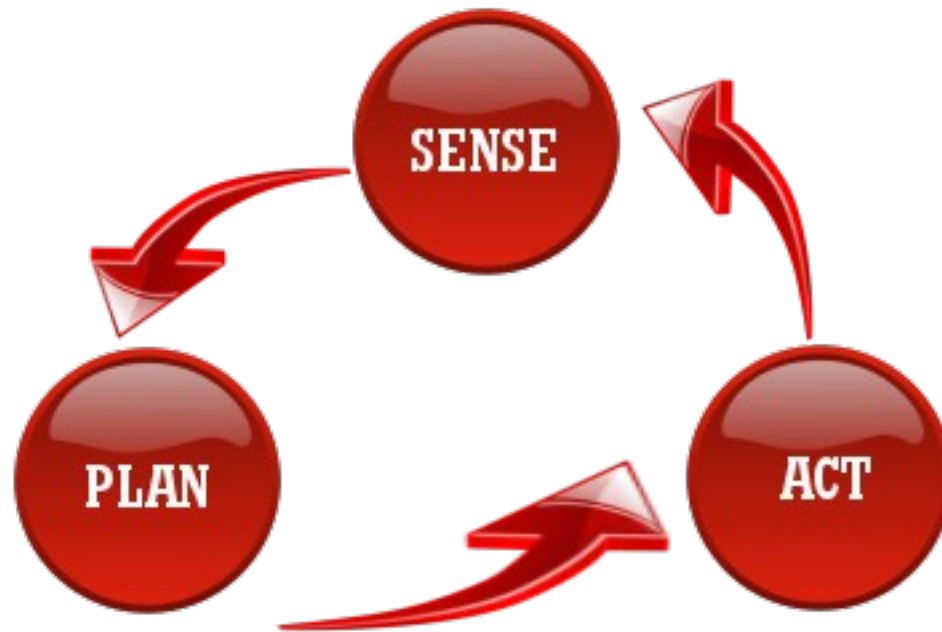
- ★ Benefits of exergames over standard exercise
  - ★ Social Benefits?
  - ★ Safety Benefits?
  - ★ Self Imposed Benefits?



# Traditional Video Games

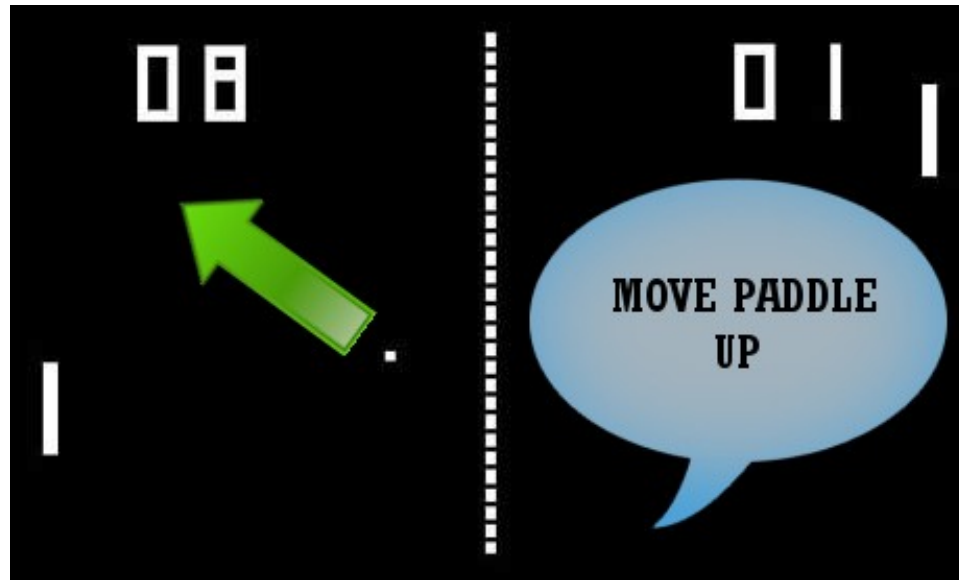
## ★ Traditional Video Game Sequence

- » Sense <= VI have difficulty with this step
- » Plan
- » Act



# VI Accessible Video Games

- » Speech and Audio cues
- » Audio Quake
- » Accessible Battleship



# Exergames and VI

- » Exergames - Visual Stimuli
- » Difficult to play with VI
- » VI Accessible Exergames
  - Could help overcome VI Exercising Barriers
  - Can audio replace video cues?



# VI Accessible Exergames

- » DDR/Eyetoy/Wii Sports
  - Primarily use visual cues
- » Audio
  - Important to game play
  - Makes the game fun
- » Replace video cues with audio
  - Is game play effected?



# Socialization of Video Games

- » Games are fun because you get to interact with others.
- » Additional Audio Cues prevent conversation
- » Could Use Haptic



# Blind Hero

- » Haptic as primary cue
- » Audio not effected



# Wii Sports

- » Sold over 45 Million Copies
- » Uses Handheld Wii Remote
- » 5 Different Games



# VI Tennis

- » Use Haptic/Audio cues
- » Based on Wii Tennis
- » Uses the Wii Remote
- » 2 Modes Audio only Haptic/Audio





# VI Tennis Vs Wii Tennis

Game Element	Wii Tennis	VI Tennis
Player Serving	visual	speech
Opponent Serving	visual+audio	speech+audio
Player Returning	visual	haptic+audio
Opponent Returning	visual+audio	audio
Ball Bouncing	visual+audio	haptic+audio

# VI Tennis

- » Camp Abilities
- » John Foley and Lauren Lieberman
- » Energy Expenditure and Game Performance measured
- » Kids played audio and haptic/audio versions

# Participants' Characteristics

Characteristic	All (n=13)
Gender (M/F)	9/4
Age( <i>years</i> )	12.6(2.5)
Height (m)	1.54(0.1)
Weight(kg)	53.2(17)
Body Mass Index (kg/m <sup>2</sup> )	22.0(5.4)

# VI Tennis

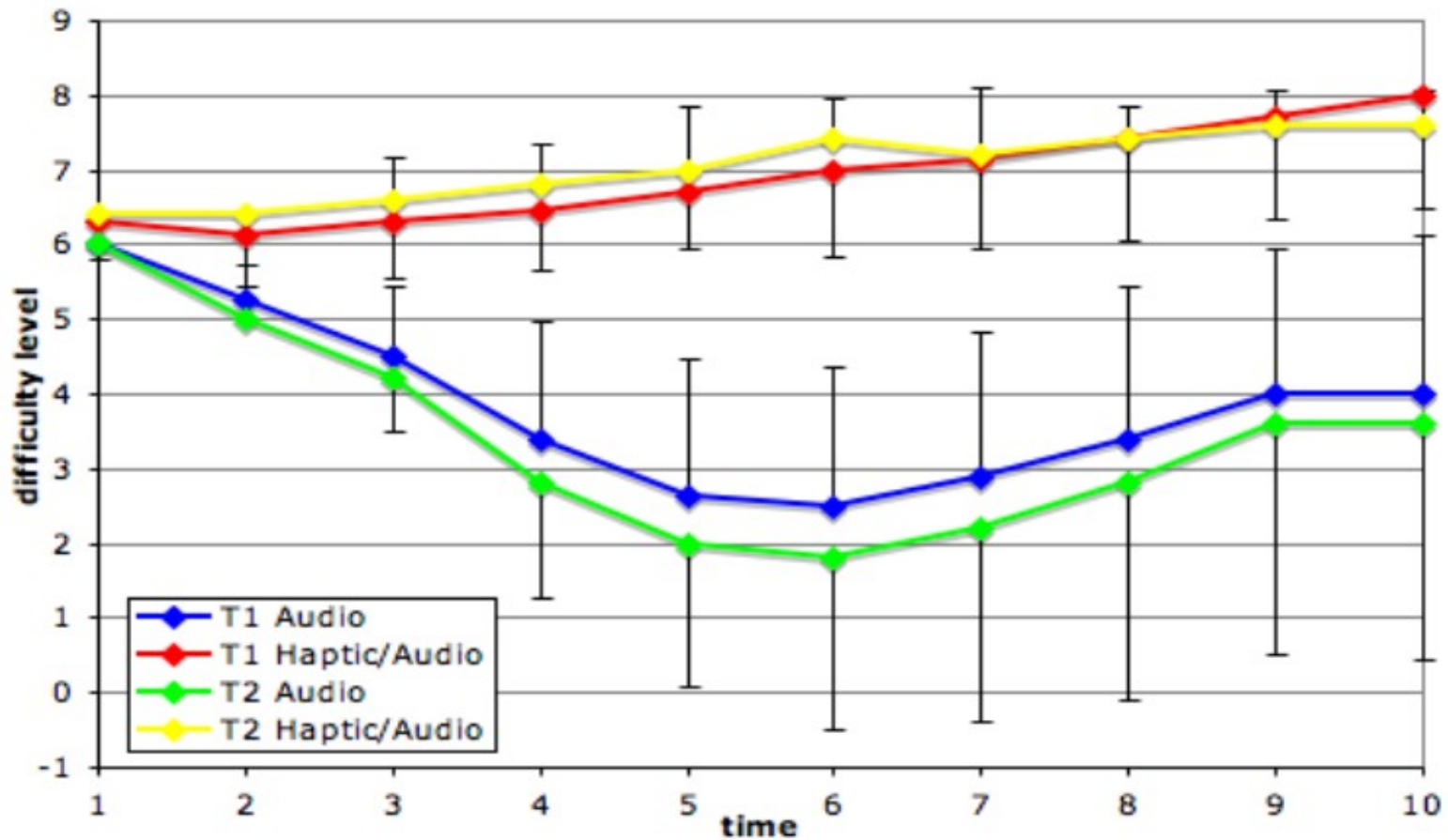
## Average Active Energy Expenditure

Kcal/Kg/Min	T1	T2	Avg
Audio	3.56(1.1)	4.49(2.0)	3.99(1.6)
Audio+Haptic	4.70(2.3)	3.47(1.0)	4.03(1.8)

## Total Time Spent In MVPA

Minutes	T1	T2	Avg
Audio	9.71(0.5)	9.5(0.8)	9.62(0.7)
Audio+Haptic	9.83(0.4)	9.71(0.5)	9.77(0.4)

# VI Tennis Camp Abilities



# VI Tennis Camp Abilities

## ★ Results

- » MVPA achieved (More to the Moderate)
- » Audio vs Haptic/Audio No significant difference in energy expenditure
- » Audio/Haptic produced higher scores
- » Audio/Haptic subjectively more fun

# VI Tennis Camp Abilities

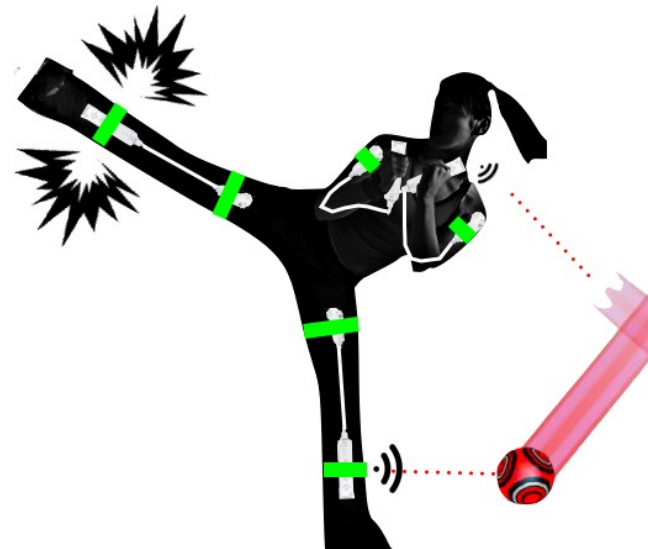
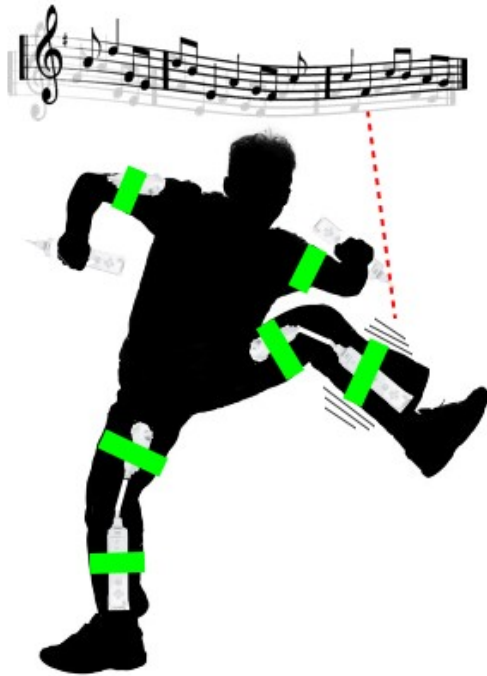
## ★ Results

- » Haptic/Audio is a viable strategy for VI accessible exergames



# Research Questions

- » How do you engage users in higher MVPA?
  - Pattern Matching Games
  - Sports Games
  - Full Body Exercise





# Research Questions

- » Can we add extra game elements to increase the energy expenditure?

# Research Questions

- » Can techniques for motor learning be created using haptic/audio cues?

# Research Questions

- » Can exergames overcome the Social, Safety, and Self-Imposed barriers of VI?

# Research Questions

- » Can we increase cognitive skills in VI through exergames?

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