# Acquiring New Technical Skills and Aptitude for Mental Rotation

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ULTRASOUND-GUIDED regional anesthesia (USGRA) requires manual dexterity, hand–eye coordination, and sonographic interpretation. Mastery of these skills allows practitioners to keep neural targets and the needle in view while avoiding nearby structures during block placement. As educators, we all have stories of the resident with "stone hands" or "10 thumbs" and the resident with great hands who effortlessly mastered these new skills. There seem to be three groups of learners: those who have it, those who will get it with some practice, and those who will always struggle. What if we could identify those who are destined to struggle before they encounter their first patient and get them prepared with training and simulated practice? In this issue of ANESTHESIOLOGY, Shafquat *et al.*[1] used assessments of visuospatial ability to predict technical performance of an ultrasound-guided needle task by novice medical students, potentially providing a means to identify students who will benefit from more intensive education.

In addition to the military and the manufacturing industry, surgical training programs have also used visuospatial and psychomotor testing to assess proficiency of trainees.[2,3] In surgical training, it is widely accepted that visuospatial aptitude correlates with laparoscopic and robotic surgical skills, specifically tests of visuospatial assessments that examine an individual's ability to interpret two-dimensional shapes in a three-dimensional context. The tests work something like this. The examinee is given a two-dimensional drawing of a three-dimensional object, like a drawing of an asymmetric group of connected cubes as viewed from a specific angle. They are then told to mentally rotate that object to a specific angle, perhaps 90° to the right around the vertical axis. They are given a set of two-dimensional drawings of the same
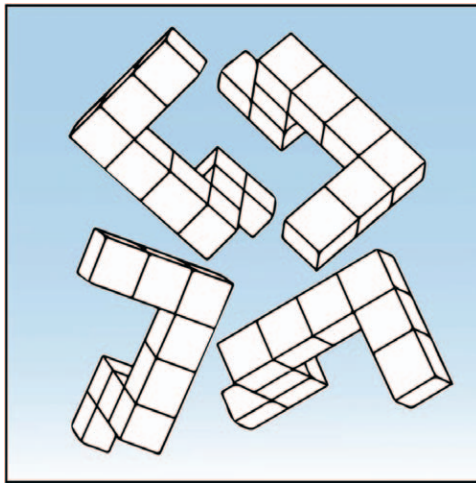
"What if we could identify those who are destined to struggle [with ultrasound-guided regional anesthesia] before they encounter their first patient and get them prepared ..."

object and asked which of the new drawings represents the first object rotated in space as described. Dental schools have used visuospatial assessment in their admission process in hopes of selecting applicants with an innate aptitude that will help them learn and excel at the technical skills required in dentistry.[4] Despite significant reliance on procedural skills, anesthesiology lags behind other fields in assessing learners' technical aptitude. Although previous studies have suggested that a high degree of visuospatial aptitude may predict the ease of mastery for learners of USGRA, there is little evidence that the use of visuospatial testing can actually identify those who may benefit from early, focused training.[5]

In this issue of ANESTHESIOLOGY, Shafquat *et al.*[1] used the mental rotation test (MRT), the group embedded figures test, and the Alice Heim group ability test as visuospatial assessment tools. These tests are designed to assess a learner's spatial reasoning skills, their ability to manipulate two- or three-dimensional shapes or patterns, and their ability to perform a focal task independent of any background information or distracters. Unlike previous studies that have evaluated the impact of visuospatial ability on skill performance in isolation, Shafquat *et al.*[1] also assessed the learner's emotional state, fear of failure, and intelligence to determine whether it correlated with performance of the new technical skill. Fear of failure is a subclinical form of anxiety, and when success is valued, anxiety is inversely related to performance.[6] The USGRA technical performance was scored by two assessors using the composite error score and global rating scale, which have been previously validated.[7] Low error rates, better image quality, and better global performance were associated with higher MRT scores that led the

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authors to conclude that the MRT significantly predicted performance with the ultrasound task. They also concluded that negative mood, anxiety, and stress adversely affected learner performance.

We commend Shafquat *et al.*[1] on their well-written study and their dedication to education research. The authors acknowledge that although the MRT visuospatial assessment may predict performance on an ultrasound task, it does not indicate at what score performance can be defined as adequate. It is interesting to think about how visuospatial assessments may be used in the future to identify learners who could benefit from more guidance, more practice, or even a different type of learning experience. Similar testing could be used beyond residency to help practicing anesthesiologists understand their own areas of strengths and weakness, thereby helping them to target their own educational efforts. Perhaps educators will be able to design specific workshops that accelerate the pace with which those with lesser visuospatial abilities are able to gain better skills. Worrisome practices that seem best avoided also come to mind, like use of this type of testing as a screening tool for selecting candidates for medical school or residency. The ability to actually measure the impact of stress and anxiety on performance is relatively new to anesthesiology and is also very intriguing. It would be fascinating to evaluate learner stress levels as they practice and become more comfortable with technical skills and ultimately use this information to determine whether a degree of comfort can be obtained through improved visuospatial skills or simulated practice. Obviously, interaction with a patient will increase the degree of anxiety, so the question is whether a learner's degree of anxiety is normal or whether as educators we can help to decrease anxiety with the use of visuospatial practice or simulated practice. We agree with the authors that future research is needed to determine whether specific training interventions could play a role in increasing a learner's visuospatial skills, decreasing their anxiety, and thus enhancing USGRA skills.

Competing Interests

The authors are not supported by, nor maintain any financial interest in, any commercial activity that may be associated with the topic of this article.

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