



The Role For Routine Dexterity And Visuospatial Ability Testing To Guide Training Of Residents In Minimally Invasive Cardiothoracic Surgery



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Background

It is not known whether innate dexterity (DEX) and visuospatial ability (VSP) impact technical proficiency in minimally invasive cardiothoracic surgery. The aim of this study was to determine which aspects of performance in the operating theatre are predicted by DEX and VSP to aid in tailoring resident training.

Methods

24 surgical residents, between 30 and 39 years of age, who had performed at least 25 minimally invasive cardiothoracic surgical operations competed well-validated tests of fine-motor dexterity (The Grooved Pegboard Test (GPT)) and visuospatial ability (The Mental Rotations Test (MRT)). Baseline characteristics were noted including age, gender, post-graduate year level as well as current and previous hobbies. Two expert cardiothoracic surgeons familiar with each resident’s technical proficiency used a 5-point Likert scale to rate operative performance in minimally invasive cardiothoracic surgery across 5 categories of: “technical efficiency”, “elegance of hands”, “decision-making and planning”, “learning curve for proficiency”, and “overall technical competence”.

Figure 1: Grooved Pegboard Test (GPT)

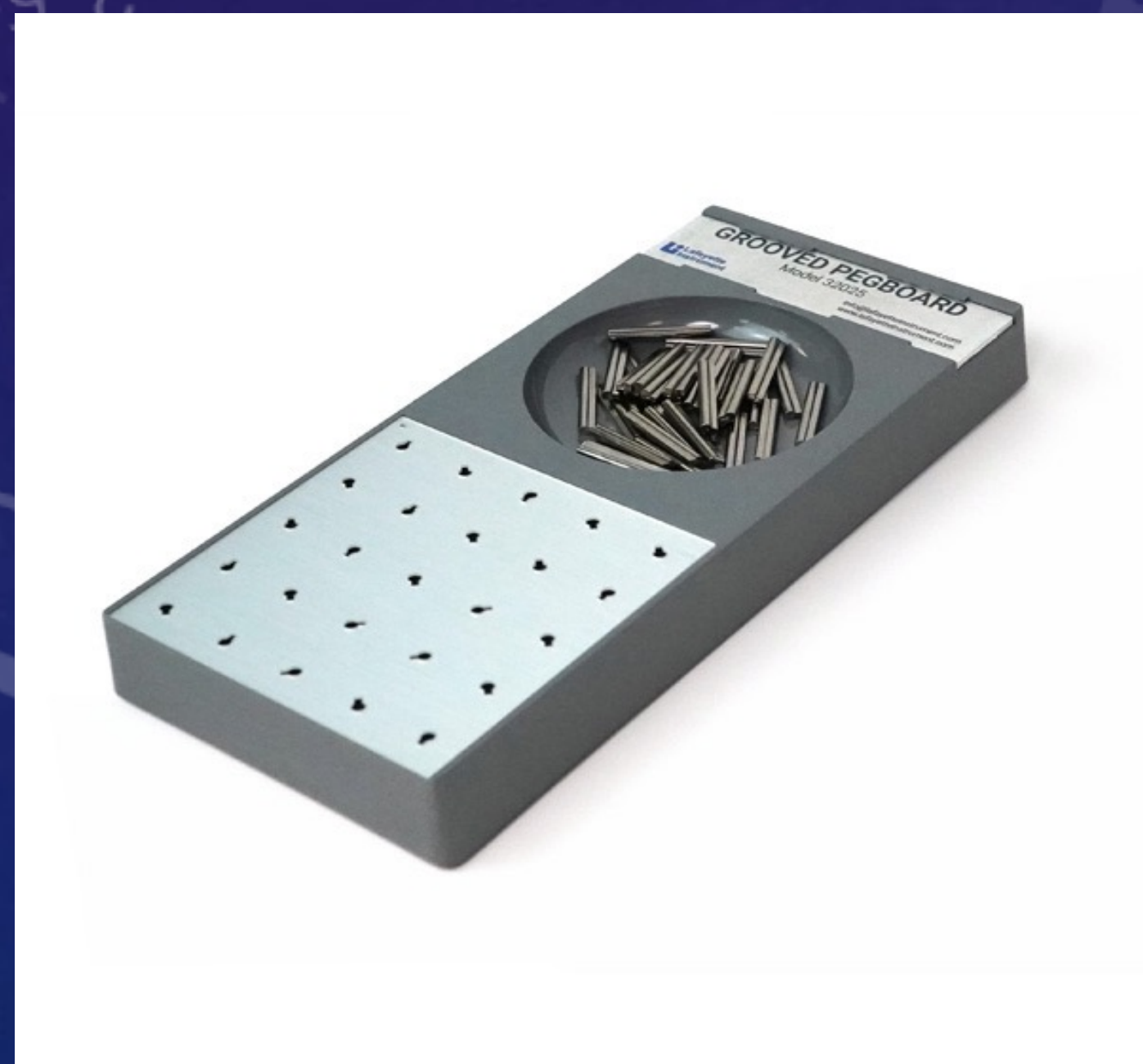
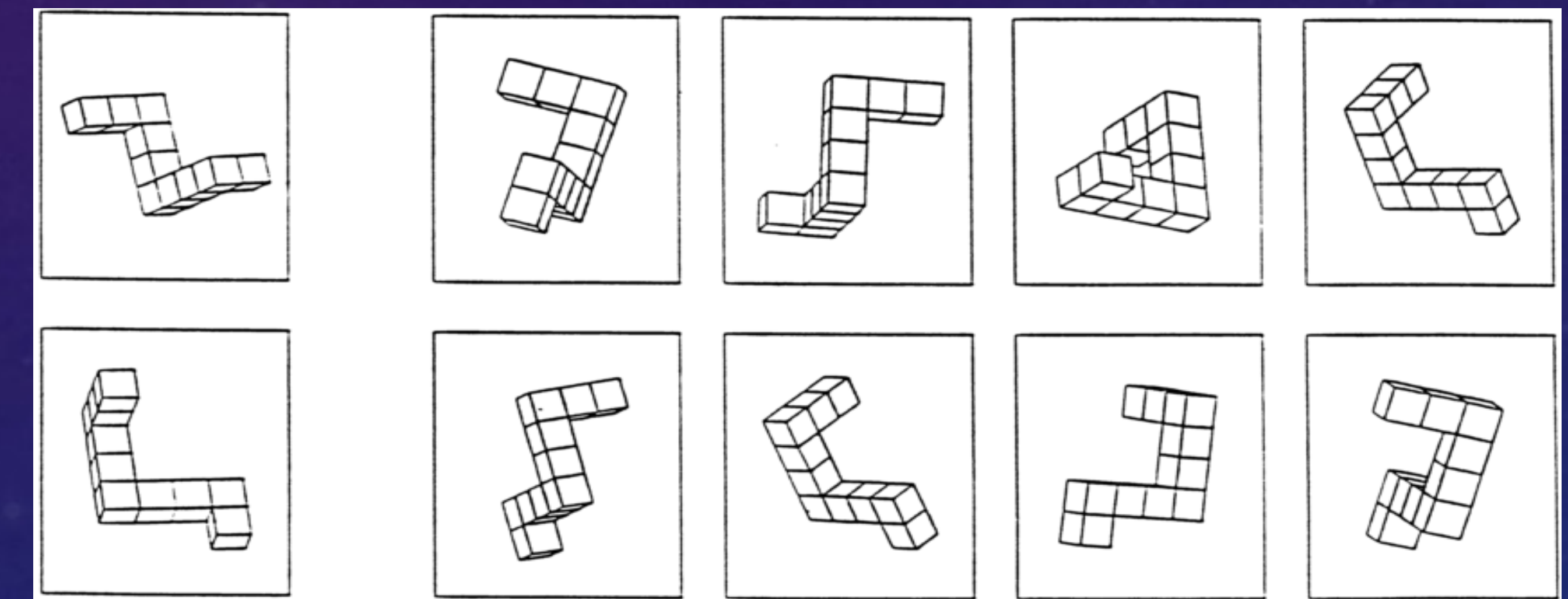


Figure 2: Mental Rotations Test (MRT)



	AGE 30 to 35 (n = 12)	AGE 36 to 39 (n =12)	P-value
<u>Baseline characteristics</u>			
Age (years)	31.3 ± 1.8	38.4 ± 1.2	< 0.001
Gender (F)	16.7% (2/12)	33.3% (4/12)	0.35
Ambidextrous	0.0% (0/12)	0.0% (0/12)	0
Dominant hand (Right)	100.0% (12/12)	100.0% (12/12)	0
Cross-dominant	41.7% (5/12)	8.3% (1/12)	0.059
Post-graduate year level	5.1 ± 1.3	14.5 ± 1.9	< 0.001
Number of open cardiac and thoracic operations performed	11.8 ± 22.9	389.2 ± 288.3	< 0.001
Number of minimally invasive cardiac operations performed	0.0 ± 0.0	6.8 ± 8.8	0.014
Number of minimally invasive thoracic operations performed	41.7 ± 21.6	115.8 ± 150.5	0.1
Use of simulators for training	2.2 ± 1.1	3.1 ± 1.1	0.053
More than occasional use of simulators for training	33.3% (4/12)	83.3% (10/12)	0.013
Knot-tying hand (Right)	50.0% (6/12)	66.7% (8/12)	0.41
Current hobbies			
Musical Instrument	41.7% (5/12)	25.0% (3/12)	0.39
Videogames	58.3% (7/12)	16.7% (2/12)	0.035
Previous hobbies			
Musical Instrument	66.7% (8/12)	58.3% (7/12)	0.67
Videogames	100.0% (12/12)	75.0% (9/12)	0.064
<u>Dexterity test (GPT) (seconds)</u>			
Dominant hand	51.7 ± 5.0	50.4 ± 5.3	0.54
Non-dominant hand	55.8 ± 5.7	58.3 ± 8.1	0.39
Bimanual average	53.8 ± 4.6	54.4 ± 6.4	0.8
<u>Visuospatial test (MRT) (raw score out of 24)</u>			
Mental rotation (6-minute score)	12.2 ± 3.4	8.9 ± 3.6	0.035
<u>Technical proficiency rating for minimally invasive surgery (1 = least proficient; 5 = most proficient)</u>			
Operative efficiency	2.6 ± 0.5	3.8 ± 1.0	0.002
Elegance of hands	3.6 ± 1.2	3.6 ± 0.9	0.92
Decision-making and planning	2.8 ± 0.6	3.4 ± 1.4	0.18
Learning curve for attaining proficiency	3.8 ± 1.1	2.7 ± 1.4	0.041
Overall technical proficiency	3.4 ± 0.6	3.8 ± 1.1	0.3

Table 1: Baseline characteristics, GPT, MRT results, technical proficiency for each age group

Results

There was high interobserver agreement between the two expert rates ($\kappa = 0.92$). Younger residents (aged 30 to 35 years), despite having less experience, had better innate VSP (MRT raw score: 12.2 ± 3.4 vs 8.9 ± 3.6 , $P=0.035$) and more current videogame playing experience (58.3% (7/12) vs 16.7% (2/12) but no difference in dexterity (average GPT time: 53.8 ± 4.6 vs 54.4 ± 6.4 seconds, $P=0.8$) (Table 1). Higher levels of VSP were associated with a shorter learning curve time for proficiency ($r=-0.89$, $P<0.001$) and average fine motor dexterity scores correlated with an “elegant pair of hands” ($r=0.92$, $P<0.001$). Neither DEX or VSP correlated with overall technical competence ($r=0.17$, $P=0.42$; $r=0.16$, $P=0.45$), technical efficiency ($r=-0.01$, $P=0.96$; $r=-0.2$, $P=0.3$) or decision –making and planning abilities ($r=0.02$, $P=0.93$; $r=0.2$, $P=0.45$).

Conclusions

Innate fine-motor dexterity and visuospatial abilities of residents are not predictive of overall technical competence, decision-making or technical efficiency for minimally invasive cardiothoracic surgery. However, fine motor dexterity is correlated with “an elegant pair of hands” and visuospatial ability with a decreased learning curve time. Therefore, such quick to administer tests (GPT $\approx$ 3 mins, MRT $\approx$ 7 mins) could be used to guide which trainees may need to spend more time in training and simulation.

References

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