

A novel puzzle-based assessment of spatial awareness for ultrasound-guided regional anesthesia.

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BACKGROUND

- Ultrasound-guided regional anesthesia (UGRA) requires rapid recognition of relevant sonoanatomy
- Serious games have been utilized to educate learners with a combination of entertainment and education
- Puzzles require mental segmentation and reconstruction of visual information to create a final image

STUDY AIM

- Develop and pilot test a web-based puzzle assessment tool for measuring sonographic anatomy recognition

METHODS – PUZZLE DEVELOPMENT

- A web-based puzzle was developed to segment interscalene brachial plexus ultrasound images into a randomized 3x3 grid of tiles (figure 1a) that could then be moved to solve the puzzle (figure 1b)
 - Volunteer images reflecting normal anatomy and difficult anatomy were obtained by regional anesthesia faculty
- The web app automatically collected metrics such as:
 - Time to solve
 - Number of moves required to solve
 - Delta optimal moves (number of moves – minimum number of moves required to solve)
- An annotation feature was also developed to test learners on the relevant anatomy for an interscalene block

METHODS – PUZZLE DEVELOPMENT

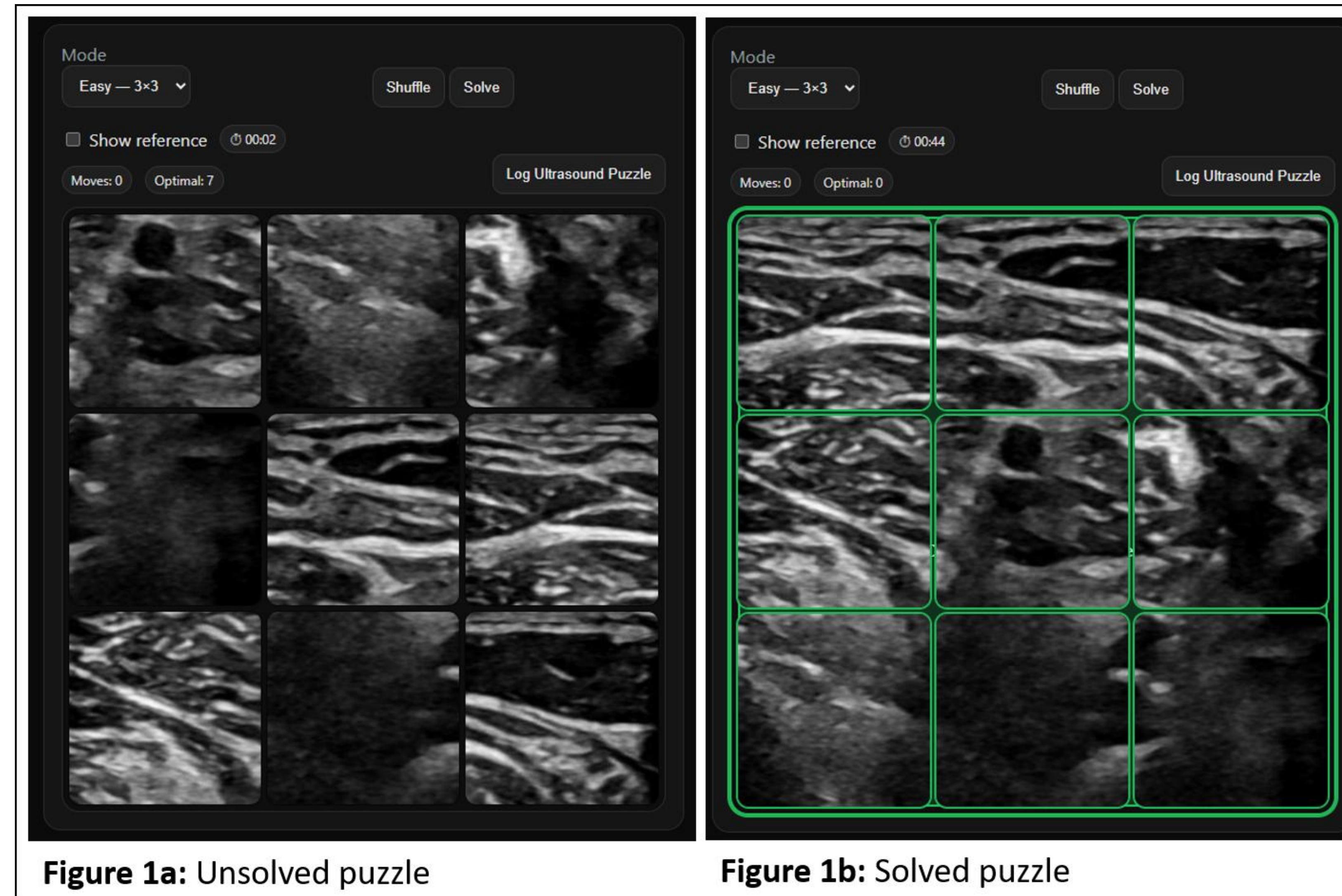


Figure 1a: Unsolved puzzle

Figure 1b: Solved puzzle

METHODS – PILOT TESTING

- Exemption of written consent from Mount Sinai IRB
- Study Design:** Prospective Observational
- Setting:** Large urban academic medical system
- Inclusion Criteria:** PGY1-4 anesthesiology residents
- Outcomes:** Time to completion (sec), number of moves to solve, delta optimal moves, identification of 5 anatomic structures if present (% correct, C5, anterior scalene, SCM, carotid)
- Statistical Analysis:** PGY and anatomy scores were evaluated for association with puzzle performance metrics. Kruskal-Wallis and Spearman testing was used where appropriate. A p-value of < 0.05 was deemed statistically significant.

RESULTS

- 53 anesthesia residents completed pilot testing (table 1)

PGY, n(%)	
-PGY-1	8 (15.1%)
-PGY-2	18 (34.0%)
-PGY-3	13 (24.5%)
-PGY-4	14 (26.4%)
Mean Time to Solve, sec(SD)	70.2 sec (31.4)
Mean Number of Moves to Solve, n(SD)	19.6 (11.0)
Mean Delta Optimal Moves, n(SD)	13.3 (10.0)
Anatomy Score, % correct	47.0%

Table 1: Participant demographics and outcomes

- PGY level was associated with improved anatomic scores (PGY1 18.8±14.6% vs PGY4 64.6±22.3%, p=0.04)
- PGY level was not associated with time (p=0.2), number of moves (p=0.87), or delta optimal moves (p=0.77)
- Across all participants, higher anatomic recognition correlated with fewer moves (Spearman ρ =-0.3, p=0.03) and fewer delta optimal moves (Spearman ρ =-0.3, p=0.03), but not time (Spearman ρ =-0.08, p=0.58)

CONCLUSIONS

- A novel web-based sonoanatomy puzzle was developed
- Increased understanding of sonoanatomy was associated with improved efficiency in moves, which may suggest puzzle performance requires anatomic understanding
- Further testing on usability and validation of the tool are required

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