

## **UC Merced**

### **Proceedings of the Annual Meeting of the Cognitive Science Society**

#### **Title**

Effect of visual-spatial ability on total performance score in endoscopic simulation training

#### **Permalink**

<https://escholarship.org/uc/item/3984h579>

#### **Journal**

Proceedings of the Annual Meeting of the Cognitive Science Society, 25(25)

#### **ISSN**

1069-7977

#### **Authors**

Hedman, Leif  
Anderson, Pehr  
Strom, Par  
[et al.](#)

#### **Publication Date**

2003

Peer reviewed

# Effect of visual-spatial ability on total performance score in endoscopic simulation training

Leif Hedman<sup>1,2</sup> ([leif.hedman@psy.umu.se](mailto:leif.hedman@psy.umu.se); [leif.hedman@cfss.ki.se](mailto:leif.hedman@cfss.ki.se))

Pehr Andersson<sup>1</sup> ([pehr.andersson@psy.umu.se](mailto:pehr.andersson@psy.umu.se))

Pär Ström<sup>2</sup> ([per.strom@cfss.ki.se](mailto:per.strom@cfss.ki.se))

Ann Kjellin<sup>2</sup> ([ann.kjellin@cfss.ki.se](mailto:ann.kjellin@cfss.ki.se))

Lars Särnö<sup>2</sup> ([lars.sarna@mta.hs.sll.se](mailto:lars.sarna@mta.hs.sll.se))

Torsten Wredmark<sup>2</sup> ([torsten.wredmark@cfss.ki.se](mailto:torsten.wredmark@cfss.ki.se))

Li Felländer-Tsai<sup>2</sup> ([li.tsai@cfss.ki.se](mailto:li.tsai@cfss.ki.se))

<sup>1</sup>Department of Psychology, Umeå University, SE-901 87 Umeå, Sweden, <sup>2</sup>Center for Surgical Sciences, Center for Advanced Medical Simulation, Karolinska Institutet at Huddinge University Hospital, SE-141 86 Stockholm, Sweden

## Introduction

We report on a study that investigates the relationship between spatial ability tests scores and total score of instrument navigation in ProceDicus KSA (simulator for training endoscopic surgery). Wanzel and colleagues (2002) tested whether junior surgical residents with high visual-spatial scores in six tests of visual-spatial ability, would perform better in completing and learning a spatial-complex surgical procedure than those with low scores in the tests. They found that visual-spatial ability, assessed by Mental Rotation test (MRT, Vandenberg and Kuse, 1978), correlates significantly with initial competency and quality of results in two- and four-flap Z-plasty procedures in pig thighs. We hypothesize that students with higher scores in visual-spatial tests would perform better in a KSA instrument navigation procedure than those with low scores in the tests.

## Method

25 medical students (novices, 18 women and 7 men), ranging in age between 21 and 38 years at Karolinska Institutet, Huddinge University Hospital in Sweden, participated in the study. All participants completed a one hour session in the KSA instrument navigation procedure (and another simulator procedure not reported here). The task was to probe 10 targets/spheres randomly interspaced throughout a virtual upper abdomen. To perform successfully the student needs to manoeuvre both an optic device and a probe as in real endoscopic surgery. The performance variable reported here is total score. It was composed of the collision of the instrument and the scope together with movement economy and time. Immediately after the training session students completed the revised MRT in two forms: MRT-A and MRT-C (mentally rotating the figures around the vertical axis, and the vertical and the horizontal axis, respectively, see Peters et al., 1995) and the BasIQ intelligence test (which generates a pure measure of general intelligence ( $g$ ), as well as non

correlated measures of spatial, verbal and numerical ability, see Mårdberg et al., 2000).

## Results

Significant Pearson's correlations were obtained between total score in instrument navigation, MRT-C ( $r=.375$ ,  $p=.005$ ) and MRT-A ( $r=.301$ ,  $p=.027$ ). BasIQ spatial scores correlated also with performance total score ( $r=.55$ ,  $p=.004$ ). A regression analysis showed that the adjusted R square for the spatial ability is .278 and that a stepwise inclusion of verbal- and numerical ability scores don't contribute to the significance of the correlation. There were no significant correlations between the general intelligence score ( $g$  factor) and total performance score ( $r=.28$ ,  $p=.17$ ).

## Discussion

Our findings suggest that spatial ability is important to possess in order to accomplish the simple endoscopic surgical training task of instrument navigation. Wanzel and collaborators (2002) findings are also applicable to training in endoscopic surgery simulators. We suggest that spatial ability, assessed by MRT-A and MRT-C as well as BasIQ might help to identify trainees who could benefit from additional endoscopic simulator training of instrument navigation.

## References

- Mårdberg, B., Sjöberg, A, and Henrysson-Eidvall, S. (2000). Manual. BasIQ begåvningsstest. *Psykologiförlaget AB*, Stockholm, Sweden.
- Peters, M. (1995.) Revised Vandenberg and Kuse Mental Rotations Test: forms MRT-A to MRT-D. *Technical Report, Department of Psychology, University of Guelph*, Canada.
- Vandenberg, G. S., and Kuse, A. R. (1978). Mental Rotation Test: a group test of three-dimensional spatial visualization. *Perceptual and Motor Skills*, 47, pp. 599-604.
- Wanzel, K. R., Hamstra, S. J., Anastakis, D. J., Matsumoto, E. D., Cusimano, M. D. (2002) Effect of visual-spatial ability on learning of spatially-complex surgical skills. *The Lancet*; 359, pp. 230-231.