Virtual Reality Simulators: Valuable Surgical Skills Trainers or Video Games?

Ross E. Willis, PhD
Srinivas J. Ivatury, MD
Pedro Pablo Gomez, MD
Hari S. Mitra, BS
Kent R. Van Sickle, MD

University of Texas Health Science Center at San Antonio
Comparison

**Physical Model**
- Actual 3D objects
- Video projection
- Haptic feedback
- Rudimentary metrics
- $1500 - $10,000

**Virtual Reality**
- Computer-driven 3D objects
- Computer-driven haptic feedback
- Advanced metrics
- $40,000 - $150,000
Virtual Reality and Video Games

Virtual Reality Sim

Video Game
Research: Physical Model and Video Games

• Found significant correlations:
  – Badurdeen et al. – laparoscopic
  – Rosser et al. – laparoscopic

• Did not find significant correlations:
  – Rosenberg et al. – laparoscopic
  – Harper et al. – da Vinci robot
  – Willis et al. – laparoscopic
  – Madan et al. – laparoscopic
Research: Virtual Reality and Video Games

• Found significant correlations:
  – Schlickum et al. – laparoscopic
  – Hogle et al. – laparoscopic
  – Shane et al. – laparoscopic
  – Enochsson et al. – colonoscopy
  – Glaser et al. – endosinus
  – Hislop et al. – endovascular

• Did not find significant correlations:
  – None?
• Visual perceptual system processes computer-generated images differently than camera-projected images
Kober et al. – EEG patterns differed for 2D and 3D VR environments

Even greater differences between virtual reality and physical models?
Purpose

• Determine whether relationships exist among virtual reality, physical model, and video games

• Experiment 1
  – Laparoscopic camera navigation

• Experiment 2
  – Colonoscopy
Hypotheses

• Video games would correlate with virtual reality, but not with physical model
• Virtual reality performance would not correlate with physical model performance
Experiment 1: Laparoscopic Camera Navigation
Methods

• n = 20 MS1 & MS2 lap camera nav novices
• 3 trials of fine motor skills video game
• 3 trials of each virtual reality lap camera nav (0° and 30°)
• 3 trials of each physical model lap camera nav (0° and 30°)
• Counterbalanced
• 1st 2 trials considered warm-up
Marble Mania Level 11
Physical Model Lap Camera Nav
Tulane Trainer (Korndorffer et al.)
## Results

<table>
<thead>
<tr>
<th></th>
<th>Fine Motor Skills Video Game Level 2</th>
<th>Fine Motor Skills Video Game Level 11</th>
<th>Fine Motor Skills Video Game Level 12</th>
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<tbody>
<tr>
<td>Virtual Reality 0°</td>
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<td><img src="image" alt="X" /></td>
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<td>Virtual Reality 30°</td>
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<td><img src="image" alt="Time: p&lt;.001, Tip Traj: p=.005" /></td>
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<tr>
<td>Physical Model 0°</td>
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<td>Physical Model 30°</td>
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</table>

No significant correlation between virtual reality and physical model performance.
Experiment 2: Colonoscopy
Methods

• n = 20
• New MS1 & MS2, colonoscopy novices
• Fine motor skills video game levels 2, 11, 12
• Counterbalanced for order of virtual reality & physical model
• 2 trials, 1\textsuperscript{st} trial considered warm-up
Virtual Reality Colonoscopy
Simbionix GI Mentor II (Case 5)
Physical Model Colonoscopy
Kyoto Model (Case 1)
No significant correlation between virtual reality and physical model performance
Conclusions
Conclusions

• Fine motor video game skills correlate with virtual reality sim performance
• Virtual reality sim performance does not correlate with physical model sim performance
• Virtual reality sims = video games?
• Fried et al. – “Residents sometimes learn bad habits that give them good scores [on VR sims]. It is a little like a video game.” Annals of Surg (2004)
Questions?

Don’t worry, sir. You’re in good hands. I got mad skillz in Crysis 3.