Are Video Game Players Better at Laparoscopic Surgical Tasks?

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Statistics

- Video game sales in the US approached $10 billion and $20 billion worldwide in 2002[1]

1. Howard, USA TODAY, 12/23/2002

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Statistics

- 94% of adolescents play video games for an average of 9 hours per week (13 hours for boys)[1]
- Average age of a video gamer is now 29 years old[2]

1. Gentile DA, Lynch PJ, Linder JR, Walsh DA; *Journal of Adolescence*, 2003
2. Interactive Digital Software Association; URL *www.idsa.com*

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Special Report

By Jo Cavallo

From the Screen to the Street

Do Video Games Encourage Violence?

November 2, 2002, started off like most other Saturday mornings for Mickey Mishne. A cofounder of the Medina Toy and Train Museum in Medina, Ohio, Mishne looked forward to the weekends, when he could spend time planning new exhibits at the museum, where he would often meet up with his daughter, JoLynn, 17, before taking her shopping or out to dinner. When he left the house that morning everything seemed in order. Mishne stopped by JoLynn's room to give her a hug and kiss good-bye and confirm their plans to meet at the museum later that day. "JoLynn said, 'I love you, Dad,' and then she repeated, 'I love you, Dad.' Those were the last words I heard her say," says Mishne.

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Negative Effects
of Video Games from Previous Studies

Video gaming has been correlated with:

- Decreased Academic Performance[1]
- Decreased Prosocial Behavior[2]
- Aggressive Thoughts, Feelings, Behavior[2]

1. Gentile DA, Lynch PJ, Linder JR, Walsh DA; *Journal of Adolescence*, 2004
2. Gentile DA, Anderson; *Media Violence and Children*, 2003

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Negative Effects
of Video Games from Previous Studies

Video gaming has been correlated with:

- Smoking[1]
- Obesity[2]
- Physiological Arousal (SBP, DBP, HR, Epi, NE, Testosterone)[3,4]

1. Kasper et. Al., 1999
2. Subrahmanyam K, et. Al.; *Future child*, 2000
3. Lynch, PJ; *Psychosomatic Medicine*, 1994
4. Lynch, PJ; *Psychosomatic Medicine*, 1998

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Factors influencing the long-term effects of video games

- **Amount:** amount of time spent playing video games
- **Content:** e.g. violence, educational, sexual content, etc.
- **Form:** formal features that define video game play, including aspects of video game design
- **Mechanics:** game controllers are similar to controls in other domains – i.e. playing driving simulators with a steering wheel should transfer better than playing with a mouse

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Positive Effects
of Video Games from Previous Studies

- Early Studies evaluated psychomotor skills vs. survey review of Video Game activity

  Video gamers showed:
  - superior eye-hand coordination[1]
  - faster reaction times[2]
  - superior spatial visualization skills[3]
  - increased capacity for visual attention and spatial distribution[4]

1. Griffith, Voloschin, Gibb, Bailey; *Perceptual and Motor Skills*,1983
2. Yuji H; *Perceptual and Motor Skills*, 1996
3. Dorval, Pepin; *Perceptual and Motor Skills*, 1986
4. Green, Bavelier; *Nature*, 2003

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Hypotheses

- Surgeons with past video game experience will perform better in a standardized laparoscopic skill and suturing program
- Video games are correlated with better performance in a standardized laparoscopic skill and suturing program

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Methods and Materials

- 33 Surgeons (21 residents and 12 attending physicians) participated in this study at Beth Israel Medical Center in New York City from May-August of 2003
- The study design centered around The Rosser “Top Gun” laparoscopic skills and suturing program

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Demographics

Attending/Resident	12 / 21
Years of Experience in Surgery (Attending/Resident)	12.9 / 3.1
Number of Laparoscopic cases (average: Attending / Resident)	239 / 46
Specialty (General surgery / Urology / OB-Gyn)	22 / 2 / 9
Dominant hand (raw: left / right)	3 / 30

* Male/Female **15/18**

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Methods and Materials

- The goal of the Top Gun course is to establish a fundamental skill set in the laparoscopic arena and teach surgeons to place intracorporeal sutures
- This program has a large data base of thousands of surgeons from around the world
- It uses an inanimate electronic proctor that controls for economy of movement errors in addition to time
- Preparatory drills can establish a skill set which can lead to more effective laparoscopic suturing capabilities

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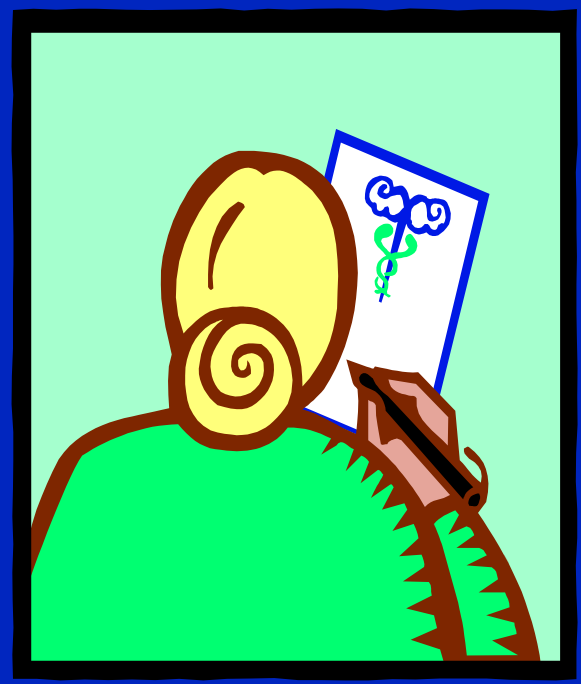
Methods and Materials

This study consisted of three elements – all subjects participated in each one

Element one: Questionnaires

- Video game play
- Surgical specialty
- Years of Surgery experience
- Number of Laparoscopic cases
- Sex
- Hand Dominance



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Element Two: Top Gun Laparoscopic Skill and Suturing Program

Preparatory drills

- Terrible triangle
- Cobra rope
- Slam Dunk

Clinical Tasks

- Intracorporeal suturing

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Drill Goals

The drills emphasized:

- Non-dominant hand dexterity
- Two-handed choreography
- Targeting
- 2-D Depth Perception skills

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Element Three:
Video Games

Games were chosen based on perceived correlation with laparoscopic skills and suturing

- Fine motor skills/Reaction time
- Eye-hand coordination
- Non-dominant hand dexterity
- Two-handed choreography
- Targeting
- 2-D depth perception compensation

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Element Three:
Video game tasks

Other Factors:

- Novel
- Lack of “bonus scores”
- Gender neutral

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RESULTS

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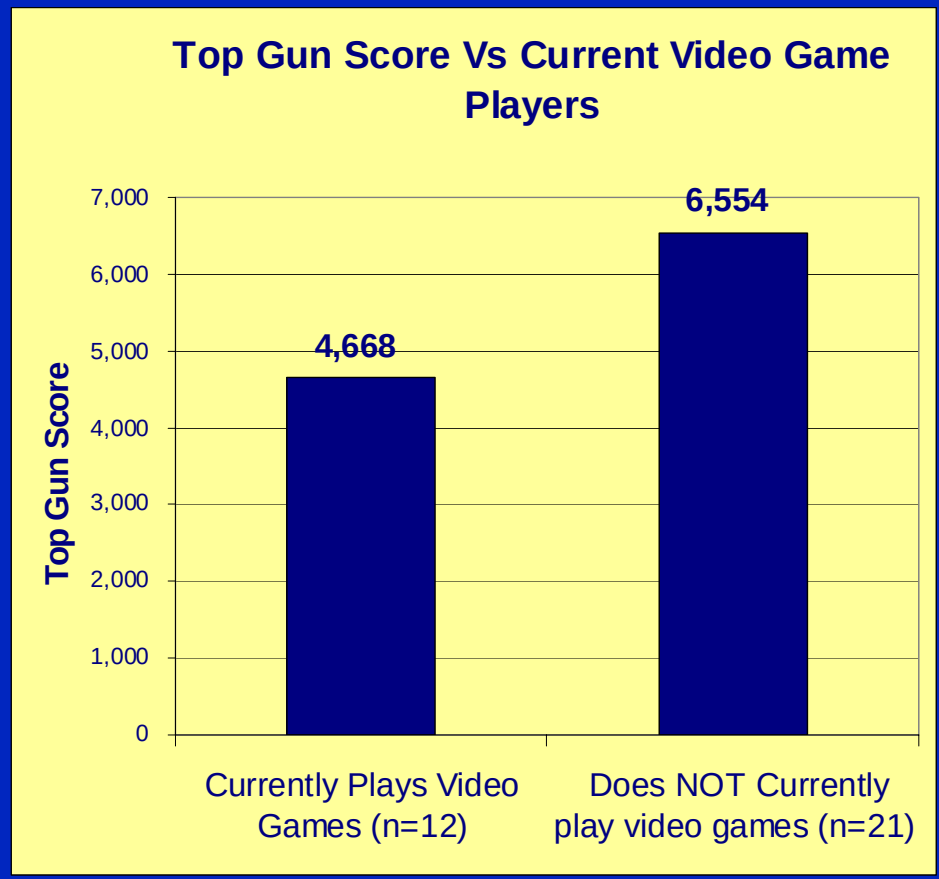
Current Gamers vs. Non-Gamers

- Top Gun scores expressed as total time – the lower the score the better
- Current Video-Gamers scored 40% better overall in the Top Gun suturing course ($p < 0.01$)*



*Independent measures t-test

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Past Video Game Experience and Suturing Skill

- Surgeons who have played video games in the past were 33% better at laparoscopic drills and suturing ($p<0.005$)*
- Surgeons with past max participation of >3 hours per week were 42% better at laparoscopic drills and suturing ($p<0.01$)*

* Analysis of variance (ANOVA)

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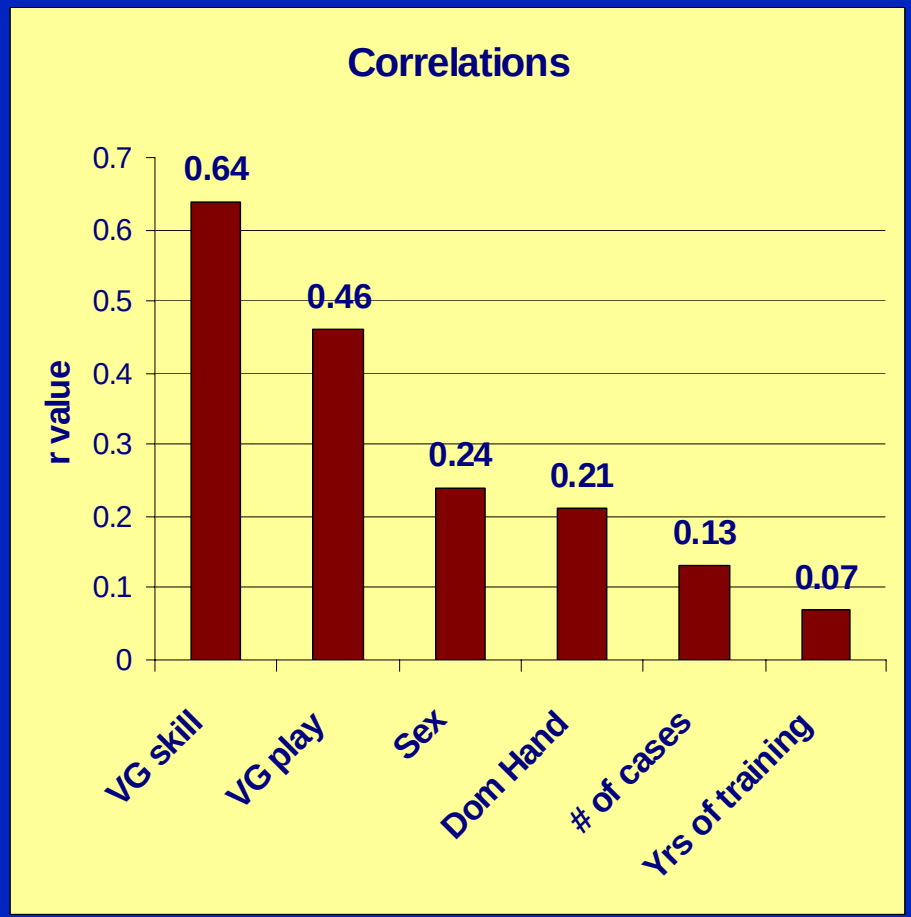
Correlations

- With multiple factors considered, only current demonstrated video game skill ($p < 0.001$)* and past experience with video games ($p < 0.01$)* were correlated with proficiency at laparoscopic drills and suturing



*Pearson's correlation coefficient

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Total Errors and Past Video Game Play

- If subjects played video games for > 3 hours per week, they had 37% fewer errors than those who never played ($p < 0.02$)*

*Analysis of Variance (ANOVA)

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Total Time and Past Video Game Play

- If subjects played video games for more than 3 hours per week, they were 27% faster at laparoscopic drills and suturing tasks ($p < 0.03$)*

*Analysis of Variance (ANOVA)

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Regression Analysis

Video game skill and past experience with video games are significant predictors of laparoscopic skills and suturing capability after controlling for sex, years of medical training and # of laparoscopic cases performed (p <0.01)

Step	Variable Entered	Change in R^2	Beta	*F* Change (*df*1, *df*2)	Sig. *F* Change
1	Years of Training	.005	-.05	.1 (1, 31)	.71
2	# of Lap Cases	.012	-.18	.4 (1, 30)	.55
3	Sex of Participant	.048	-.07	1.5 (1, 29)	.23
4	**Amount of VG Play**	.159	.11	5.7 (1, 28)	**.03**
5	**Video Game Skill**	.218	-.76	10.5 (1, 27)	**.00**

Total $R^2 = .44$ ($F(5,27) = 4.3$, $p < .01$)

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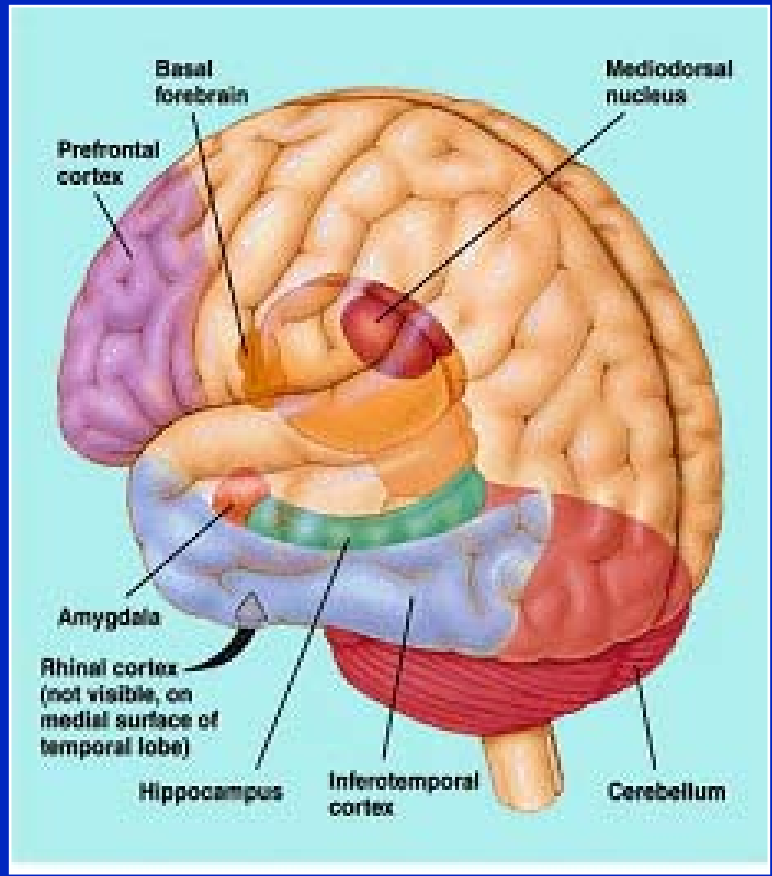
NeuroPhysiology

- During video game play, there are substantial increases in Dopamine release in the striatum and prefrontal cortex - areas associated with eye-hand coordination[1]
- Dopaminergic neurotransmission is also involved in learning, reinforcement of behavior, and attention[1]



1. Donkelaar, Lee, Drew; *Human Movement Science*, 2002

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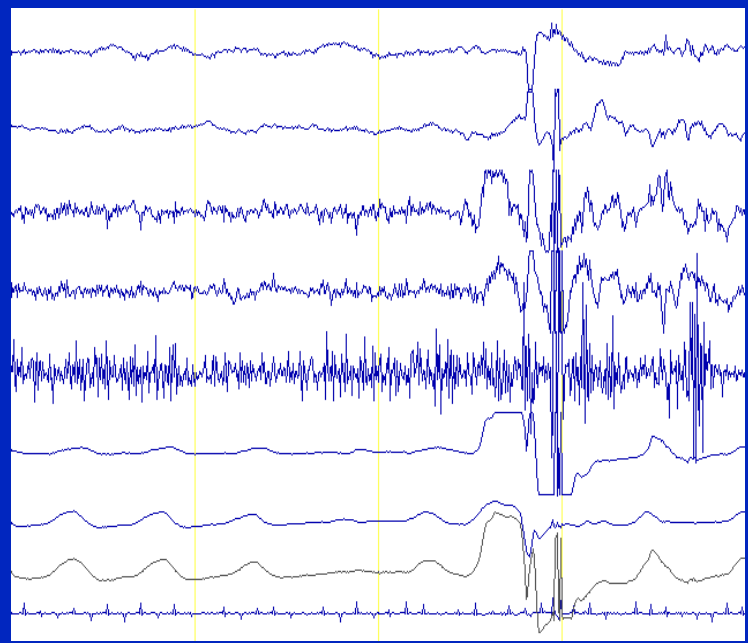
NeuroPhysiology

- EEG studies have shown that practice of any task yields efficiency – suggesting neural reorganization that accompanies skill acquisition[1]
- This indicates that many areas of the brain involved in task-related activation are not stable[1]



1. Smith, McEvoy, Gevins; *Cognitive Brain Research*, 1999

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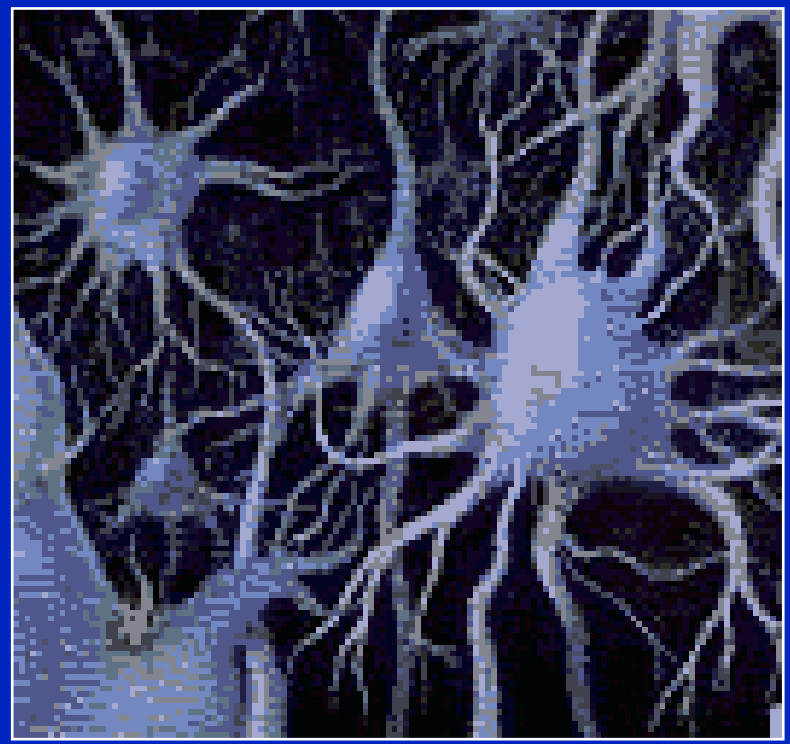
NeuroPhysiology

- With significant video game play neural pathways may develop such that eye-hand coordination and visual depth perception skills are honed and then later available for skills development similar to those show-cased during the “Top Gun” and laparoscopic surgery



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Advantages of using video games in surgical training

- Cost effective platform of training and skill development
- Wide availability and portability
- Future physician recruitment of Generations X and Y
- Error prevention and reduction implications

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Future Direction

- Using video games to “warm-up” before minimally invasive surgical procedures
- Surgery specific video game development

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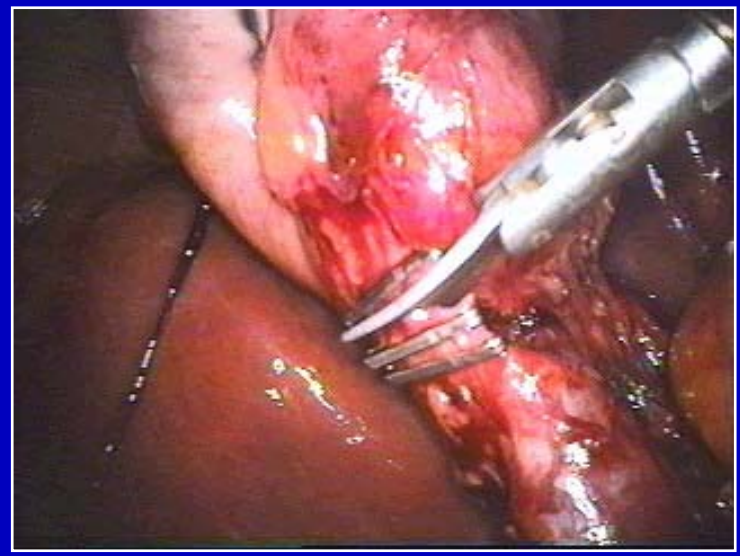


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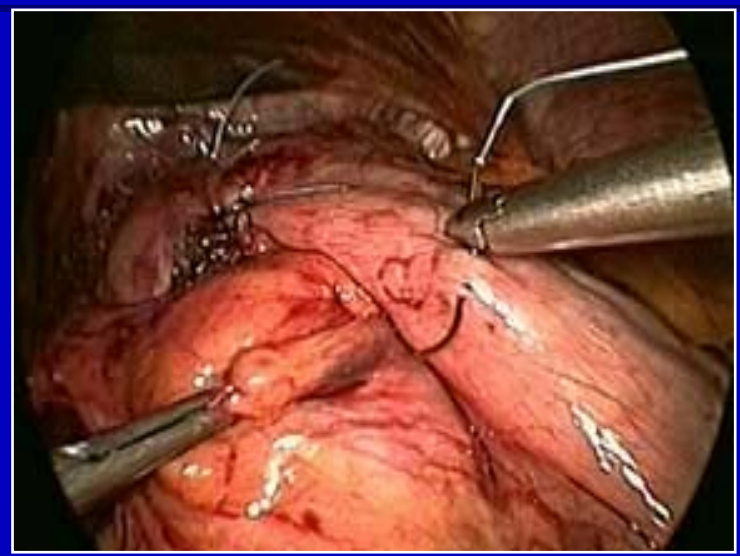

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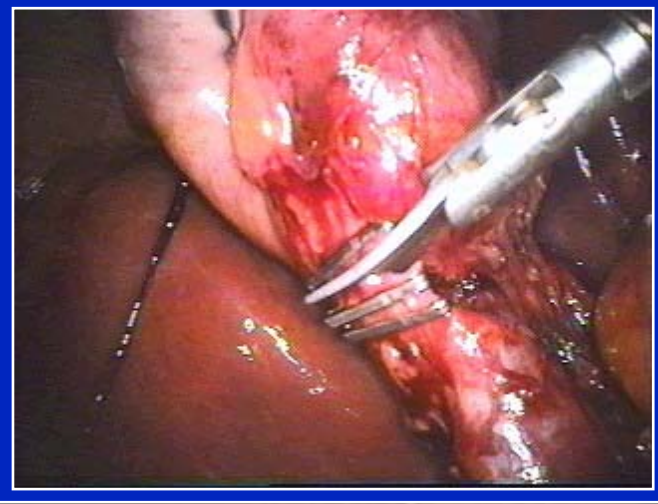
Discussion

- Initially, it is somewhat surprising that laparoscopic experience is not more highly correlated with Top Gun scores
- And that video games are a better predictor of intra-corporeal suturing ability
- Possibly due to the fact that many laparoscopic surgeries do not require advanced techniques



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Why are Video Game Simulators Important?

- Performance of a specific task has been shown to improve with video game-like simulators
  - Driving[1]
  - Flying airplanes
  - Golf[2]

1. Walter, Vetter, Grothe, Wunderlich, Hahn, Spitzer; *Neuroreport*, 2001
2. Fery, Ponserre; *Ergonomics*, 2001

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Why alternatives to traditional training models are necessary…

Follow examples set by the US military, the airline industry and the aerospace industry

- Error prevention
- Cost effectiveness
- Eliminate ethical issues surrounding use of live animal models
- Embrace and incorporate new technology

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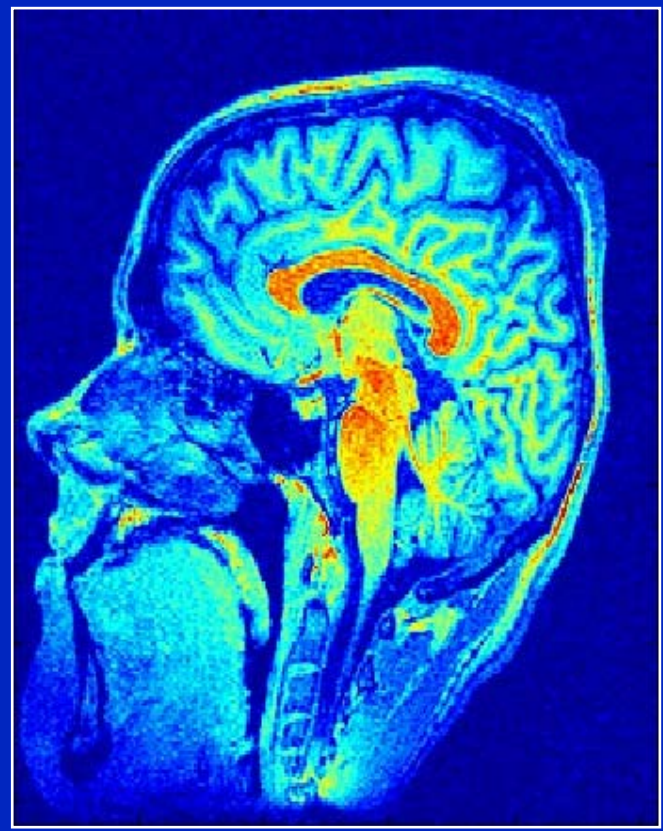
NeuroPhysiology

- Dopamine release during video game play is involved in establishing learning pathways that are further enhanced by practice.



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