

Video Context Improves the Performance of Surgical Trainees in Identifying Operative Planes on Static Surgical Images

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Introduction

Identifying surgical tissue plane of dissection is a fundamental skill required for every surgeon. Several methods have been developed to improve such a skill based on accelerating the cognitive abilities of surgeons and trainees.

In our previous study,(1) we showed that the performance of laparoscopic surgeons/trainees differed significantly predictably correlating with the level of experience when the participants (consultants [C], seniors [S], and juniors [J]) were instructed to draw the optimal tissue planes on still images taken from real operations.

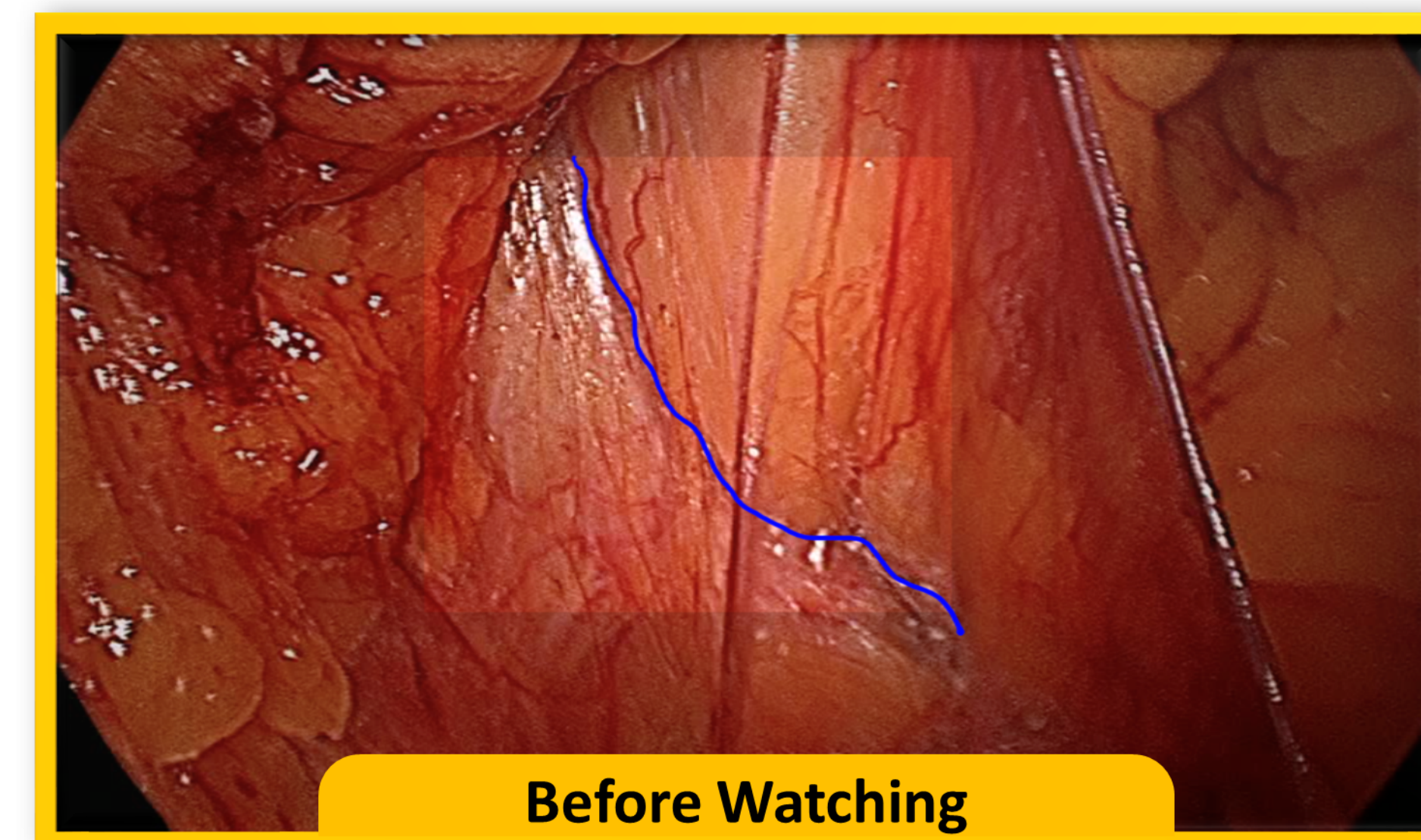
However, we now need to investigate this novel tool in a more realistic operative context, considering its potential educational relevance.

Objectives

To investigate the role of adding video clips taken from key parts of the operation to distinguish between surgeons of different experience levels and to test their efficacy on the precision and accuracy of participants.

Methods

- Video clips included high-definition videos of laparoscopic colectomy procedures. An expert panel selected 20 images where an optimal operative moment of tissue plane identification could be approached.
- All participants (n=15; five in each group) were shown the operative still images, and they were asked to draw line using a stylus, indicating the line of dissection (pre-watching lines). This was followed by watching a 10-second video clip preceding the last frame which had been the same still image as before. The participants were allowed to redraw the line that best identifies the dissection planes (post-watching line). Additionally, the expert panel drew lines where the dissection is presumably optimal (expert lines).

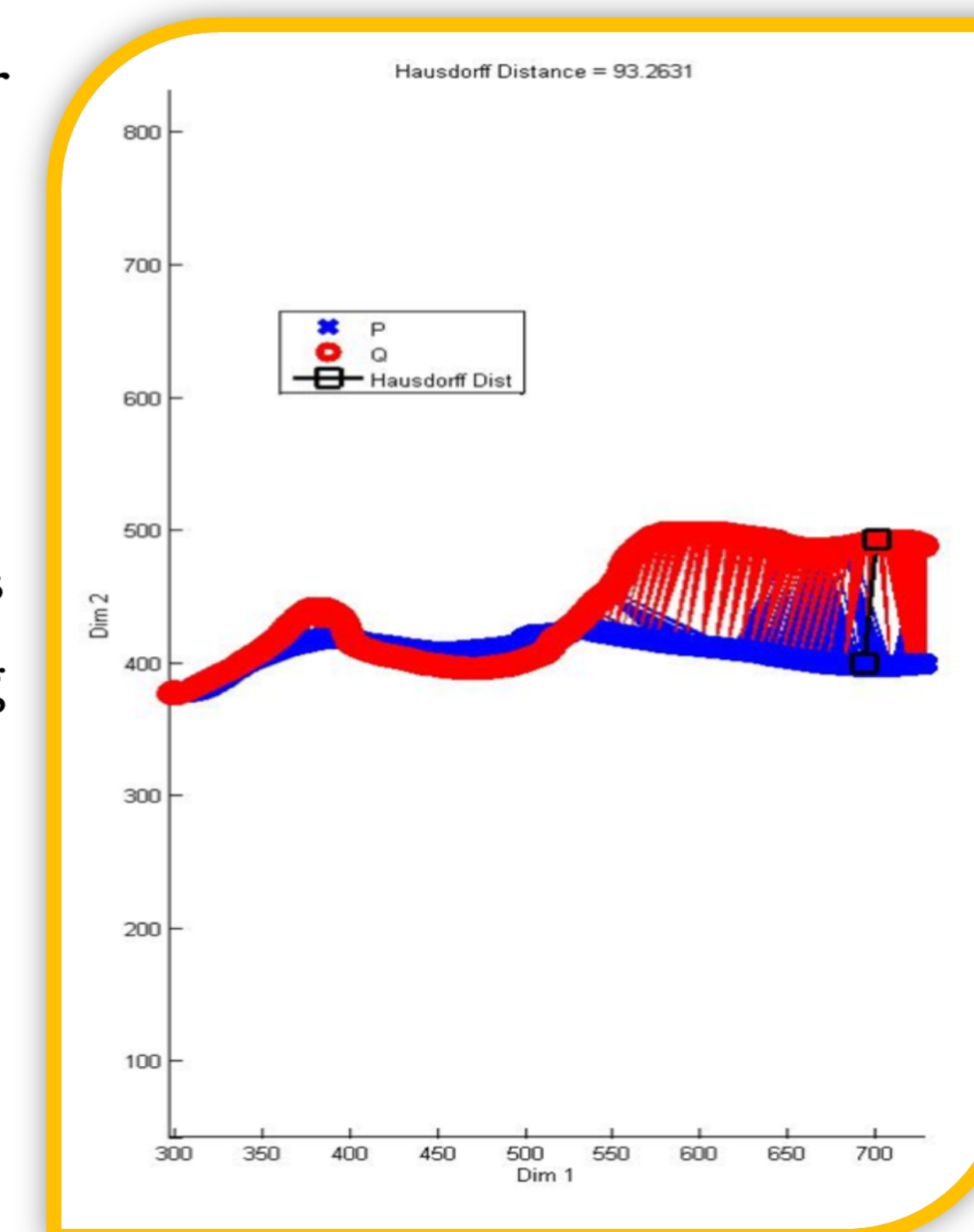


Before Watching



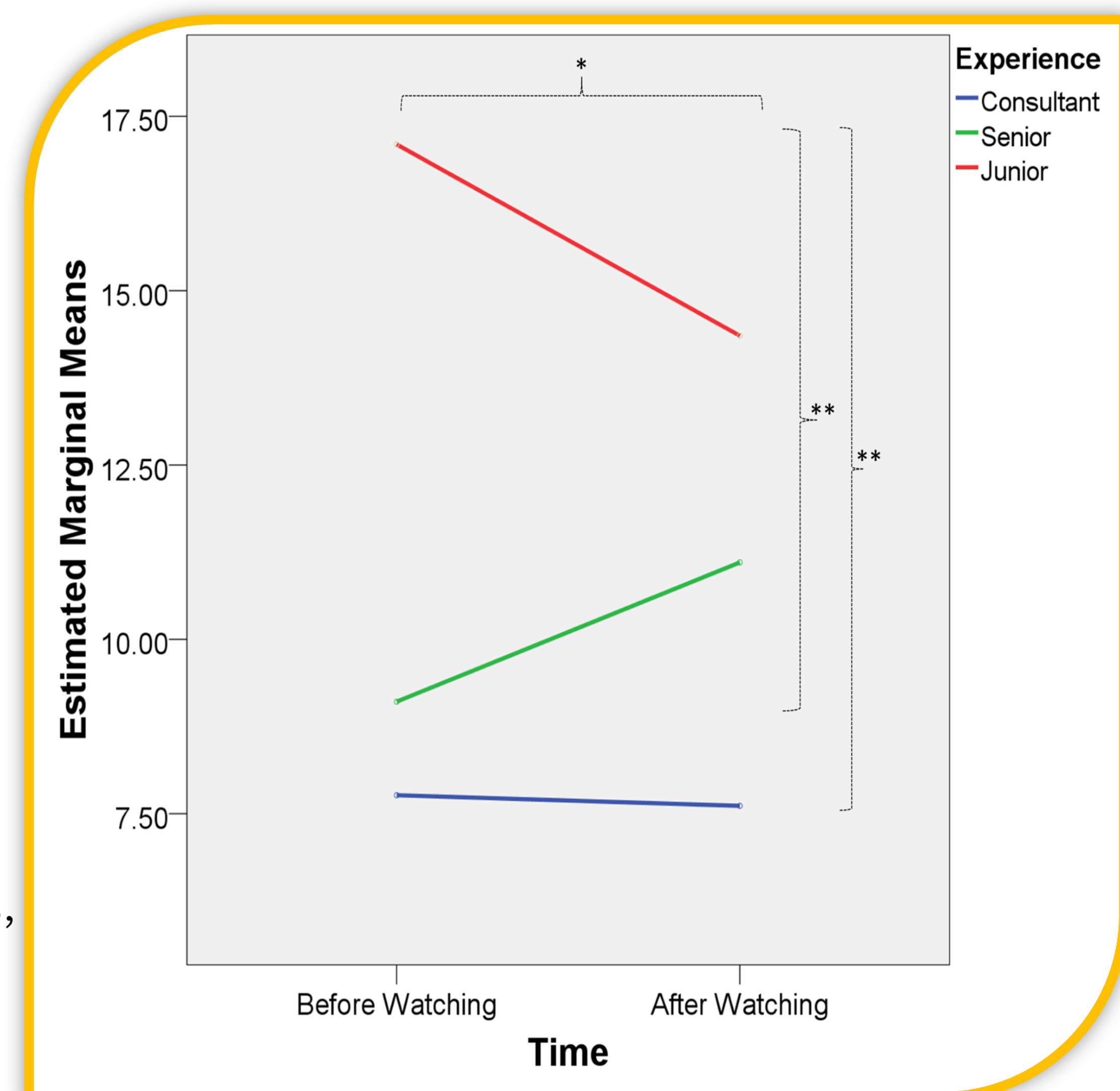
After Watching

- The drawn lines were divided into segments and defined by their Cartesian coordinates to compute the distance between them numerically using a validated comparative metric (a modified Hausdorff distance [%Hdu]). The variability in pairwise comparisons between lines drawn by the participants before and after watching the video prequels were used for the analysis of precision. Between-group comparisons were carried out using a one-way analysis of variance (ANOVA).
- On the other hand, the participants' lines were compared to those of the expert panel to test the accuracy of these lines, and a repeated measures ANOVA was utilized for the analysis.



Results

- The mean time required for drawing the lines increased gradually from the C group to the S and then the J group; however the difference was not statistically significant.
- Subjects in the C group were significantly more precise than the S group and the J group (the difference in the mean Hdu distance before and after watching the lead-in video was 9.17 ± 11.86 , 12.1 ± 15.5 , and 20.0 ± 18.32 pixels, respectively, $P < 0.001$). The differences between groups were also statistically significant in 14 images (70%), and a stepwise-reduction in precision from C to S to J was noted in 9 images. These findings would further validate the novel method to discriminate between surgeons based on their surgical expertise.
- For the accuracy outcomes (considering the expert panel as a reference), lines drawn by C were the most closer to experts, followed by S and finally J. The difference was significant between J and S as well as between J and C. Interestingly, the time $\times$ experience level interaction was statistically significant. Only J showed significant improvements in their accuracy after watching the lead-in videos, indicating that this method is educationally invaluable for trainees.



Reference

- Schlachta CM, Ali S, Ahmed H, Eagleson R. A novel method for assessing visual perception of surgical planes. Can J Surg. 2015;58(2):87-91.