

# *Why simulators are a good training model*

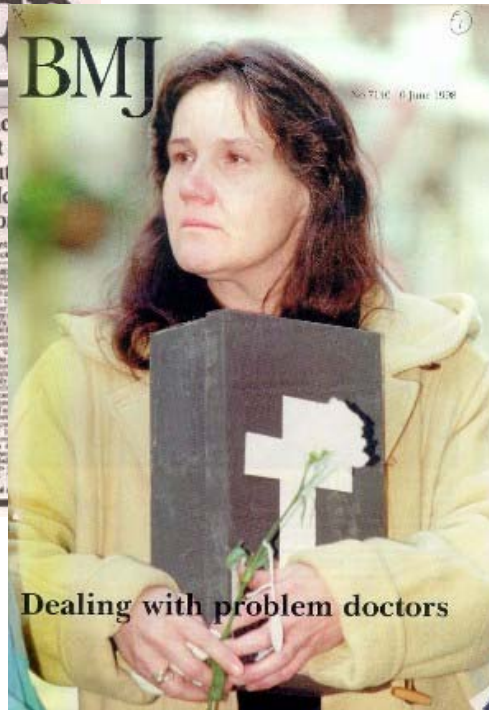
*Nick Cheshire*

*Professor of Vascular Surgery*

*Vascular Unit  
St Marys Campus*



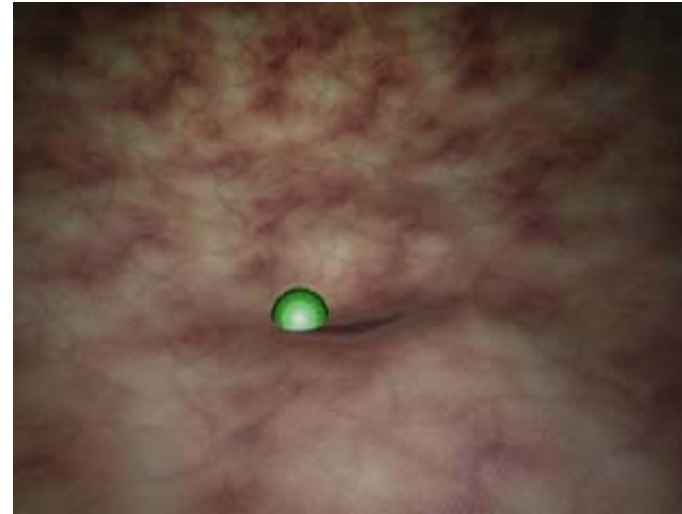
# Changing Society; Evolving Surgery



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# VR laparoscopic simulators

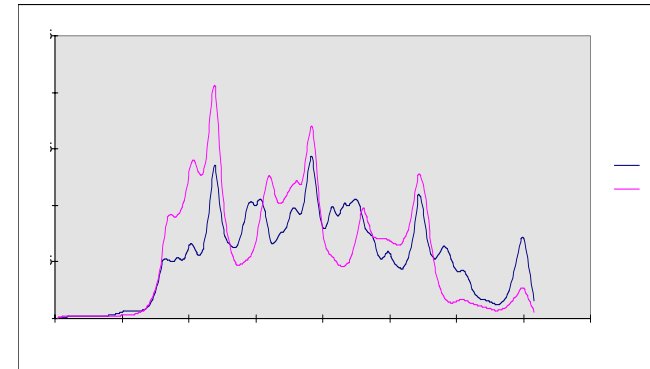
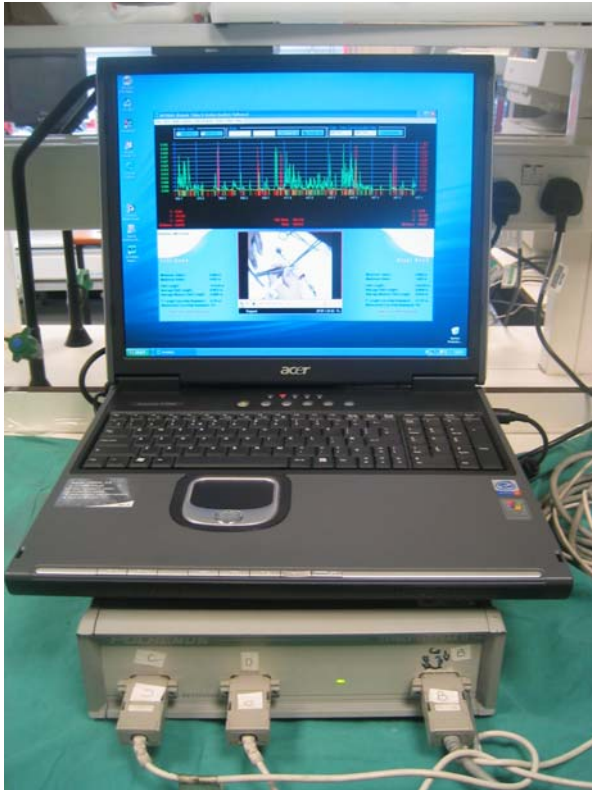


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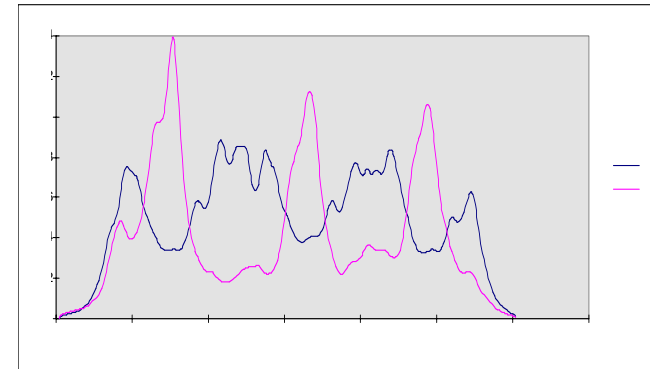


# Imperial College Surgical Assessment Device (ICSAD)

## Hand motion analysis



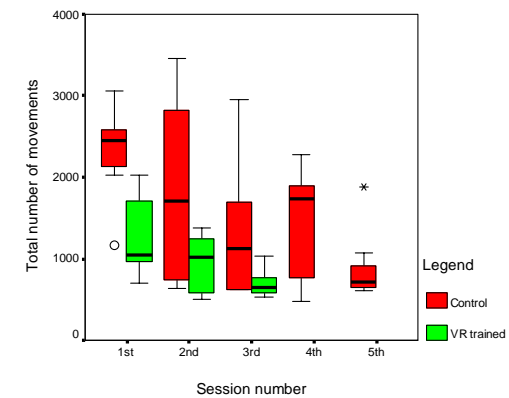
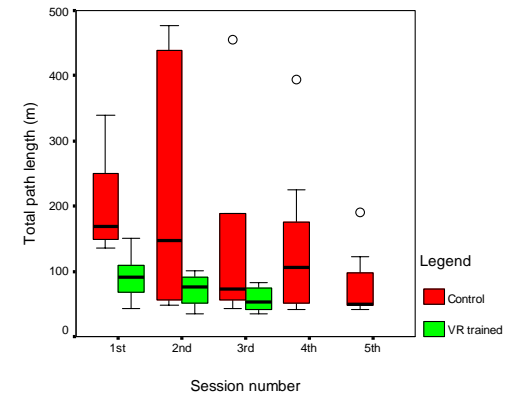
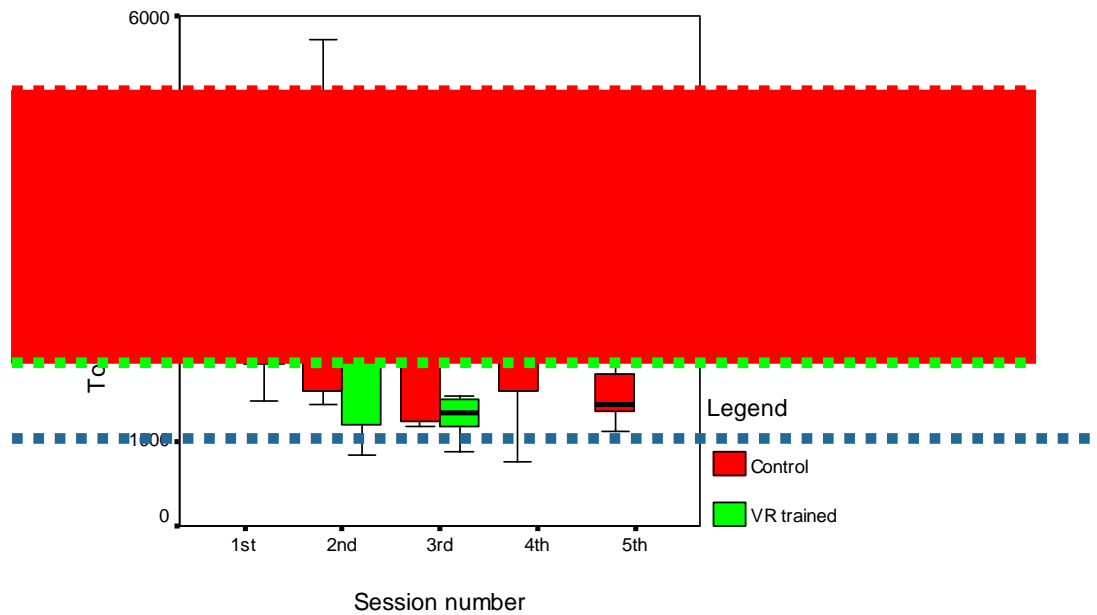
Inexperienced



Experienced *Vascular Unit  
St Marys Campus*



# Learning curves – Motion analysis



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4. Blum MG, Powers TW, Sundaresan S. Bronchoscopy simulator effectively prepares junior residents to competently perform basic clinical bronchoscopy. *Ann Thorac Surg* 2004;78:287-91.

5. Grantcharov TP, Kristiansen VB, Bendix J, Bardram L, Rosenberg J, Funch-Jensen P. Randomized clinical trial of virtual reality simulation for laparoscopic skills training. *Br J Surg* 2004;91:146-50.

6. Sedlack RE, Kolars JC. Computer simulator training enhances the competency of gastroenterology fellows at colonoscopy: results of a pilot study. *Am J Gastroenterol* 2004;99:33-7.

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# Surgeons compared with Gamers

**The Times**  
**Game experts play at life and death**

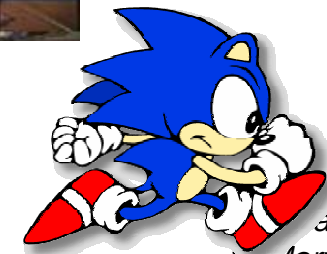


**The Daily Telegraph**  
**Game theory at the cutting edge**



**The Scotsman**

**Sonic Boom for keyhole surgery**



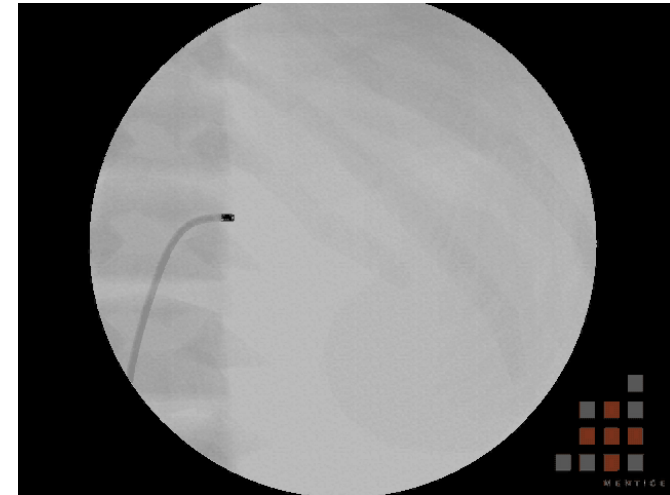
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# VR Simulation 2007

*(Mentice Sweden)*

- Modern simulators
  - Highly developed
  - Quality images
  - Haptic feedback
- Potential
  - Training
  - Grading
  - Accreditation



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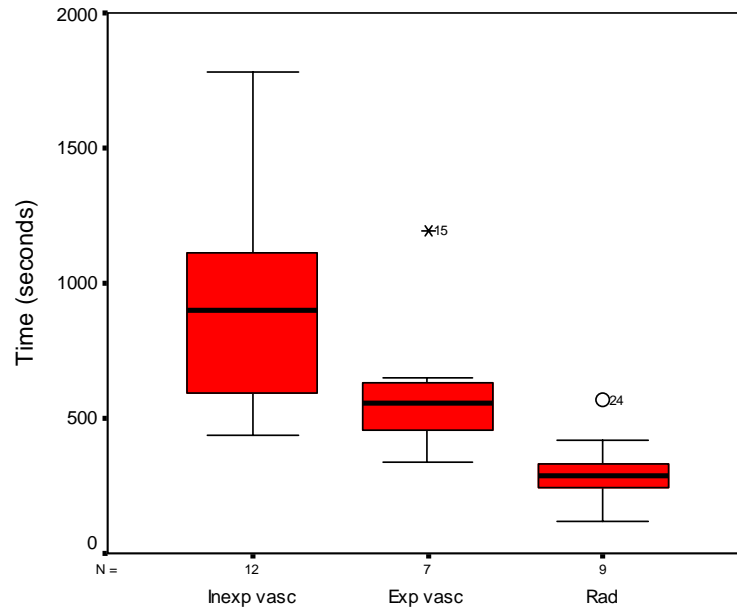




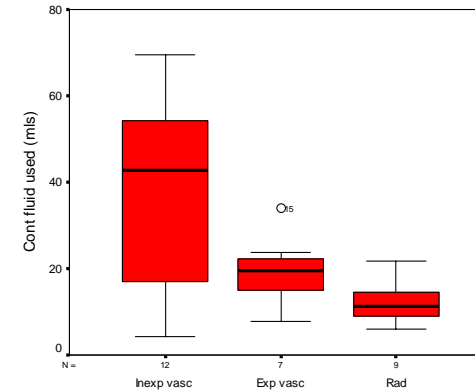
# Experienced Surgeons & Radiologists

Renal module

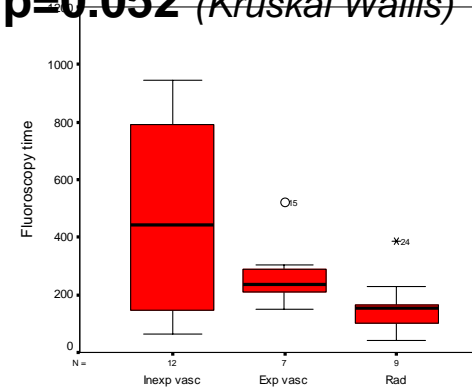
**Total time taken (secs)**  
**p=0.005** (Kruskal Wallis)



**Contrast fluid usage (mls)**  
**p=0.022** (Kruskal Wallis)



**Fluoroscopy time (secs)**  
**p=0.052** (Kruskal Wallis)

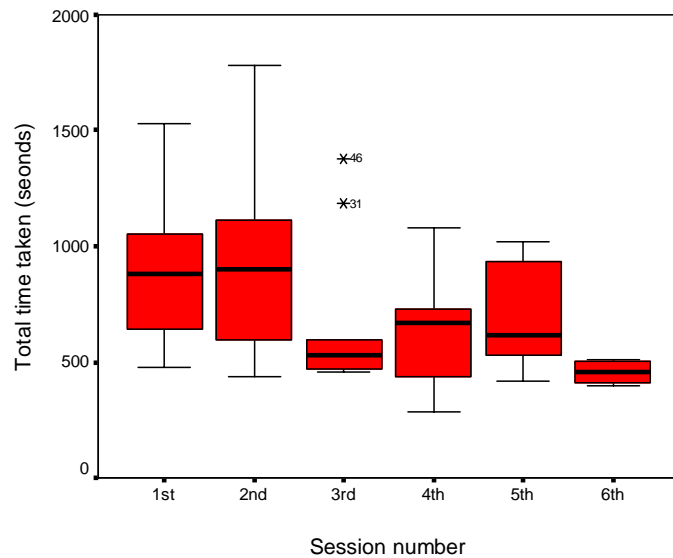


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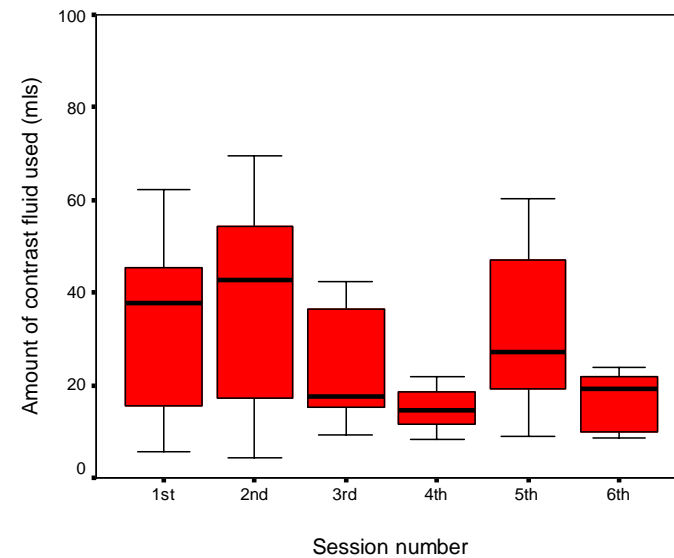
# Learning curves

*Total Time Taken (secs)*



$p=0.007$  (Friedman test)

*Contrast fluid used (mls)*

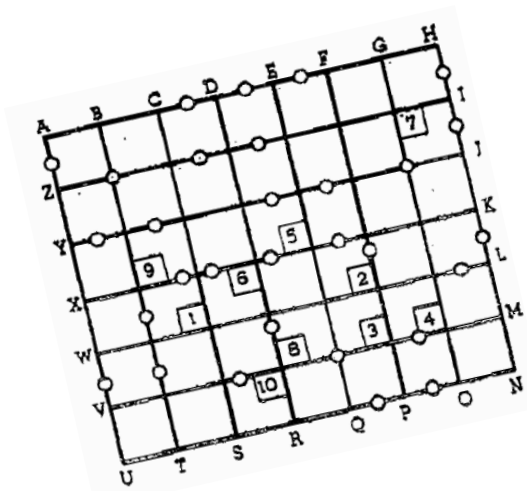
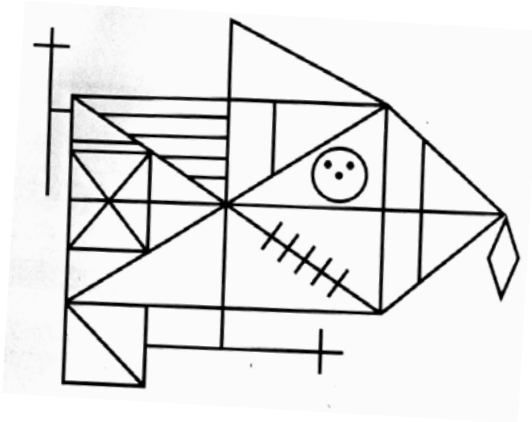


$p=0.021$  (Friedman test)

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# Testing Innate Abilities



Test
Rey-Osterrieth Complex Figure
Perdue Pegboard
Grooved Pegboard
Map Planning
Minimally Invasive Surgical Trainer

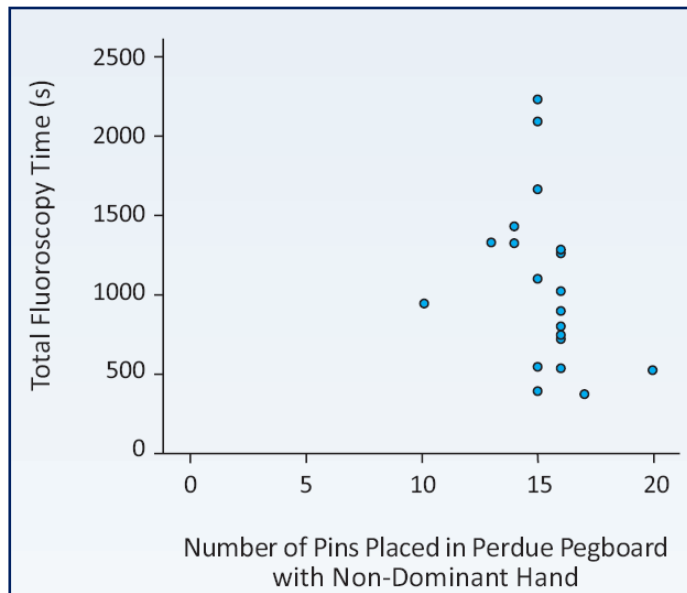




# Visuospatial ability & Performance at Initial Session

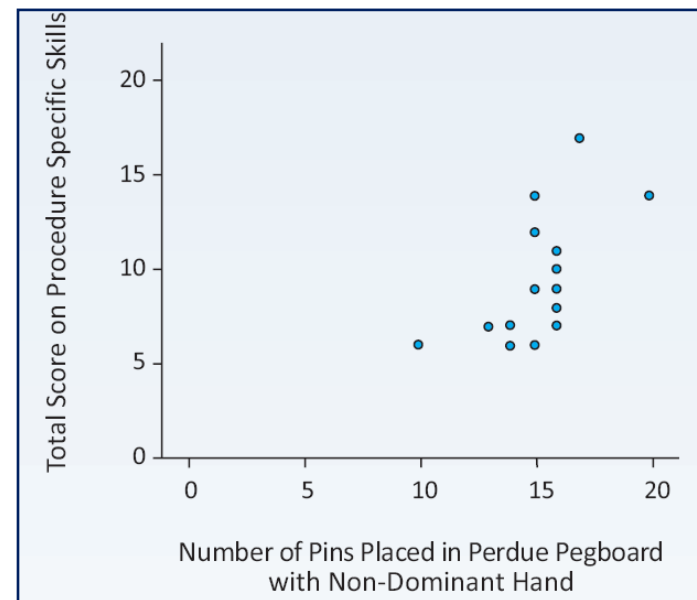
Perdue Pegboard vs. Fluoroscopy time at Initial Session

Spearman  $r=-0.564$ ,  $p=0.010$



Perdue Pegboard vs. Initial Rating with Procedure Specific Rating Scale

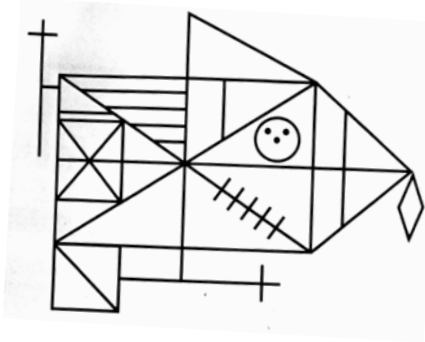
Spearman  $r=0.607$ ,  $p=0.006$



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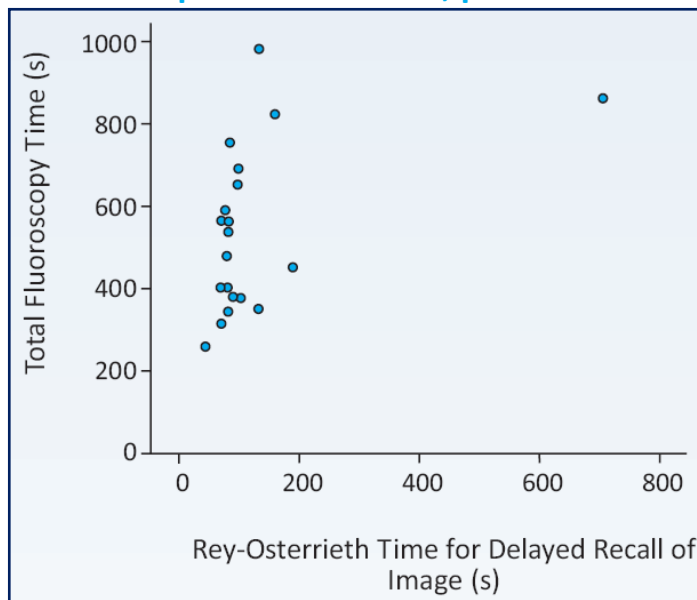


# Visuospatial ability & performance at Plateau and Final Session



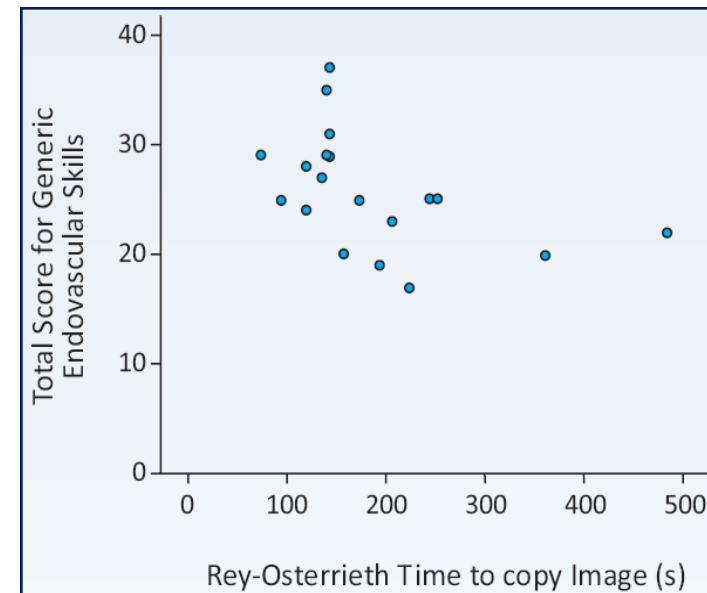
Rey-Osterrieth Test vs. Fluoroscopy Time at Plateau Session

Spearman  $r=0.632$ ,  $p=0.015$



Rey-Osterrieth Test vs. Final Rating with Generic Rating Scale

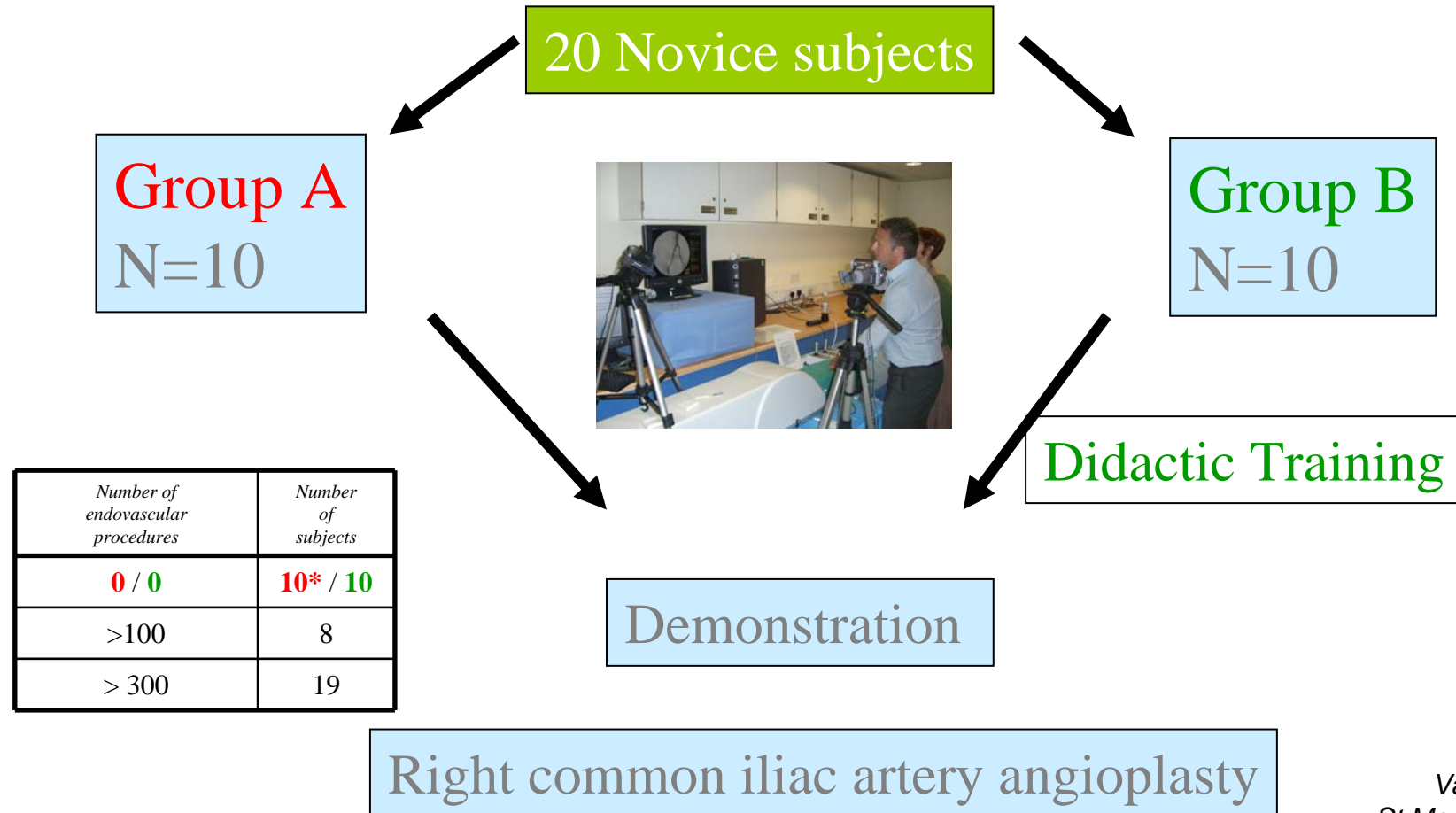
Spearman  $r=0.587$ ,  $p=0.006$



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# Effect of education on iliac angioplasty

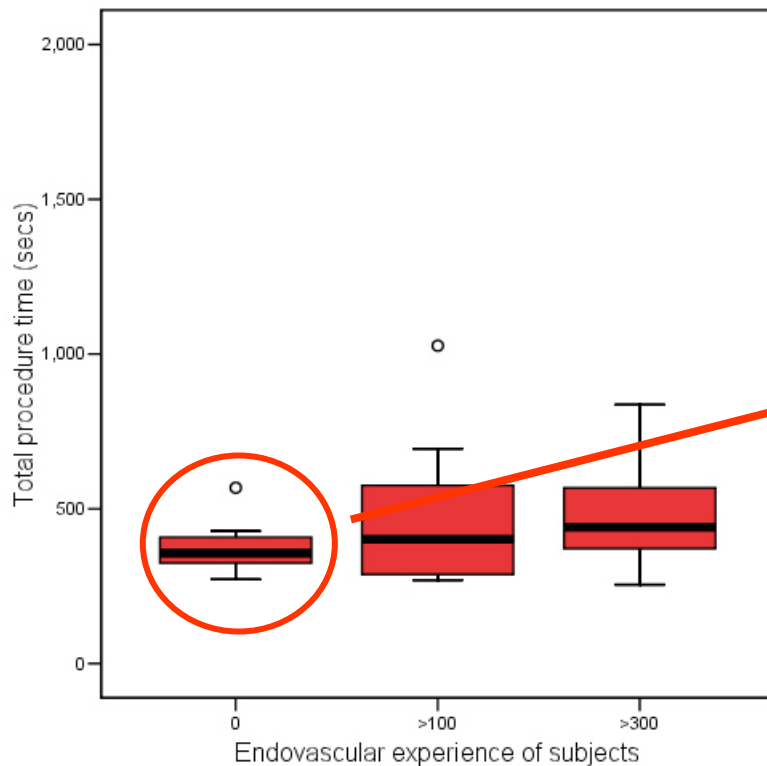


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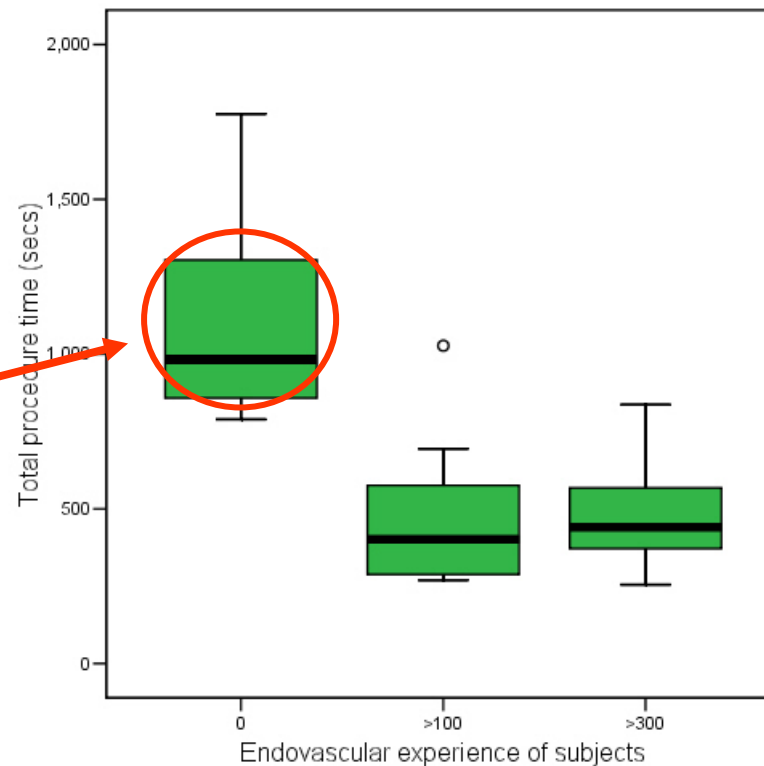


# Effects of Education

Total time taken (secs)  
 $p=0.344$  (Kruskal Wallis)



Total time taken (secs)  
 $p<0.001$  (Kruskal Wallis)



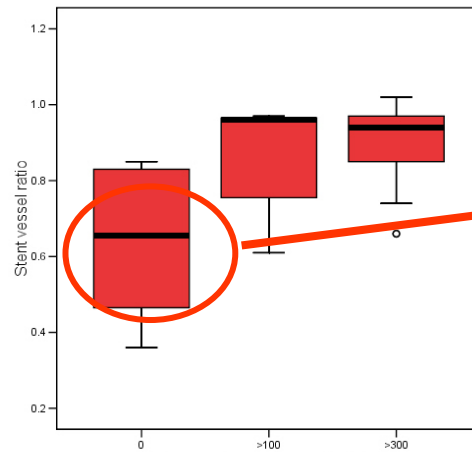
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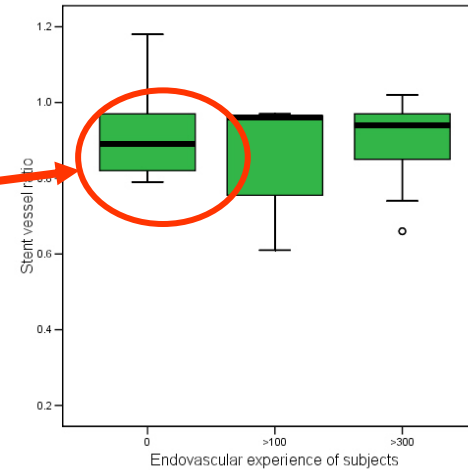
# Effects of education; Qualitative metrics

## Stent/vessel ratio

$p=0.007$  (Kruskal Wallis)

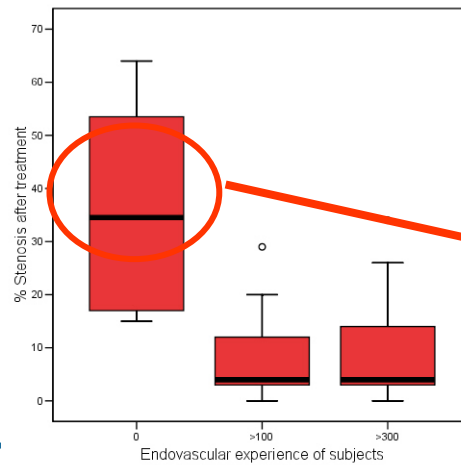


$p=0.936$  (Kruskal Wallis)

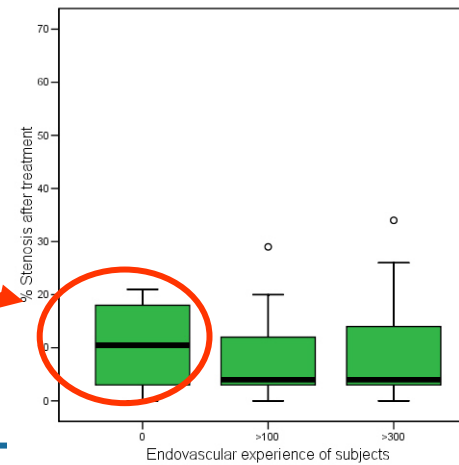


## Residual Stenosis (%)

$p=0.003$  (Kruskal Wallis)






$p=0.770$  (Kruskal Wallis)









# Carotid Stenting; Credentialing?

*Europe & USA*

CAS			
0	3	3	6
1 - 20	3	0	9
21 - 50	2	4	4
>50	1	6	4
<b>Total</b>	9	13	23



**45**  
**Interventionalists**  
 >100 endovascular  
 therapeutic cases

-  A **0 CAS** n=12
-  B **1-20 CAS** n=12
-  C **21-50 CAS** n=10
-  D **>50 CAS** n=11

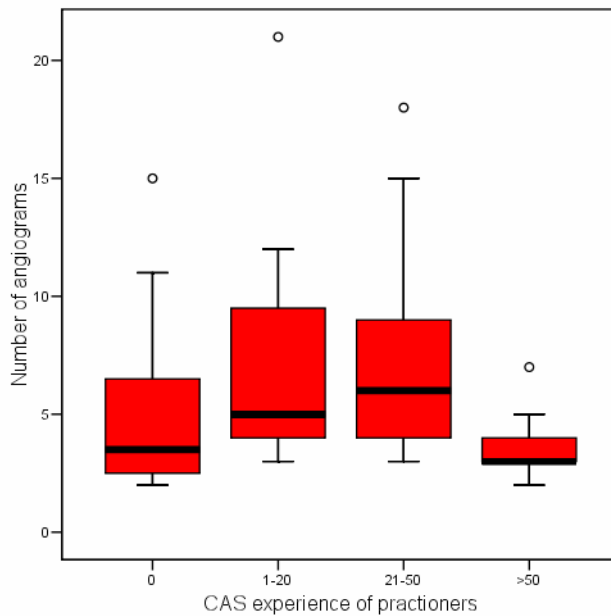
St



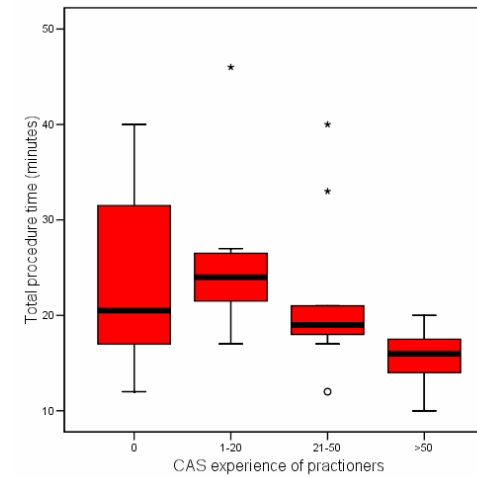
# Construct validity

## Quantitative metrics

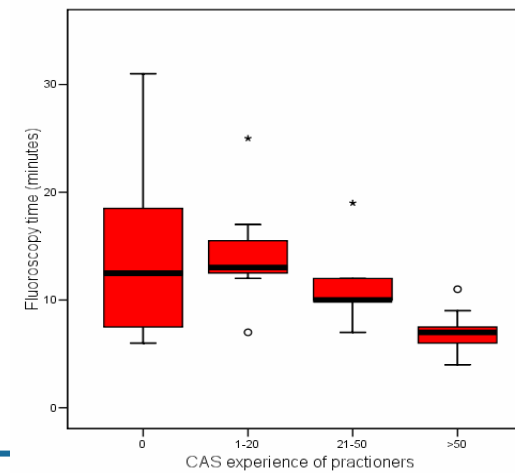
### Number of cine-loops



### Total time taken (mins)



### Fluoroscopy time (mins)

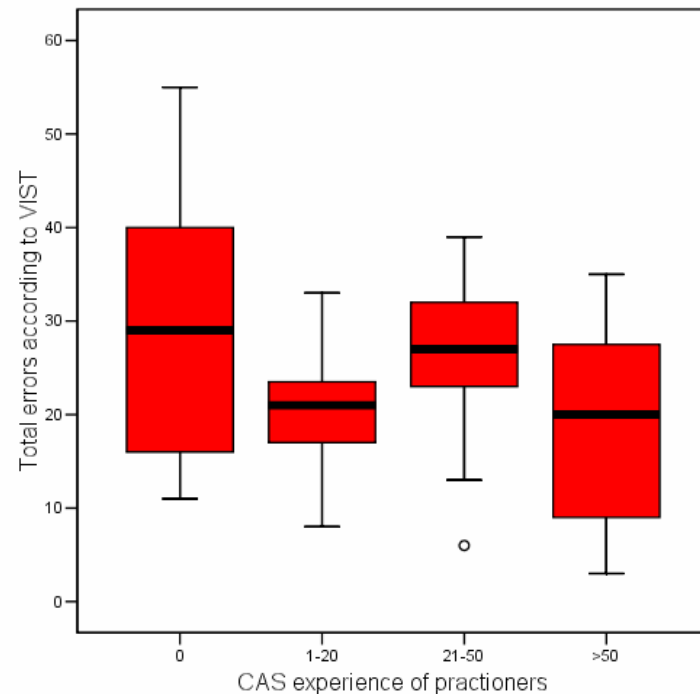


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# Error measurements

Total errors VIST  
 $p=0.209$  (Kruskal Wallis)



Other metrics recorded by VIST:  
**No** difference between 4 groups

- Errors
  - Pressing catheter against vessel wall
  - Moving catheter without wire support
  - Moving catheter/guide wire near lesion
  - Moving EPD
- Clinical parameters
  - Endovascular tools
  - % Lesion covered by balloon/stent
  - Vessel/balloon, vessel/stent ratio
  - Residual stenosis

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St Marys  
Regional  
Vascular Unit



# Video based ratings

- Error scale
- Weighted error scale
- Modified rating scales (OSATS)
  - Generic endovascular skills
  - Procedure specific endovascular skills

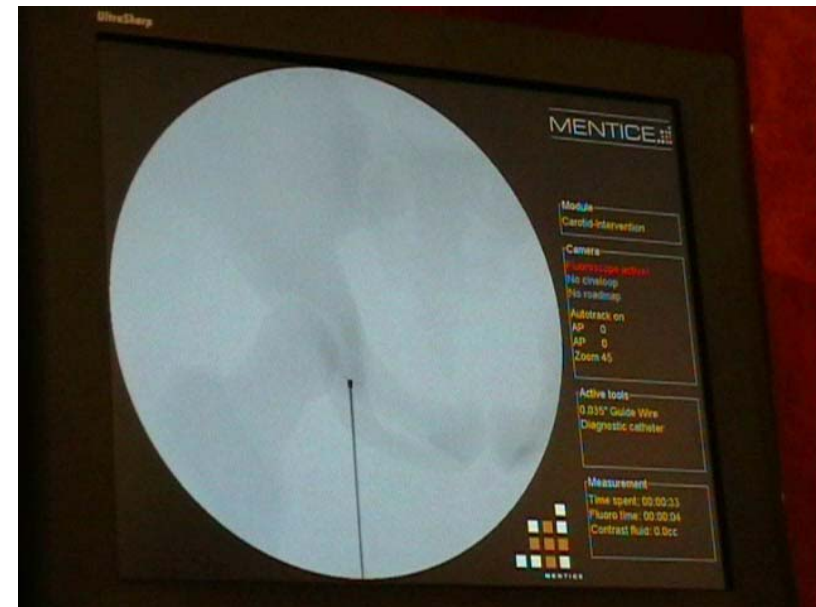


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# Modified Rating Scale: Procedure Specific

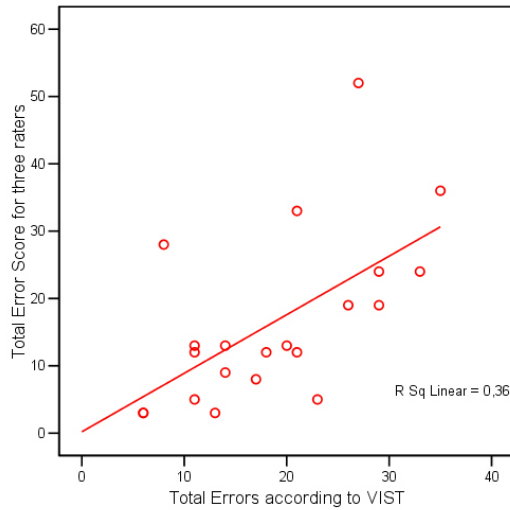
Aortic angiogram	1 Does not use guide wire to support diagnostic catheter, not advanced into ascending aorta, loses position, no positioning of C-arm.	2	3 Appropriate set up for aortic angiogram	4	5 Excellent set up for aortic angiogram, handles guide wire and diagnostic catheter expertly
Catheterise phase	1 Inappropriate choice and use of selective catheter and guide wire, pressure against wall excessively while cannulating CCA and ECA, losing position during exchanges, guiding catheter or sheath too close to lesion. Bad angle to view carotid bifurcation.	2	3 Appropriate choice and use of guide wire and selective catheters. Order of exchanges correct. Good angle to view carotid bifurcation.	4	5 Excellent choice and usage of guide wire and selective catheter. Smooth exchanges of the catheters. Perfect positioning of C-arm.
Crossing lesion phase - EPD	1 Inappropriate selection and excessive manipulation of EPD, deployed prematurely, movement of EPD after deployment. No control of correct apposition.	2	3 Proper EPD advanced carefully through lesion and correct deployment. Stable position.	4	5 Superior crossing of lesion. EPD choice, advancement, deployment, stabilization and control of apposition are perfect.
Stent-ballooning phase	1 Inadequate size or placement of stent, excessive filter manipulation, incorrect inflation and deflation, lost stent position during deployment	2	3 Accurate size and placement of stent + PTA.	4	5 Excellent covering of lesion with ideal stent, stable position of EPD and appropriate post dilation.
Retrieval of EPD	1 Quick, uncontrolled removal of EPD device, not fully closed	2	3 Competent removal of the closed EPD	4	5 Slow, controlled and atraumatic removal of the closed EPD
Quality of final product	1 Unacceptable, stenosis>30%, wrong choice and positioning of stent	2	3 Average	4	5 Superior. No stenosis, accurate choice and placement of stent
Overall performance	1 Very poor	2	3 Competent	4	5 Clearly superior
Pass rating	Would you feel confident in allowing this person to perform the procedure, under supervision, on a real patient, in IRS?				Yes/No



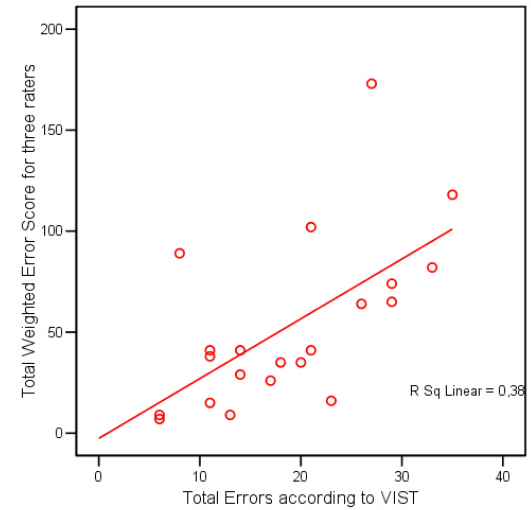
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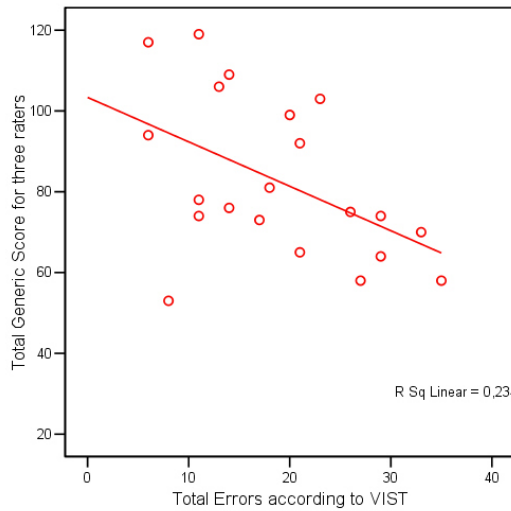
**$r=0.611$ ,  $p=0.002$**



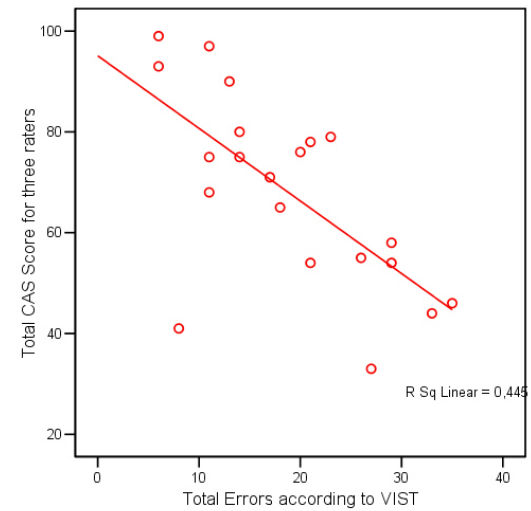
**$r=0.640$ ,  $p=0.002$**



**$r=-0.488$ ,  $p=0.025$**



**$r=-0.611$ ,  $p=0.003$**

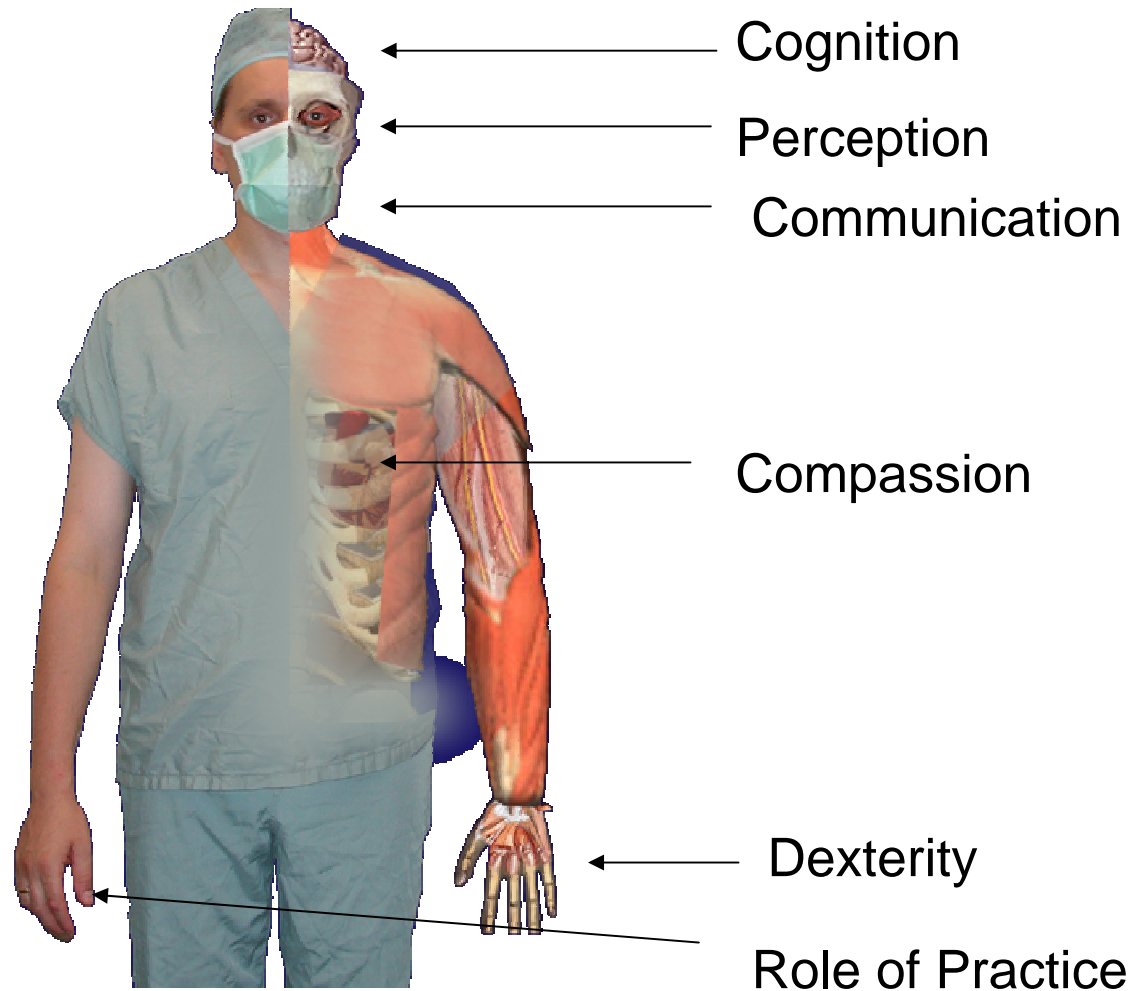


**Spearman correlation**

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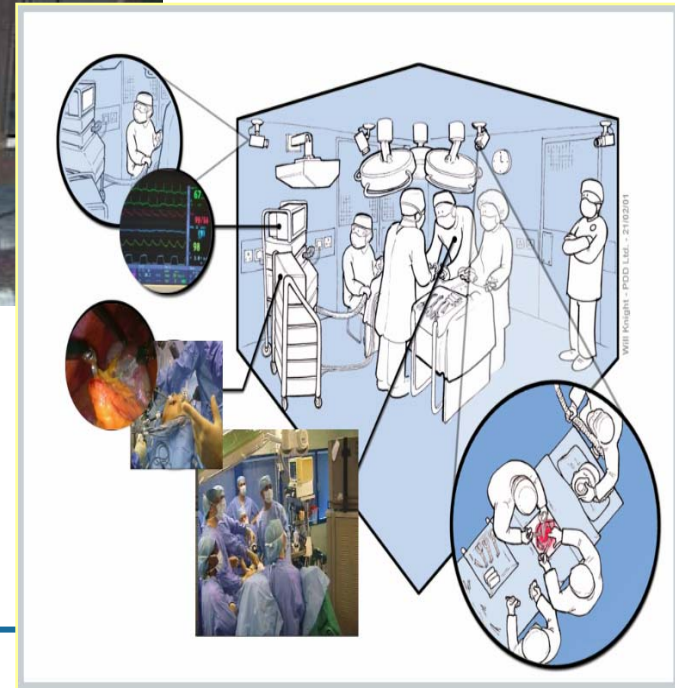


# Anatomy of a Surgeon



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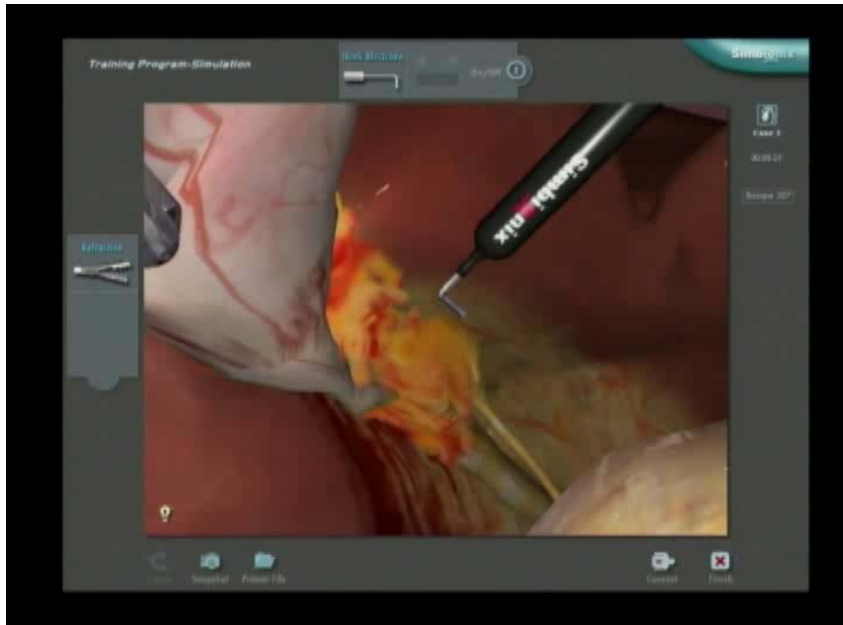
Init  
ous





# The VISTA Project

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SynaptiQ



## Review Session

Touch the Play, Stop and Pause buttons below to view the session. Touch the position bar to move to a new location

VIRTUAL CHAPERONE

27/10/2005

10:09:22

Mr Virtual Theatre

Camera 1



Camera 2



Start time

10:54:31

Current time

14:13:27

End time

18:08:09

Patient Name:

Vista Vista



Exit

Recorded on

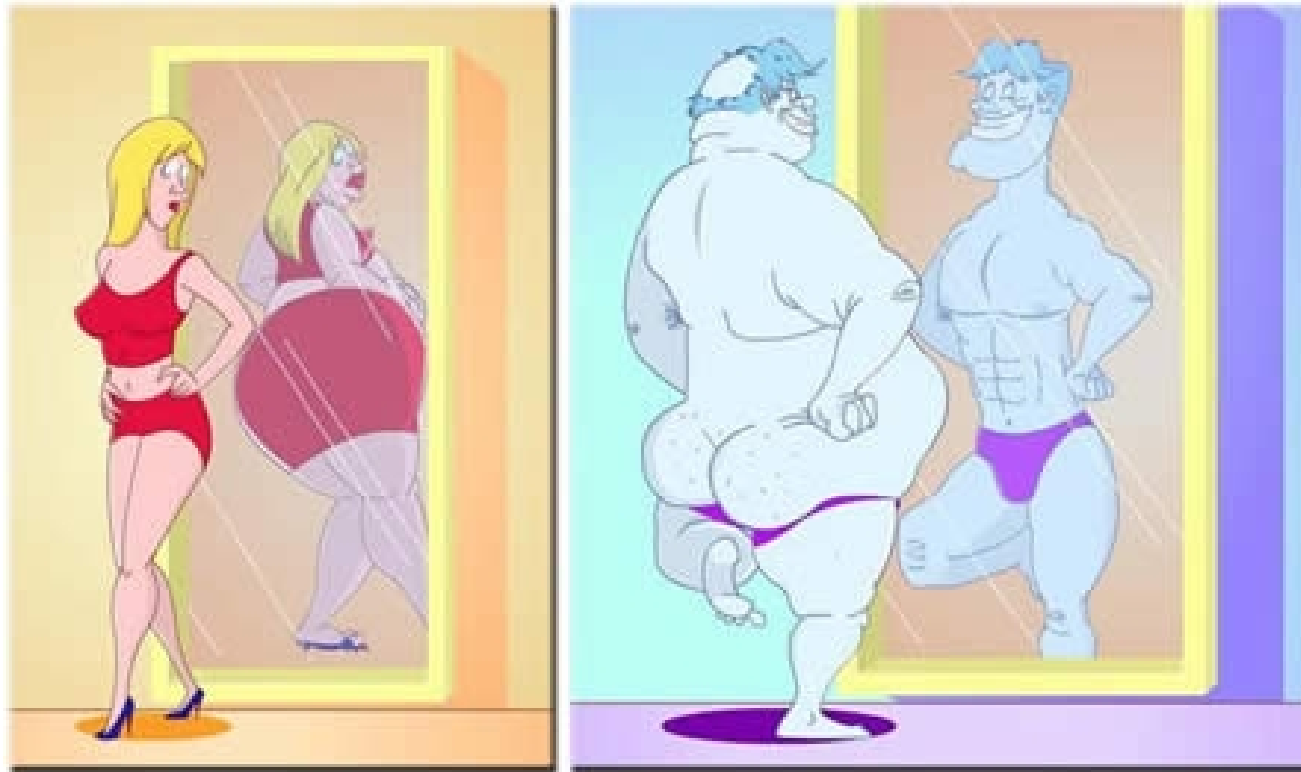
04/10/2005

by:

Mr Virtual Theatre

nit  
us

# Understanding what we are doing.....



***The Difference Between Women & Men***

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