



Live Surgical Feedback with AI

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Supported by

National Cancer Institute

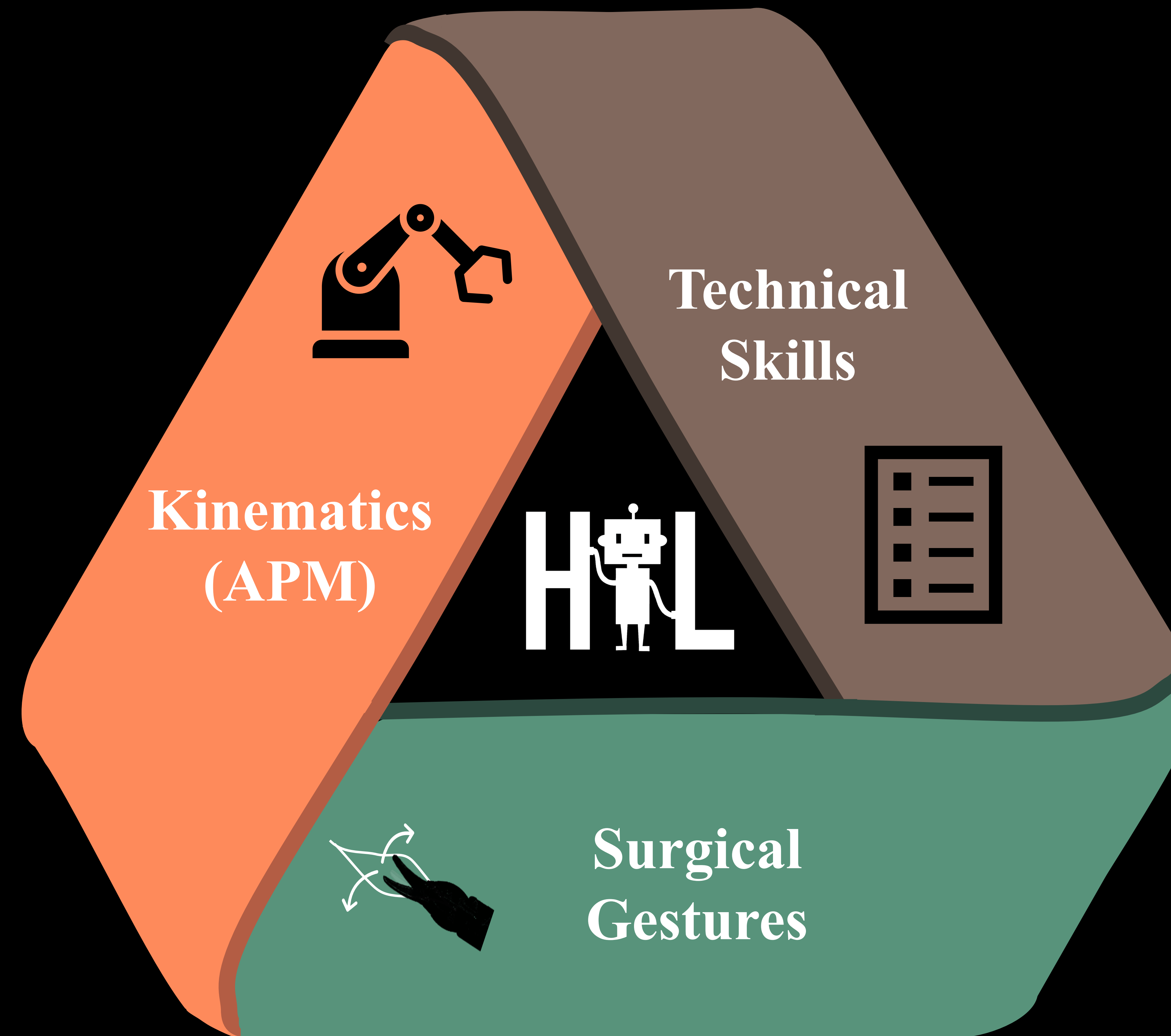
Award No. R01CA251579

Award No. R01CA273031

Award No. R01CA298988

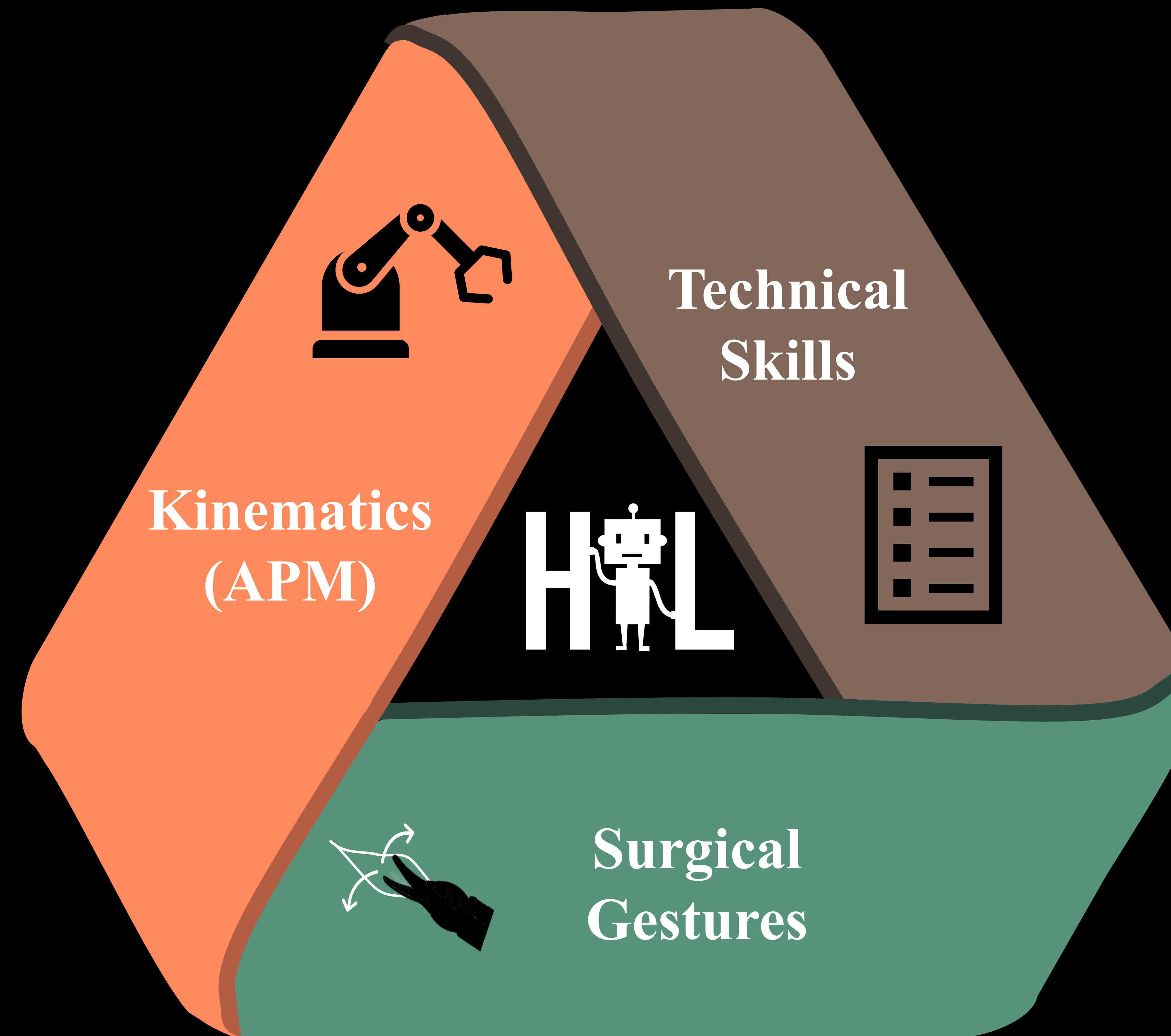


Surgeon Assessment



Surgeon Assessment

10+ years
of research



\$10 million
of NIH funding

Surgery Videos

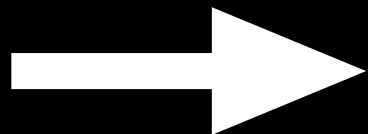
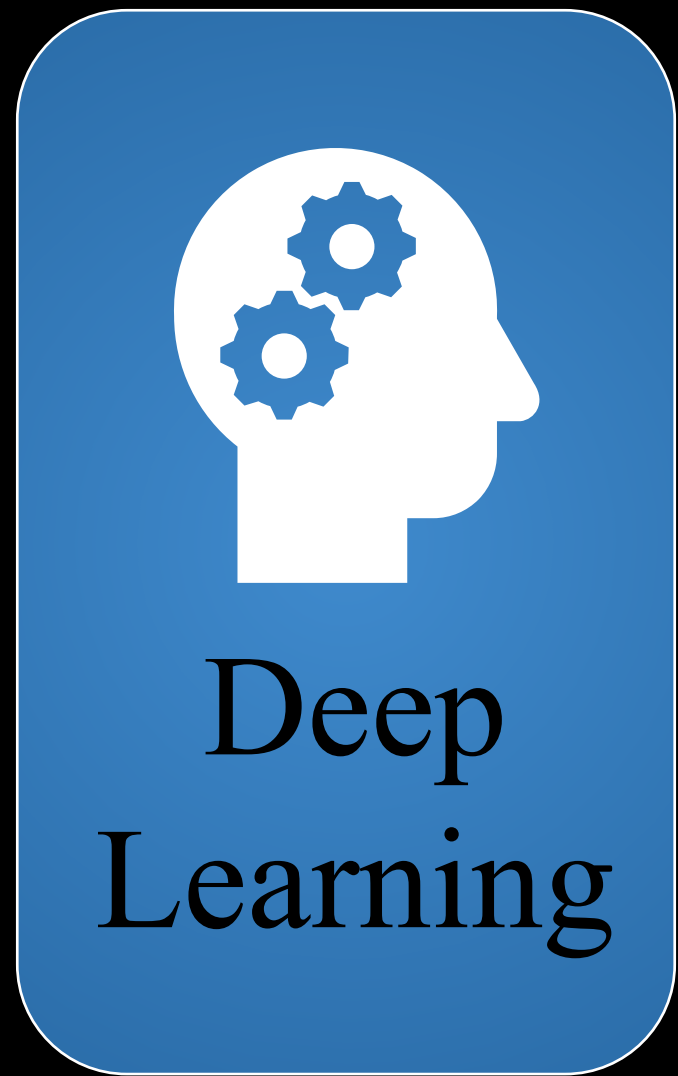
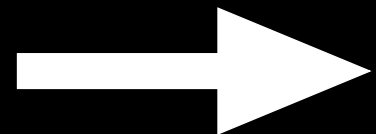


Video 1

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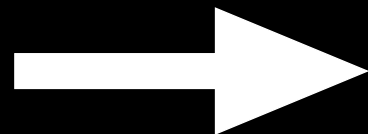
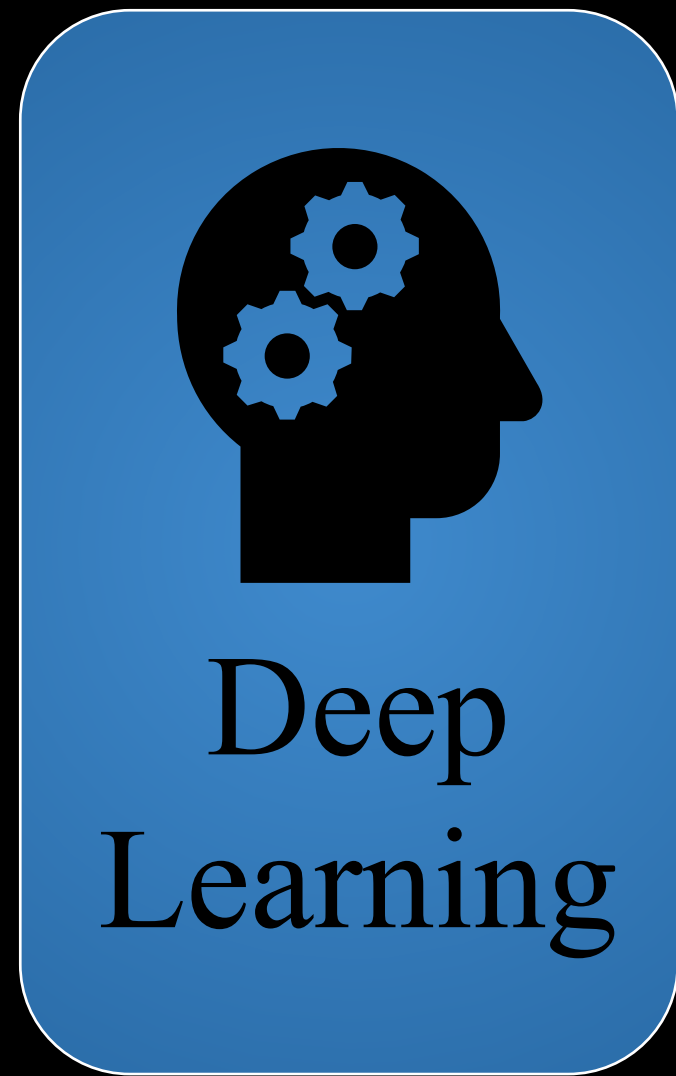
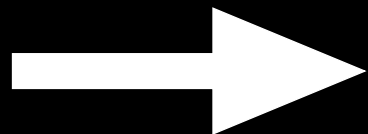


Video X



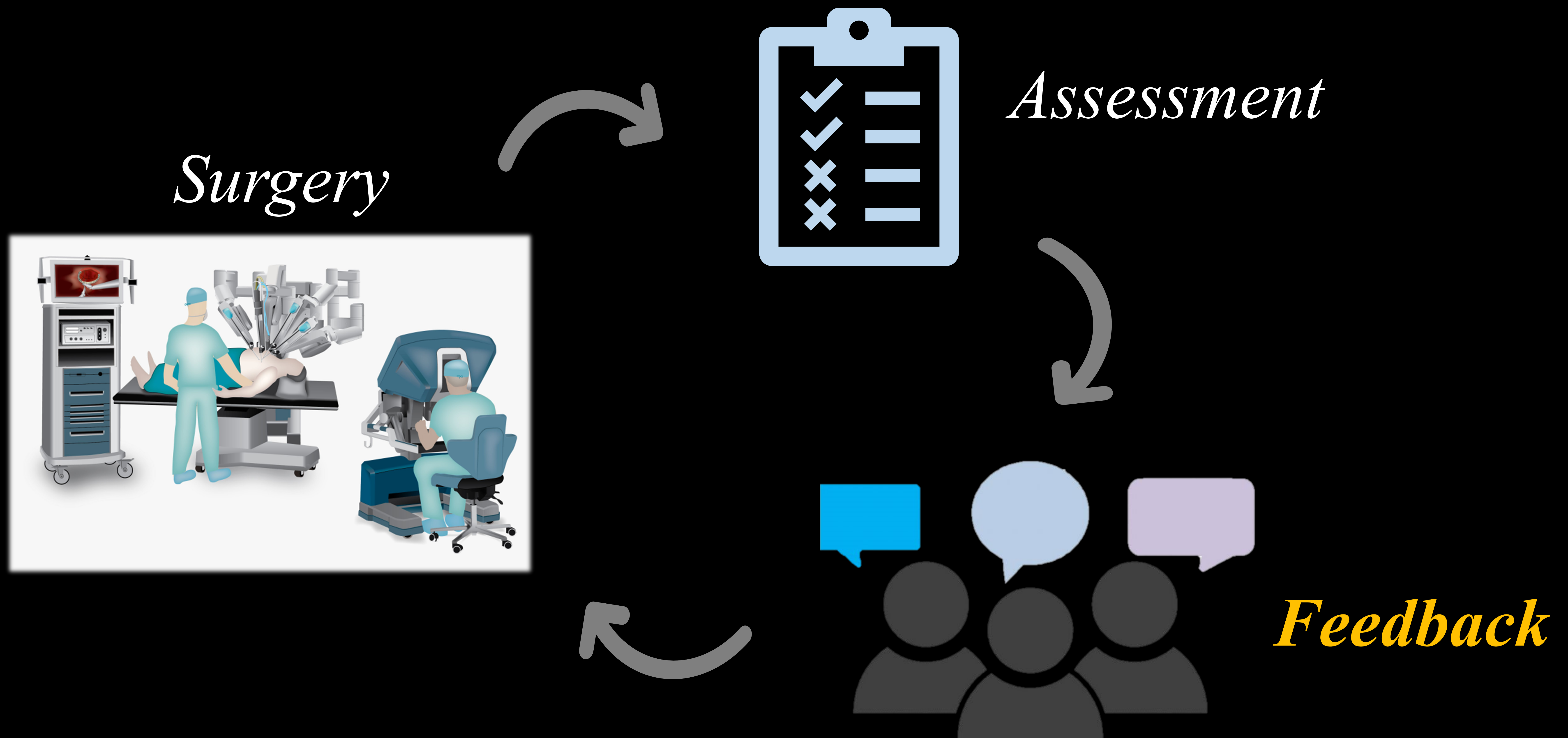
Automated Technical Skills Assessment

Domains	Sub-Skills
Pre-Planning	• Surgical Field Optimization
Needle Handling	• Gesture Sequence • Needle Hold Ratio • Needle Hold Angle • Depth of Needle Hold
Needle Entry	• Needle Entry Angle
Needle Driving	• Driving Sequence • Wrist Rotation • Depth of Suture
Needle Withdrawal	• Wrist Rotation
Suture Placement and Management	• Suture Awareness • Cinching Technique • Suture Spacing • Tissue Approximation
Knot Tying	• Free Tie Length • Knot Tying Preparation • Knot Tension • Secure/Air Knot



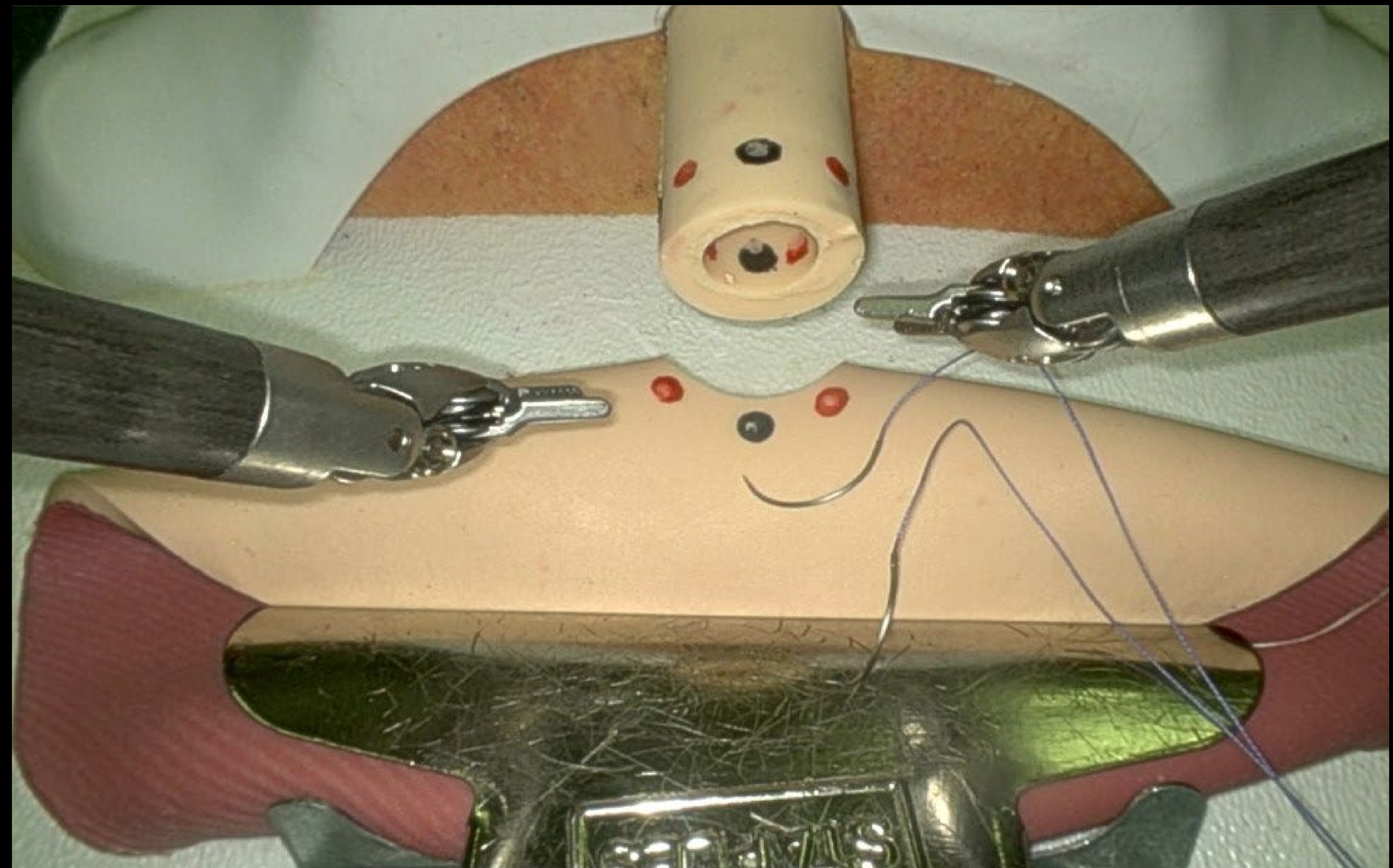
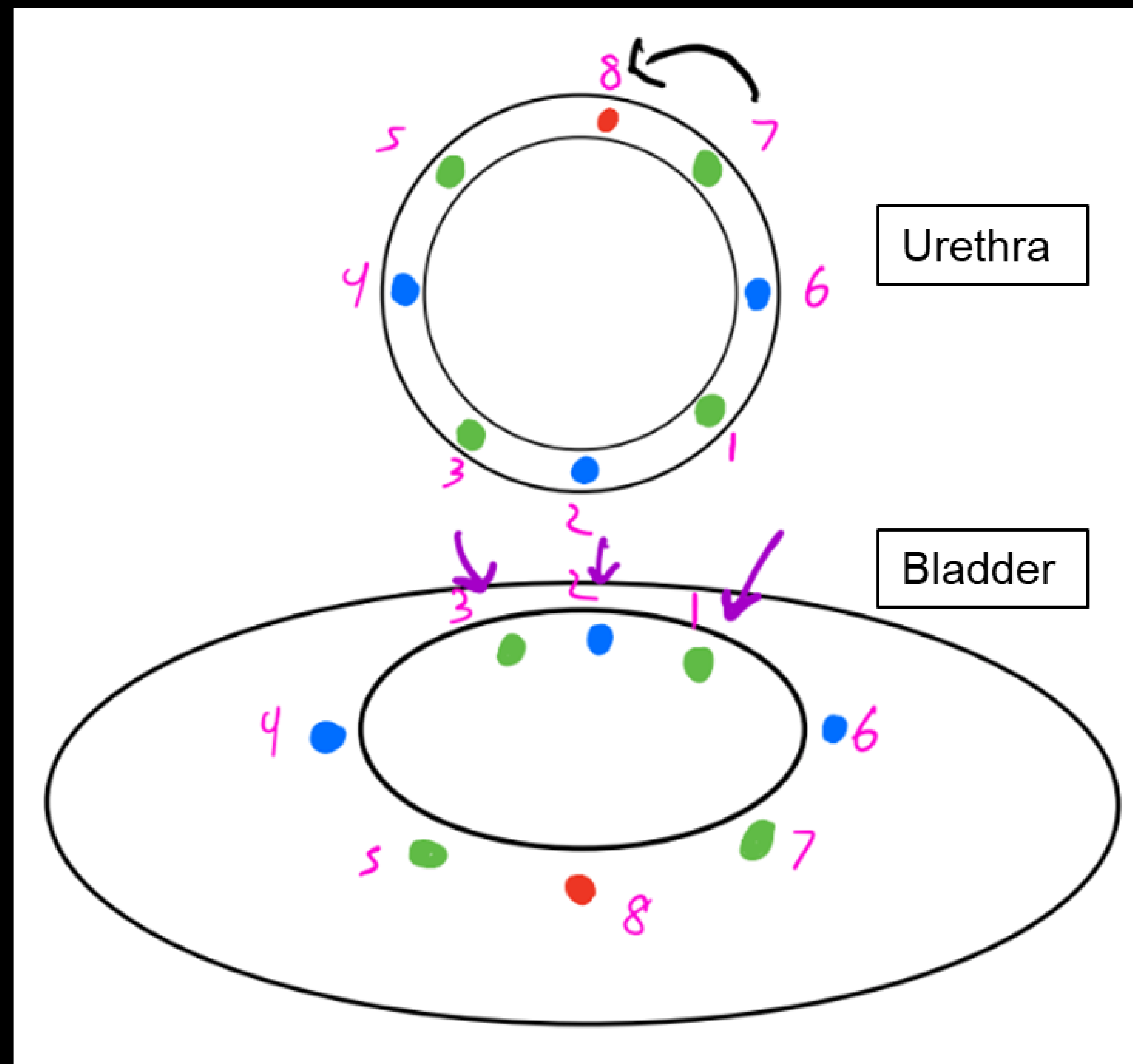
Patient Outcomes

Surgeon Feedback



Assessments deployed during training

RCT: Tailored personalized feedback for VUA



Assessments deployed during training

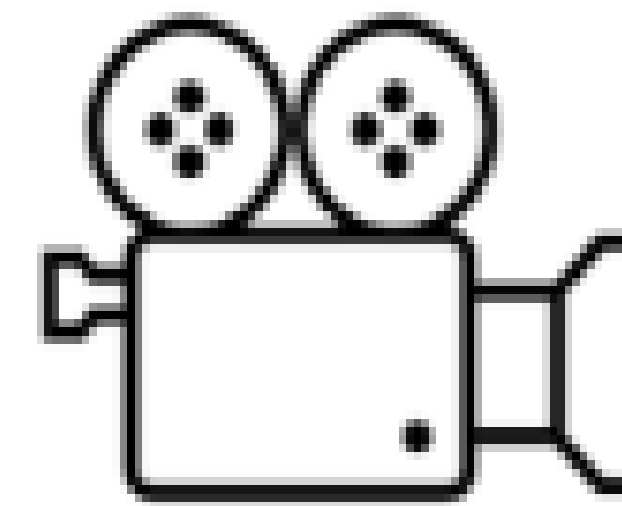


Ideal Training
Video

Control Group



Ideal Training
Video

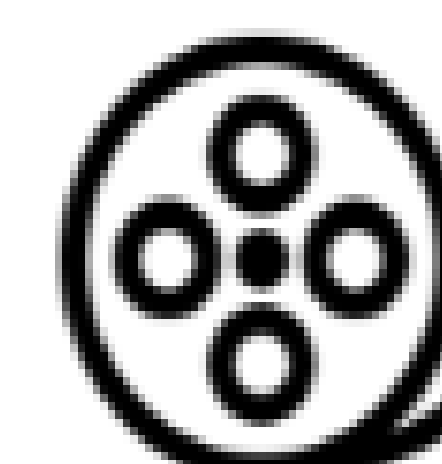


Own Prior
Video

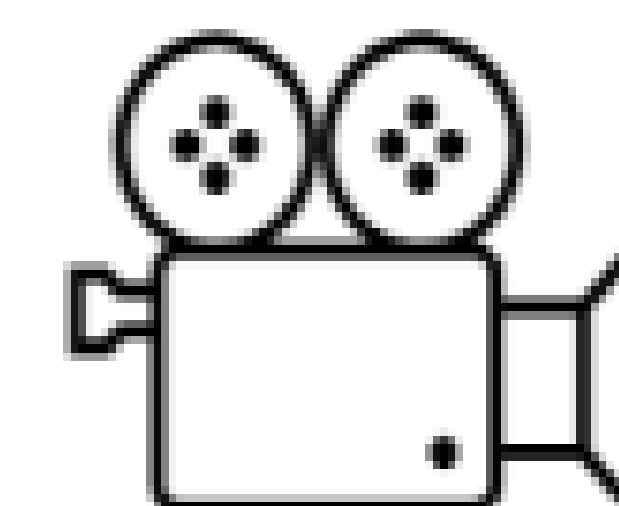


Scoring
Criteria

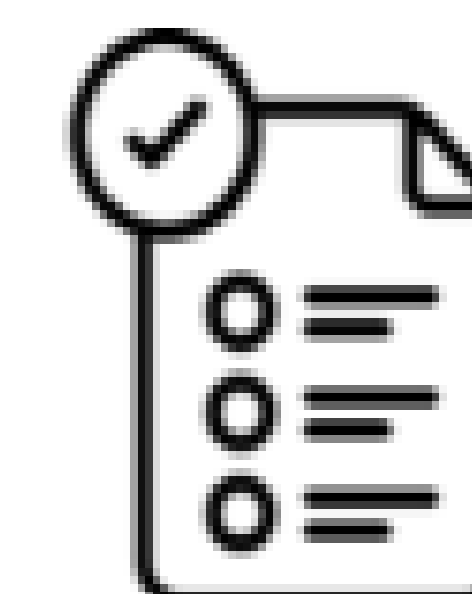
Conventional Feedback Group



Ideal Training
Video



Own Prior
Video



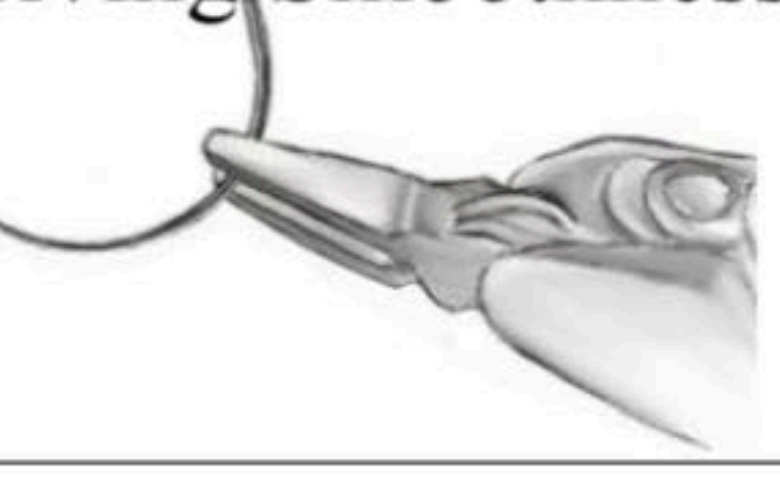
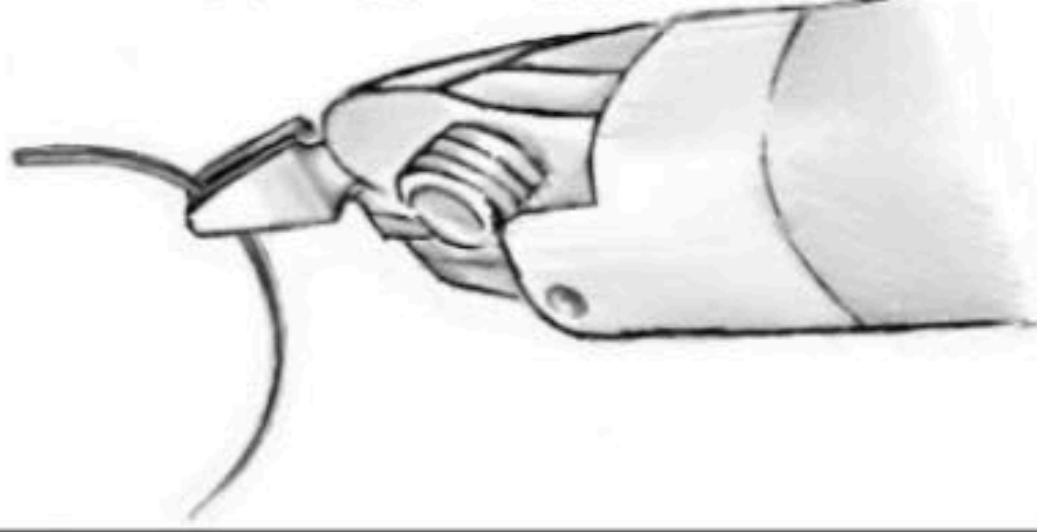
Scoring
Criteria



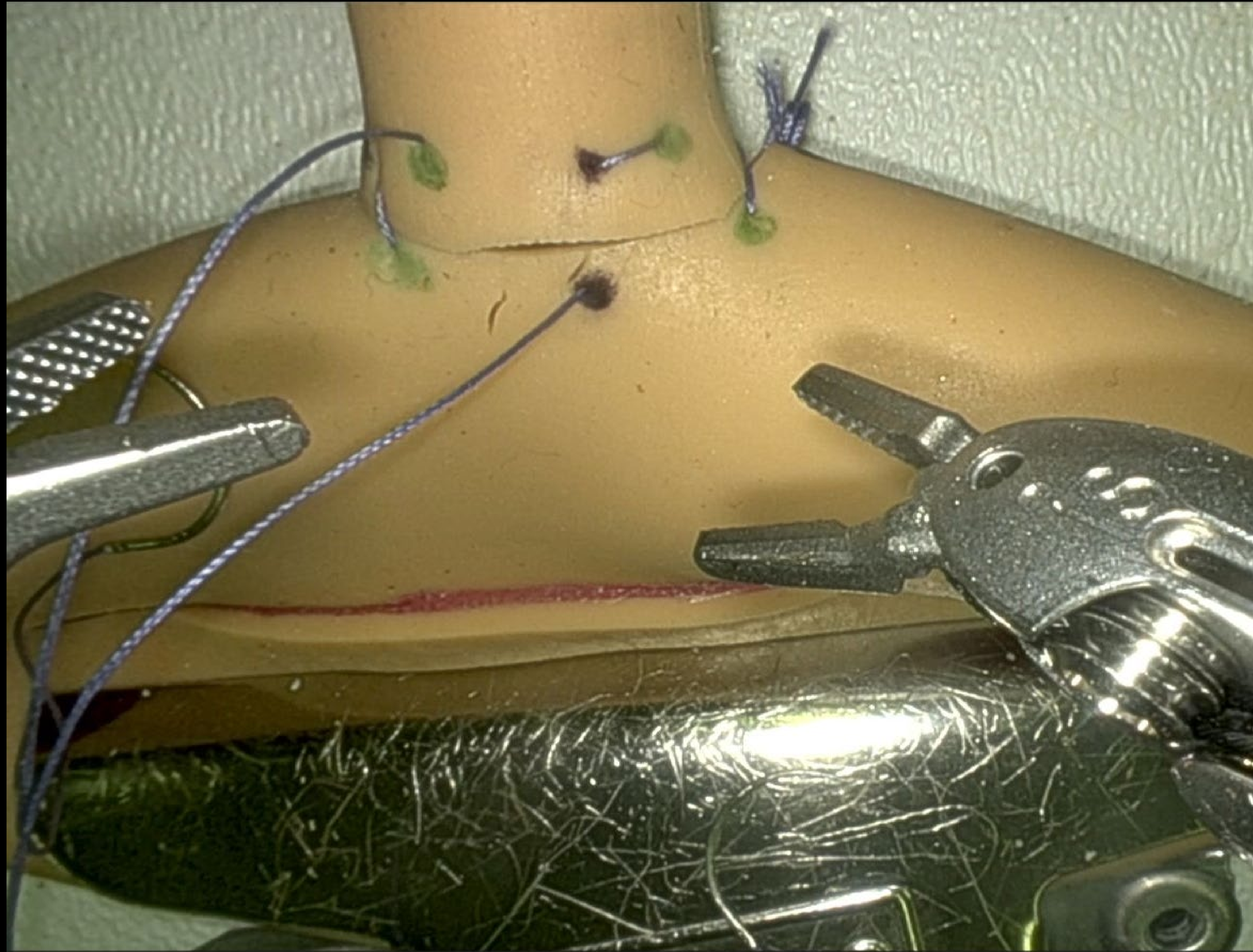
Personalized
Feedback

Tailored Feedback Group

Assessments deployed during training

Suturing Skill	Criteria	Success Threshold
Needle Repositions 	Each discreet pass of needle	2 passes or less
Needle Hold Ratio 	Needle grasped inside of acceptable range	Halfway to 3/4 distance from tip
Needle Hold Angle 	Angle between needle tip and driver	Between 90°-135°
Depth of Needle Hold 	Depth of needle body in driver jaws	Distal 1/4 of driver jaws
Driving Smoothness 	Smooth, continuous motion of needle drive	Maximum 1 re-adjustment 1 re-grab of needle
Wrist Rotation 	Rotation of wrist during needle drive	Complete rotation of wrist following curve of needle
Wrist Rotation 	Rotation of wrist during needle withdrawal	Complete rotation of wrist following curve of needle

Assessments deployed during training

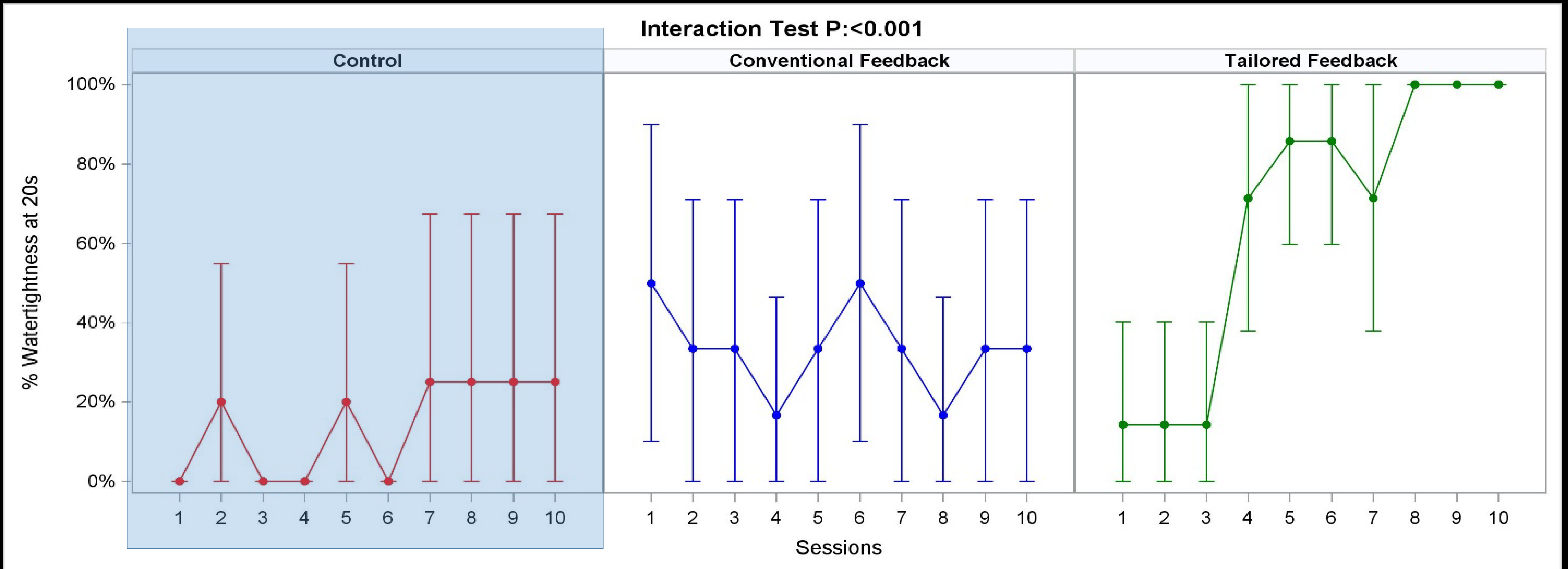


June 2026 : Volume 83 : Number 6

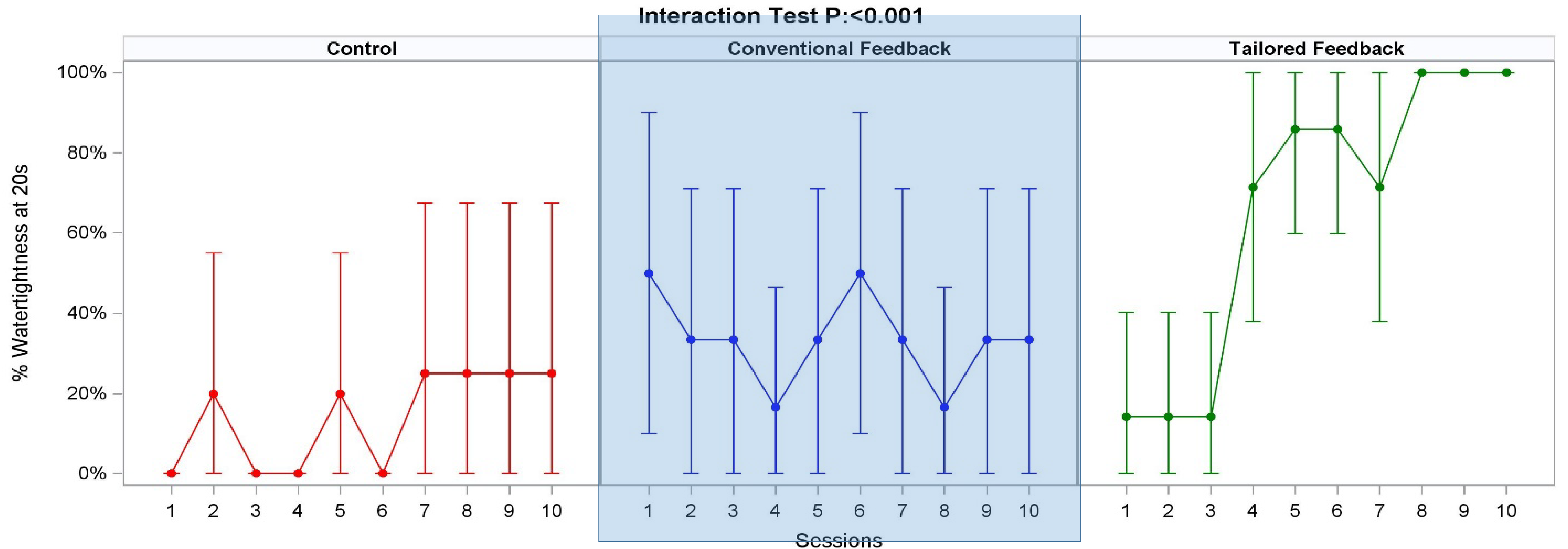
Journal of Surgical Education

The Official Journal of the Association of Program Directors in Surgery

Assessments deployed during training

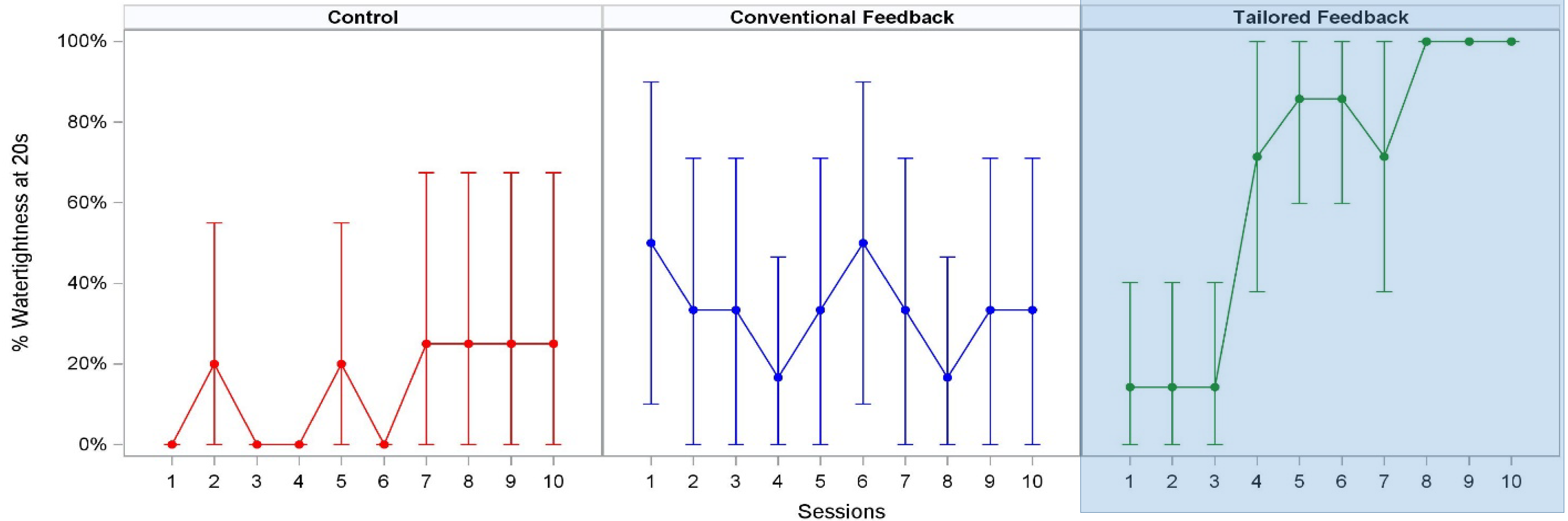


Assessments deployed during training



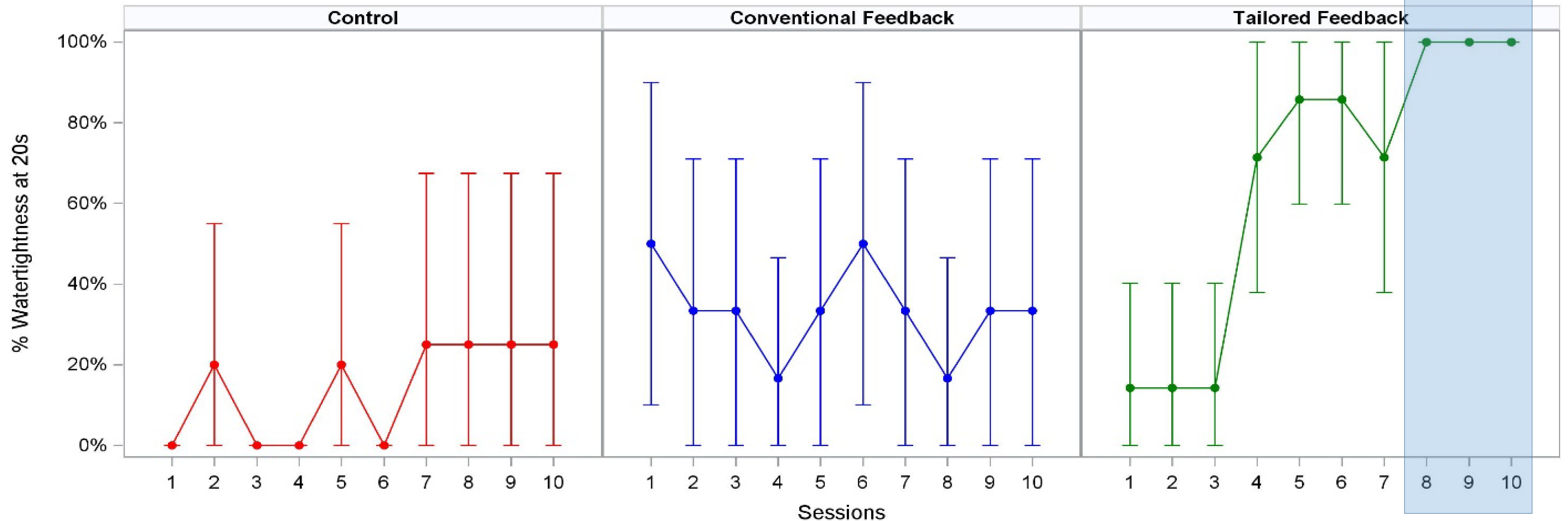
Assessments deployed during training

Interaction Test P:<0.001



Assessments deployed during training

Interaction Test P:<0.001

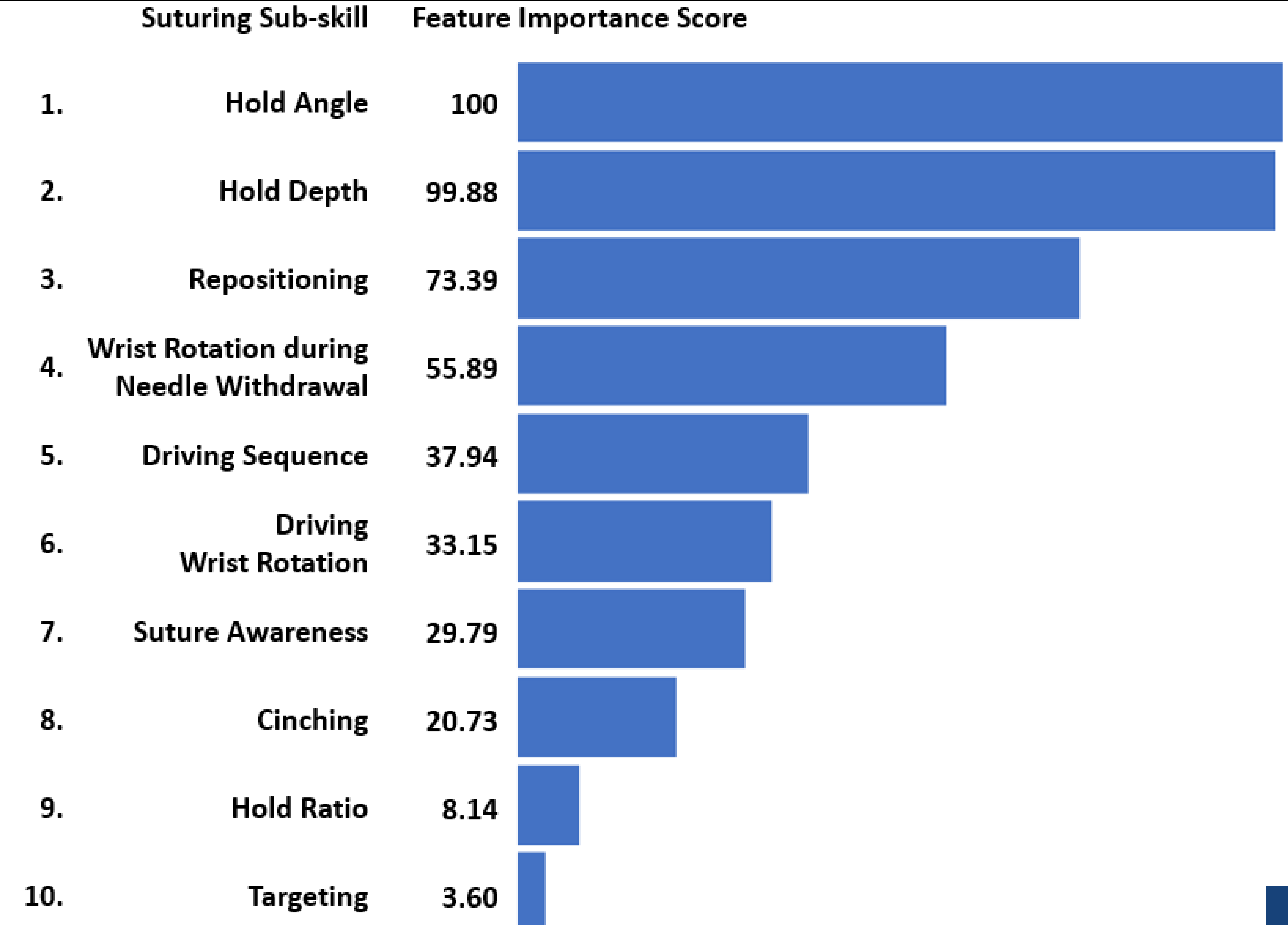


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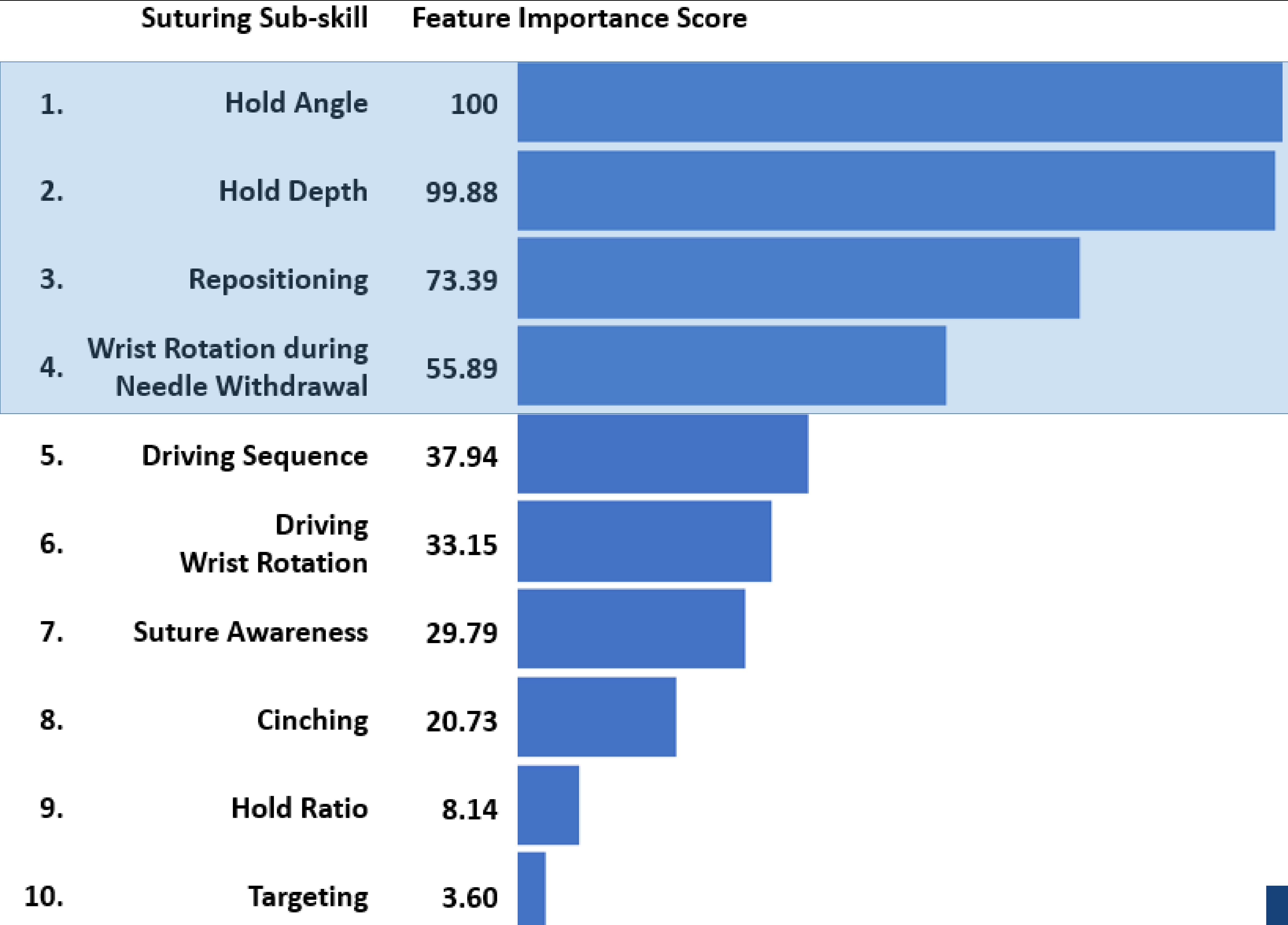
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Assessments deployed during training



Assessments deployed during training



Assessing, Optimizing, and Delivering Surgical Feedback with AI for Urological Robotic Surgeries



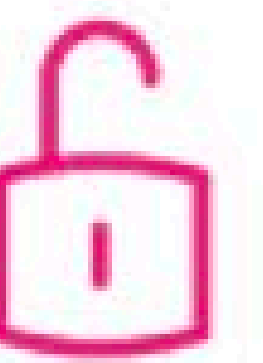
PI: Andrew Hung

Sites: Cedars, UCSD, Stanford, NYU

Grant ID: R01CA298988



Developing a Feedback Classification System



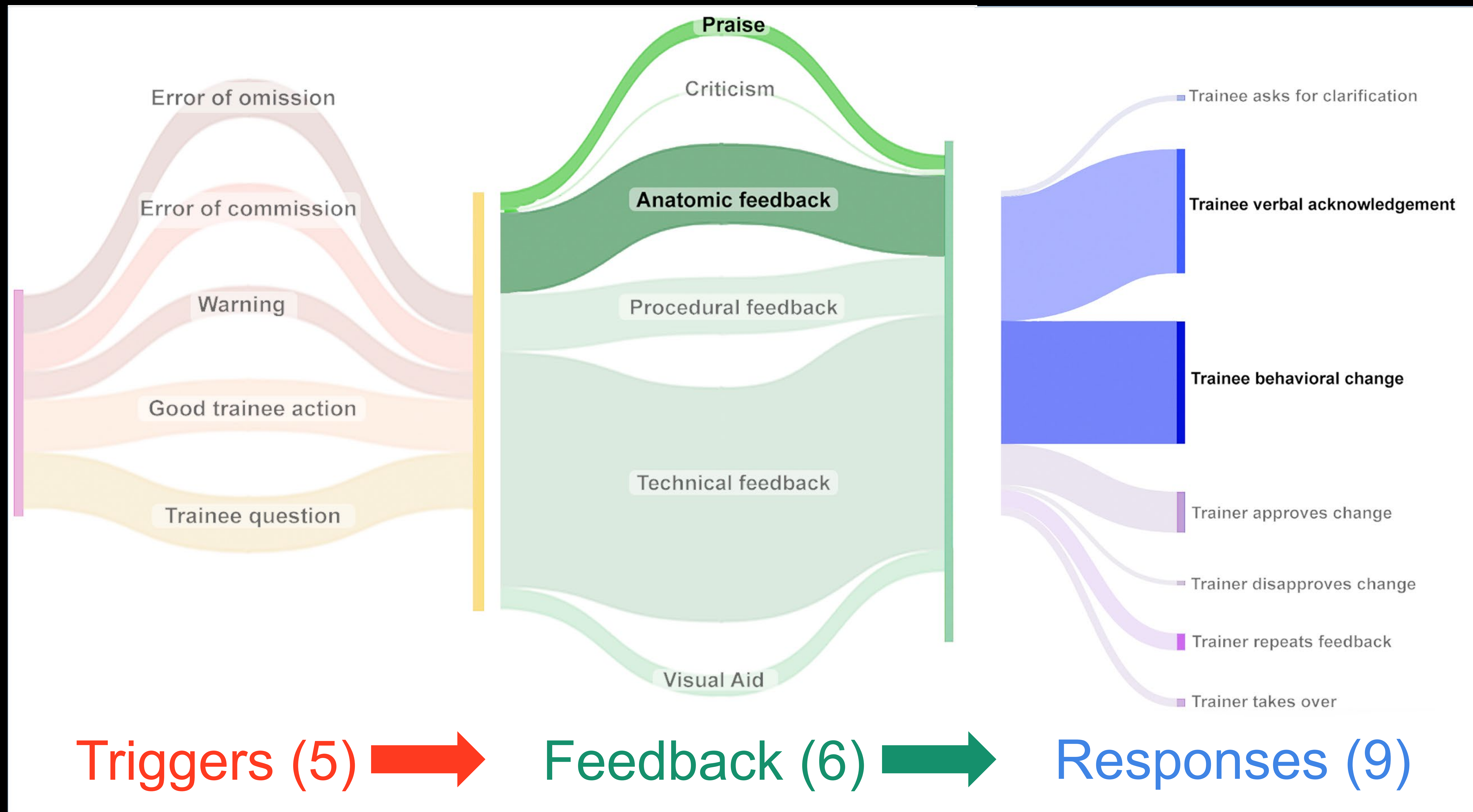
Original Investigation | Medical Education

Development of a Classification System for Live Surgical Feedback

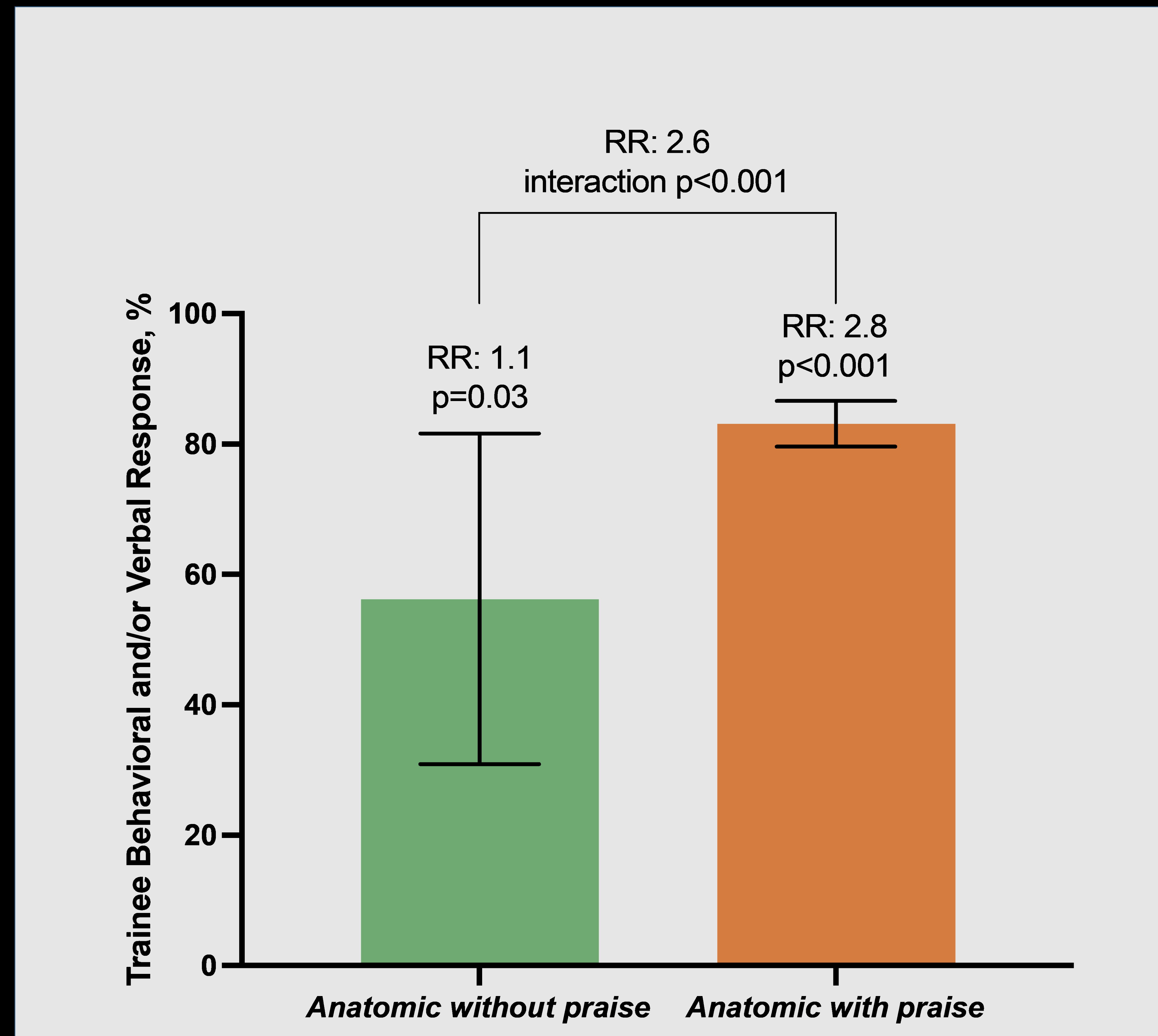
Elyssa Y. Wong, BS; Timothy N. Chu, BS; Runzhuo Ma, MD; Istabraq S. Dalieh, BS, MS; Cherine H. Yang, BA; Ashwin Ramaswamy, MD, MPP; Luis G. Medina, MD; Rafal Kocielnik, PhD; Seyedeh-Sanam Ladi-Seyedian, MD; Andrew Shtulman, PhD; Steven Y. Cen, PhD; Mitchell G. Goldenberg, MD, PhD; Andrew J. Hung, MD

29 teaching cases
3,711 instances of feedback

Developing a Feedback Classification System



Utility of the Feedback Classification System



Human and AI understanding surgical feedback

npj | digital medicine

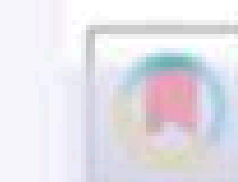
Article

Published in partnership with Seoul National University Bundang Hospital



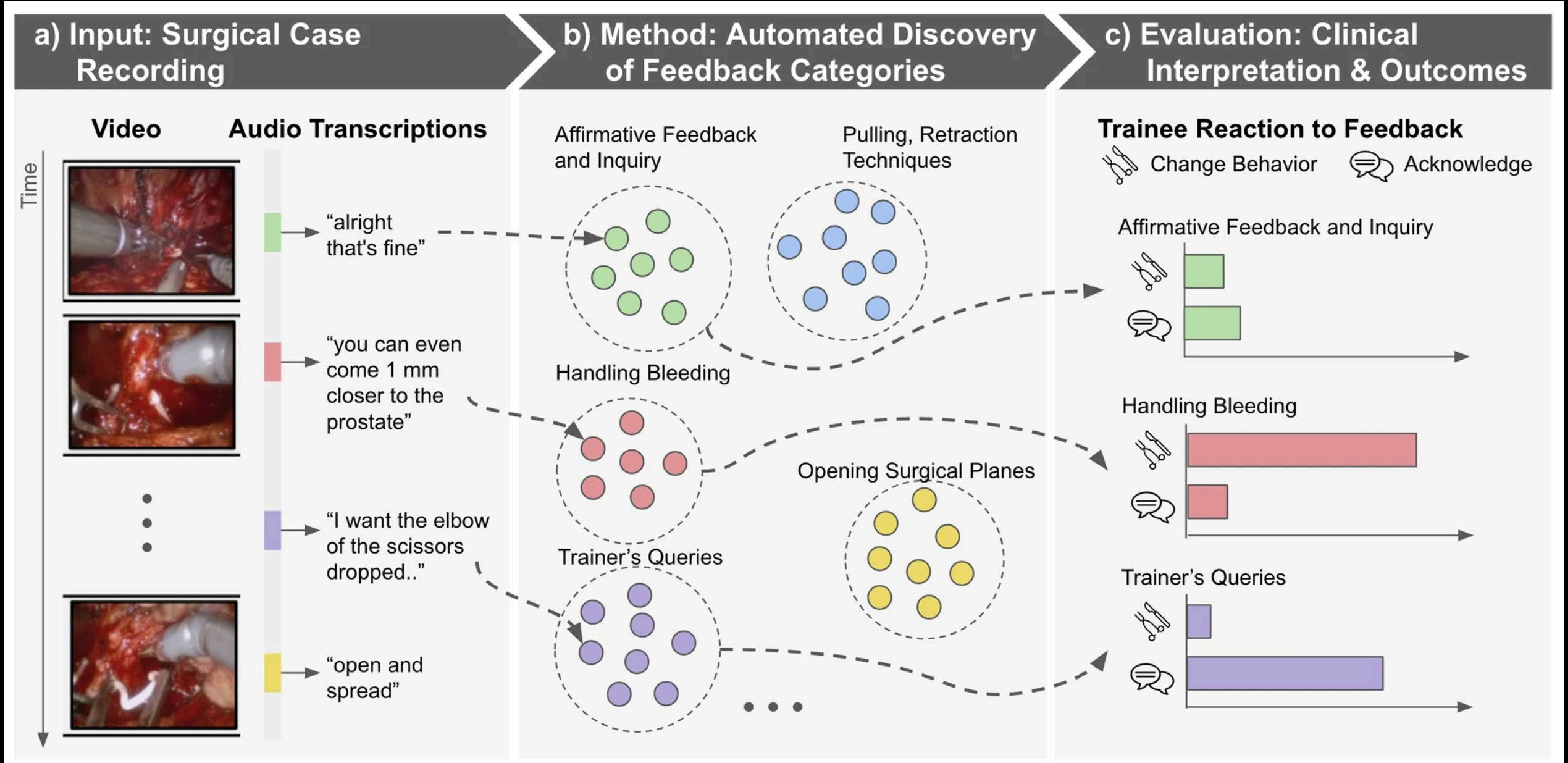
<https://doi.org/10.1038/s41746-024-01383-3>

Human AI collaboration for unsupervised categorization of live surgical feedback

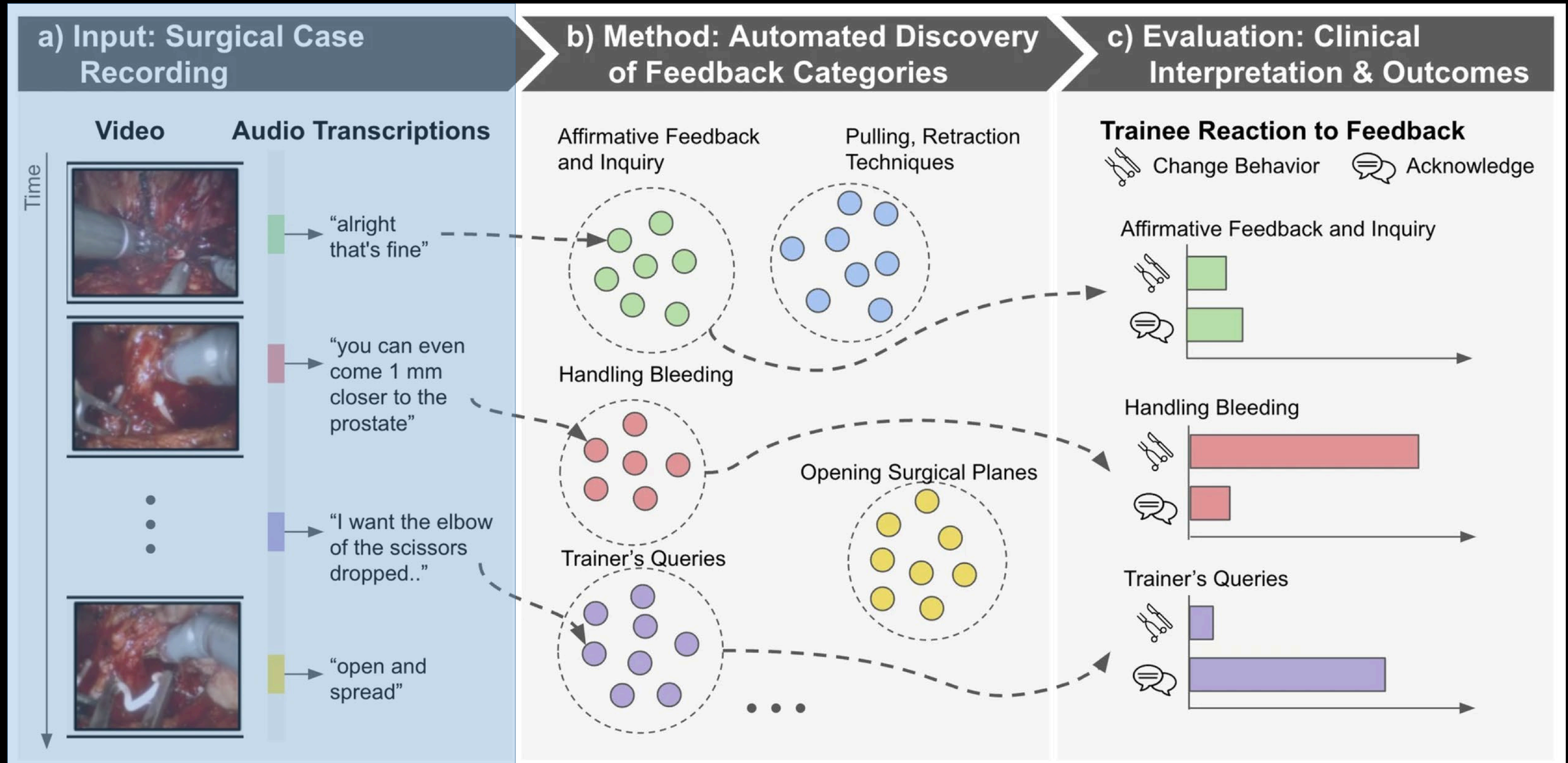
 Check for updates

Rafal Kocielnik¹, Cherine H. Yang², Runzhuo Ma³, Steven Y. Cen⁴, Elyssa Y. Wong⁵, Timothy N. Chu², J. Everett Knudsen², Peter Wager², John Heard², Umar Ghaffar², Anima Anandkumar¹ & Andrew J. Hung²  

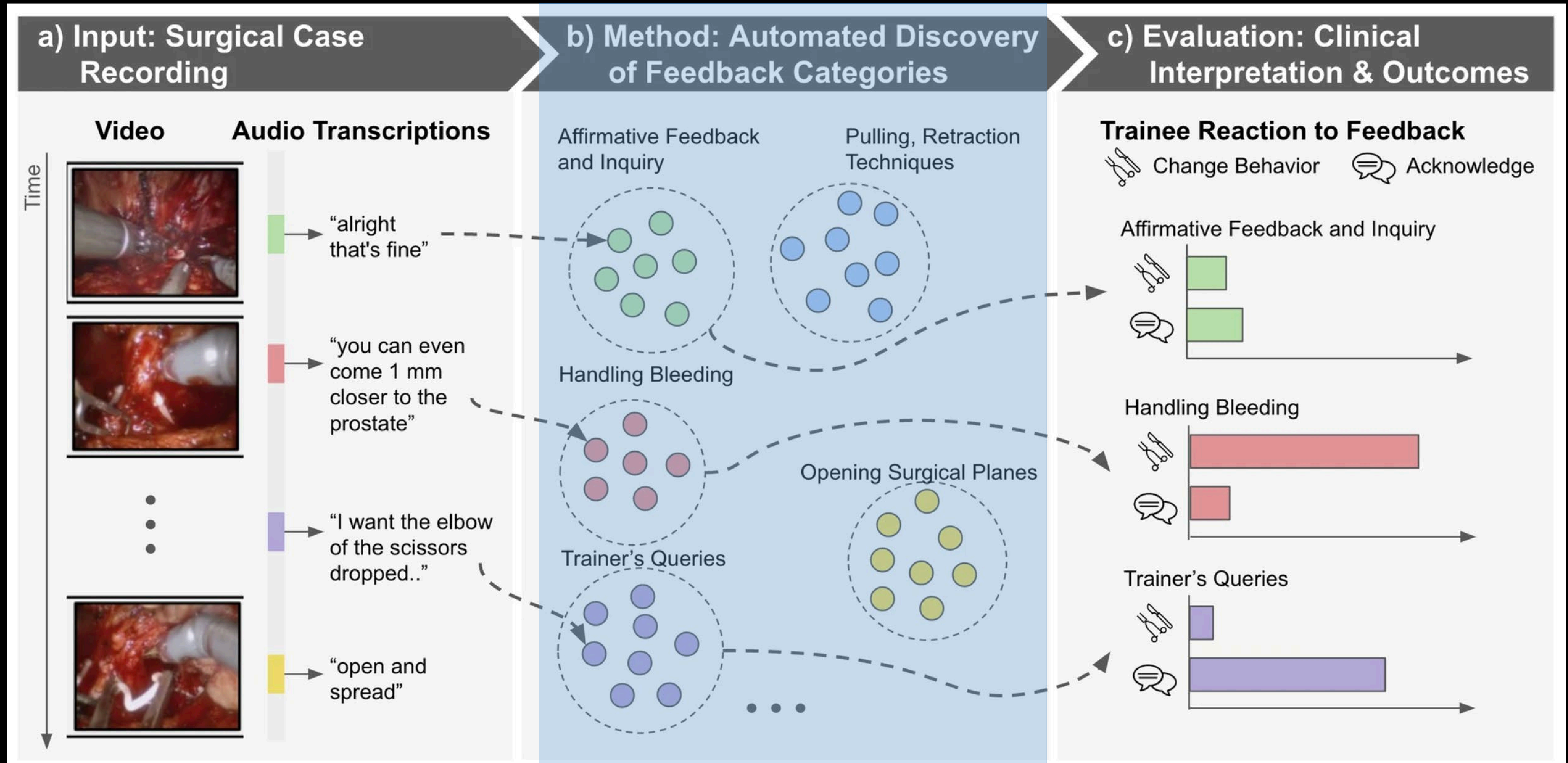
Human and AI understanding surgical feedback



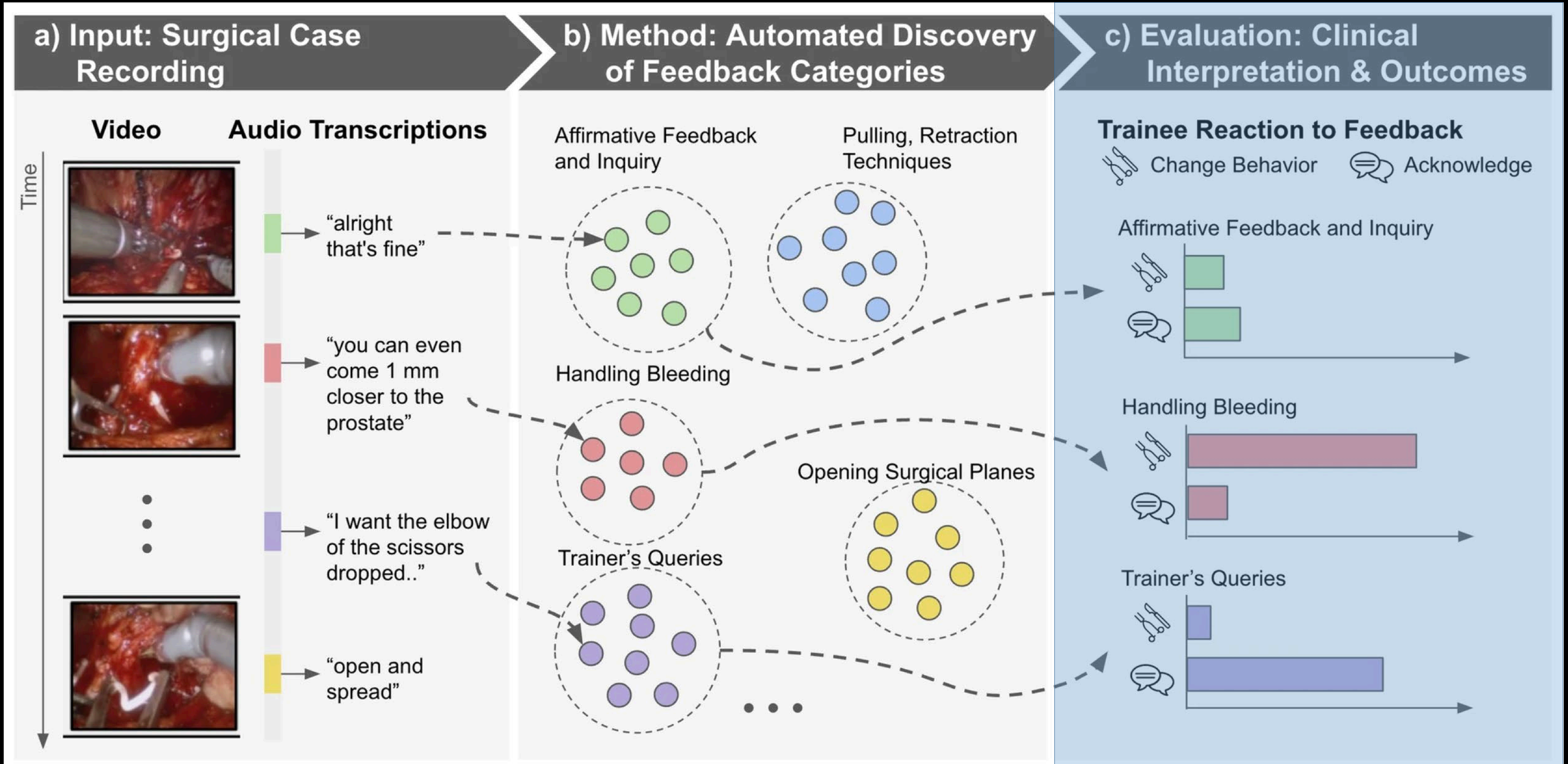
Human and AI understanding surgical feedback



Human and AI understanding surgical feedback



Human and AI understanding surgical feedback



The effect of *timing* during live surgical feedback

Jeanine Kim¹, Cherine Yang¹, Aaron Denmark¹, Ludovica Cella¹, Sweta Parija²,
Jill Buckley², Simon Conti³, Lee Zhao⁴, Steven Cen⁵, Andrew J Hung¹

1. Cedars-Sinai 2. UCSD 3. Stanford 4. NYU 5. USC

Case Breakdown



5 sites:

- Cedars-Sinai
- USC
- NYU
- UCSD
- Stanford

37 cases

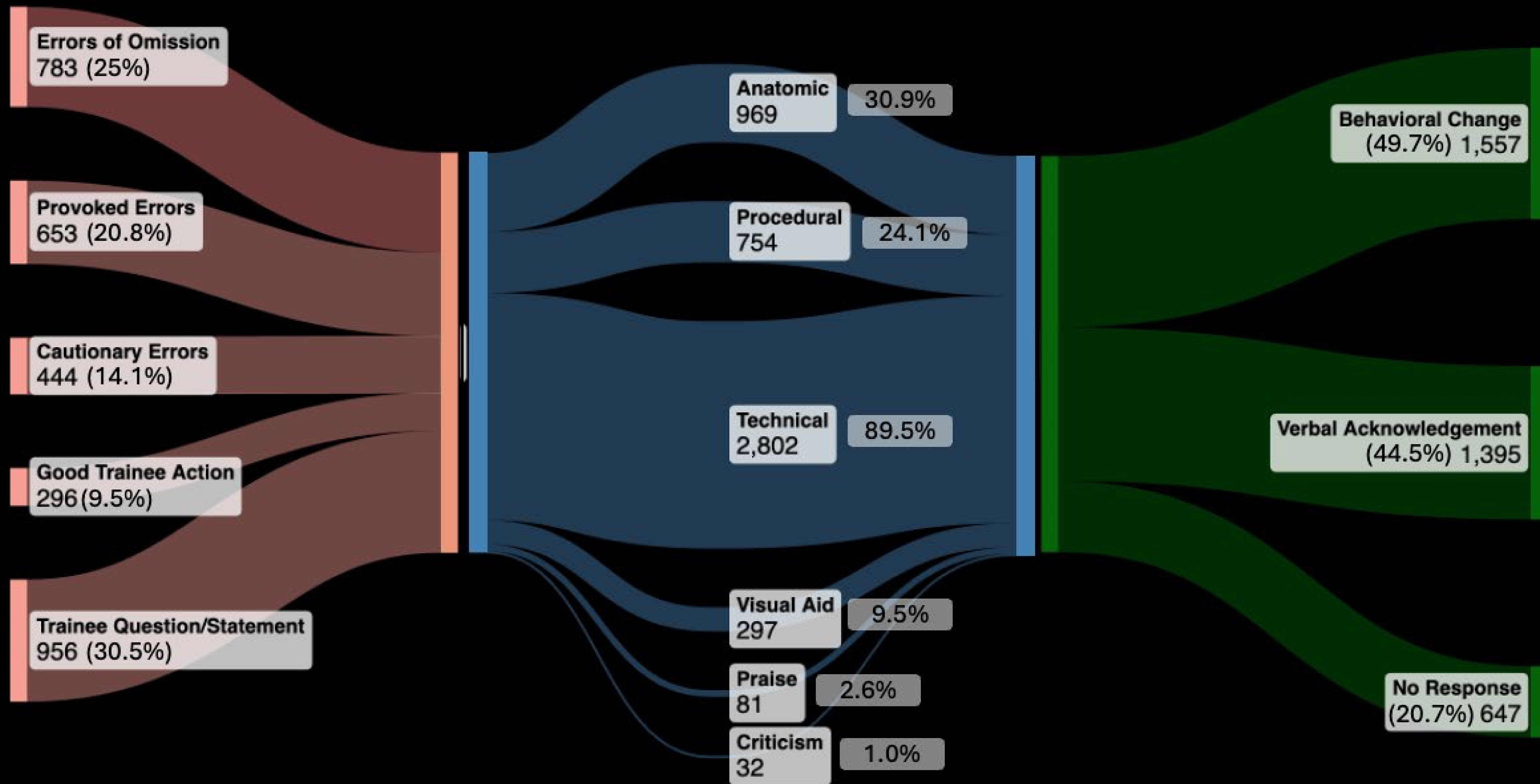
3683 feedback lines

11 attending surgeons
6 fellows
11 residents

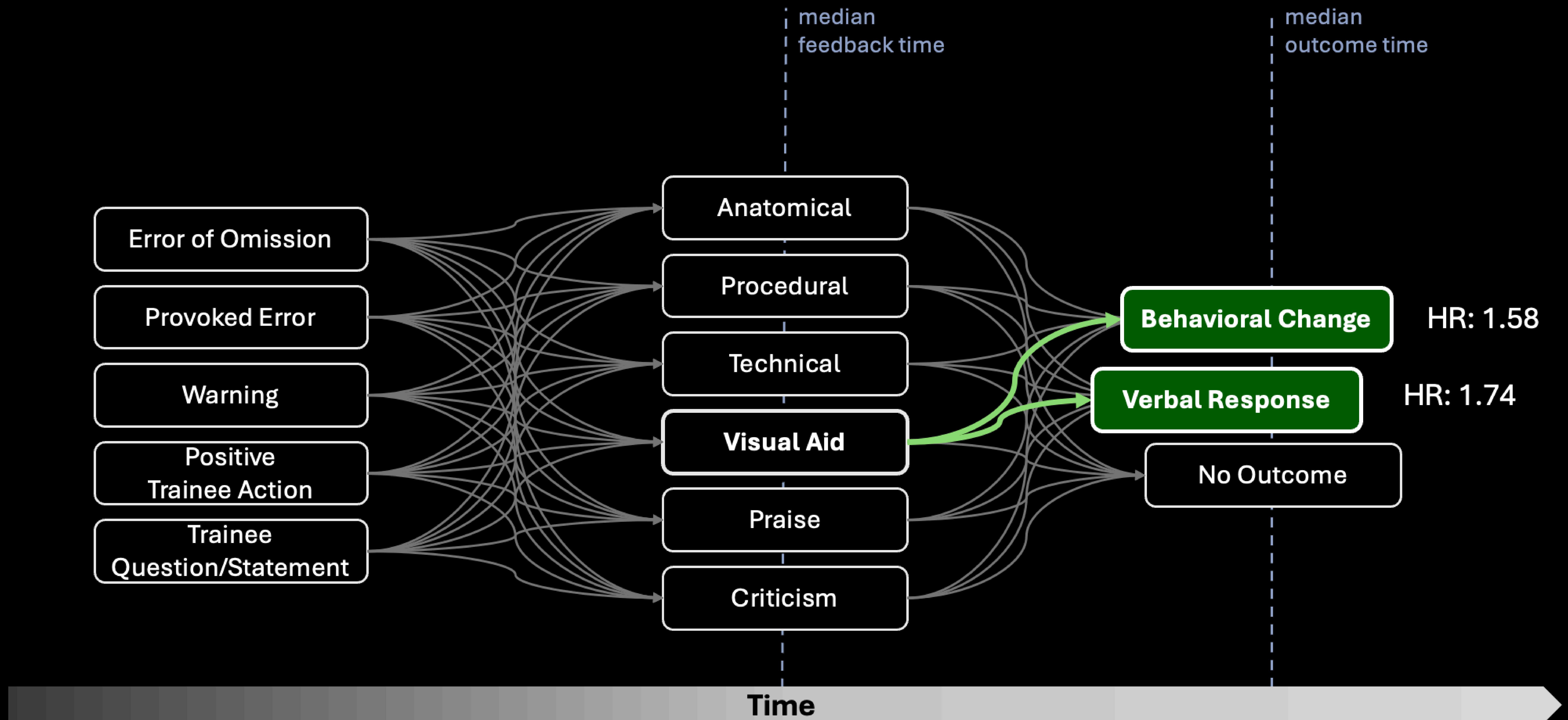
Trigger

Feedback

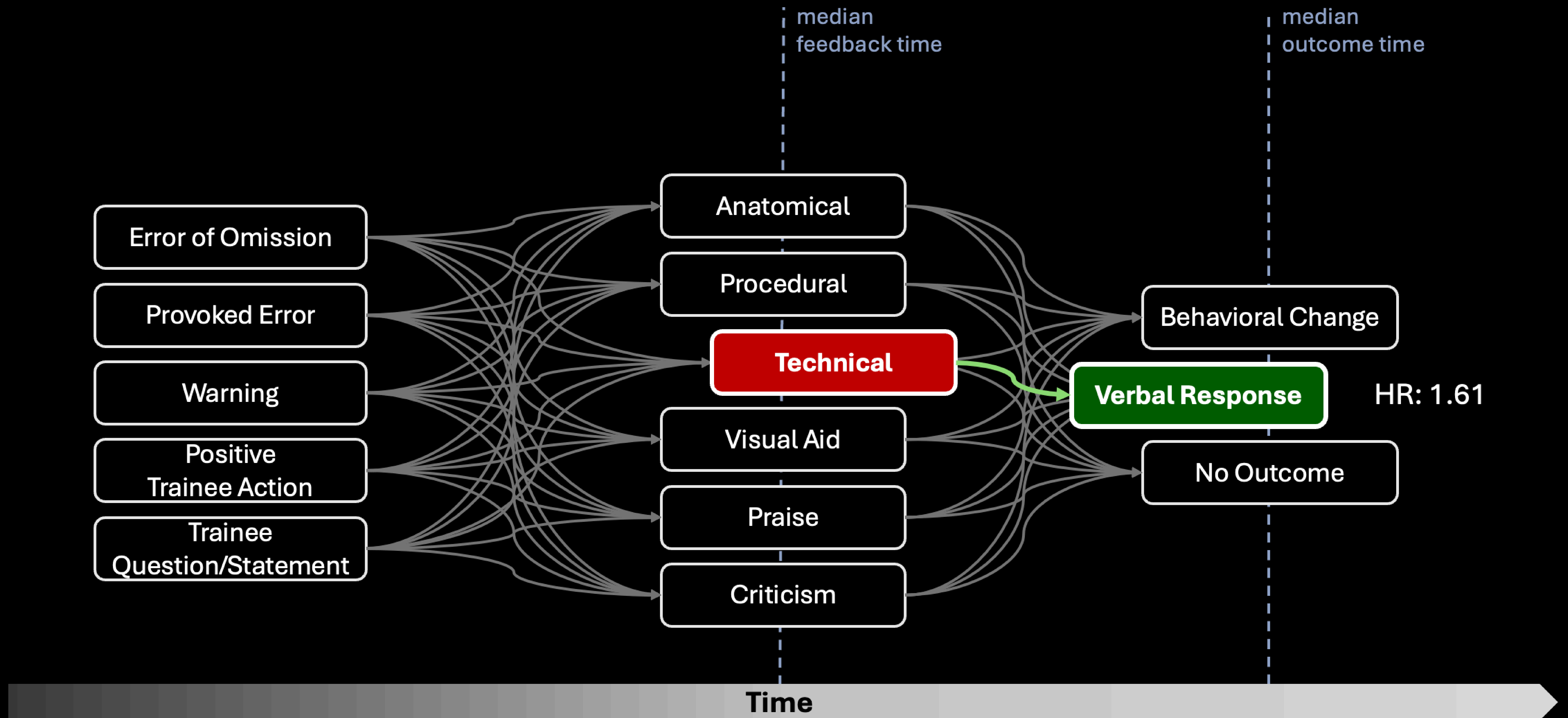
Outcome



Visual Aid

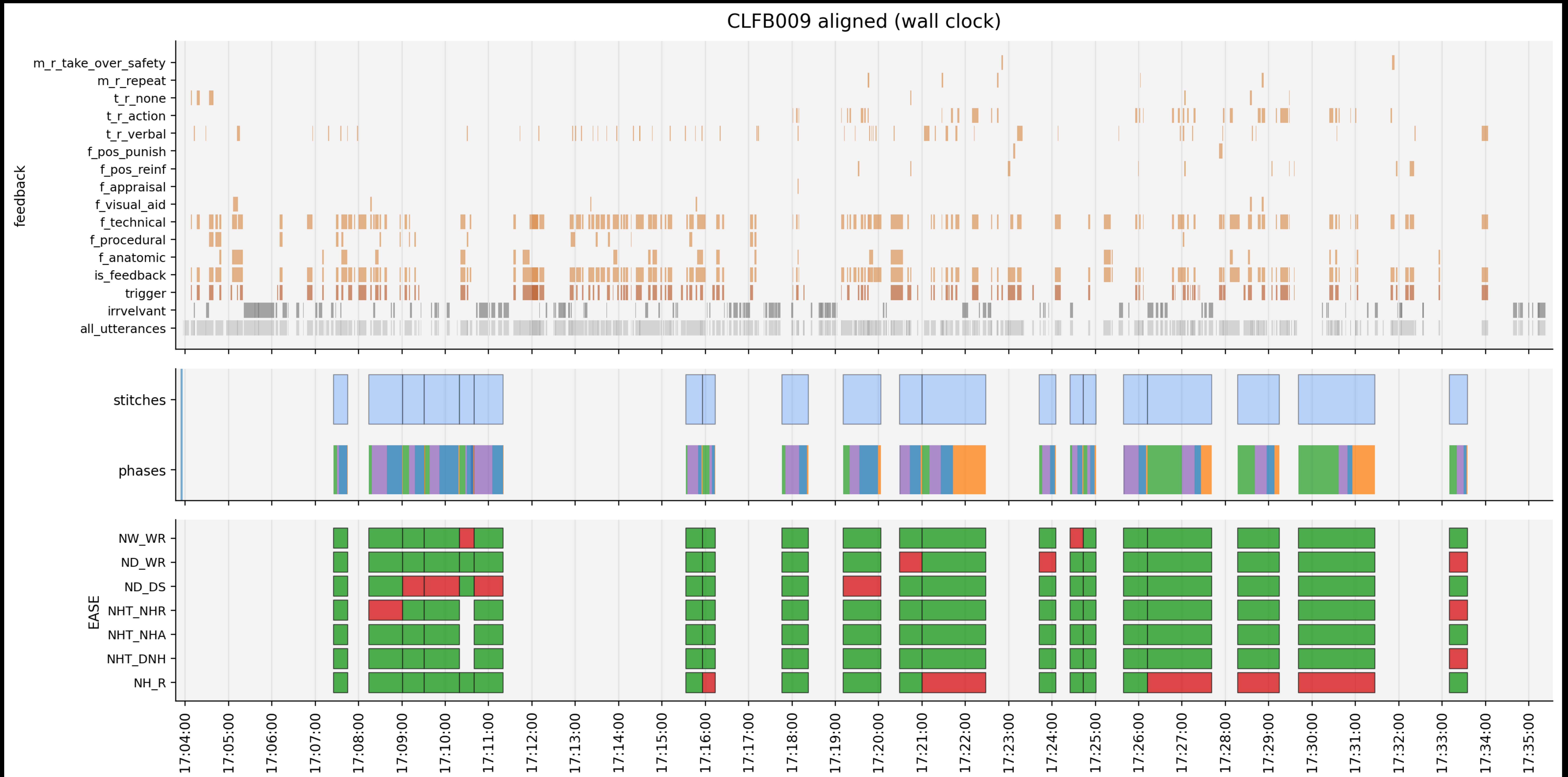


Technical



Skill Assessment x Live Surgical Feedback

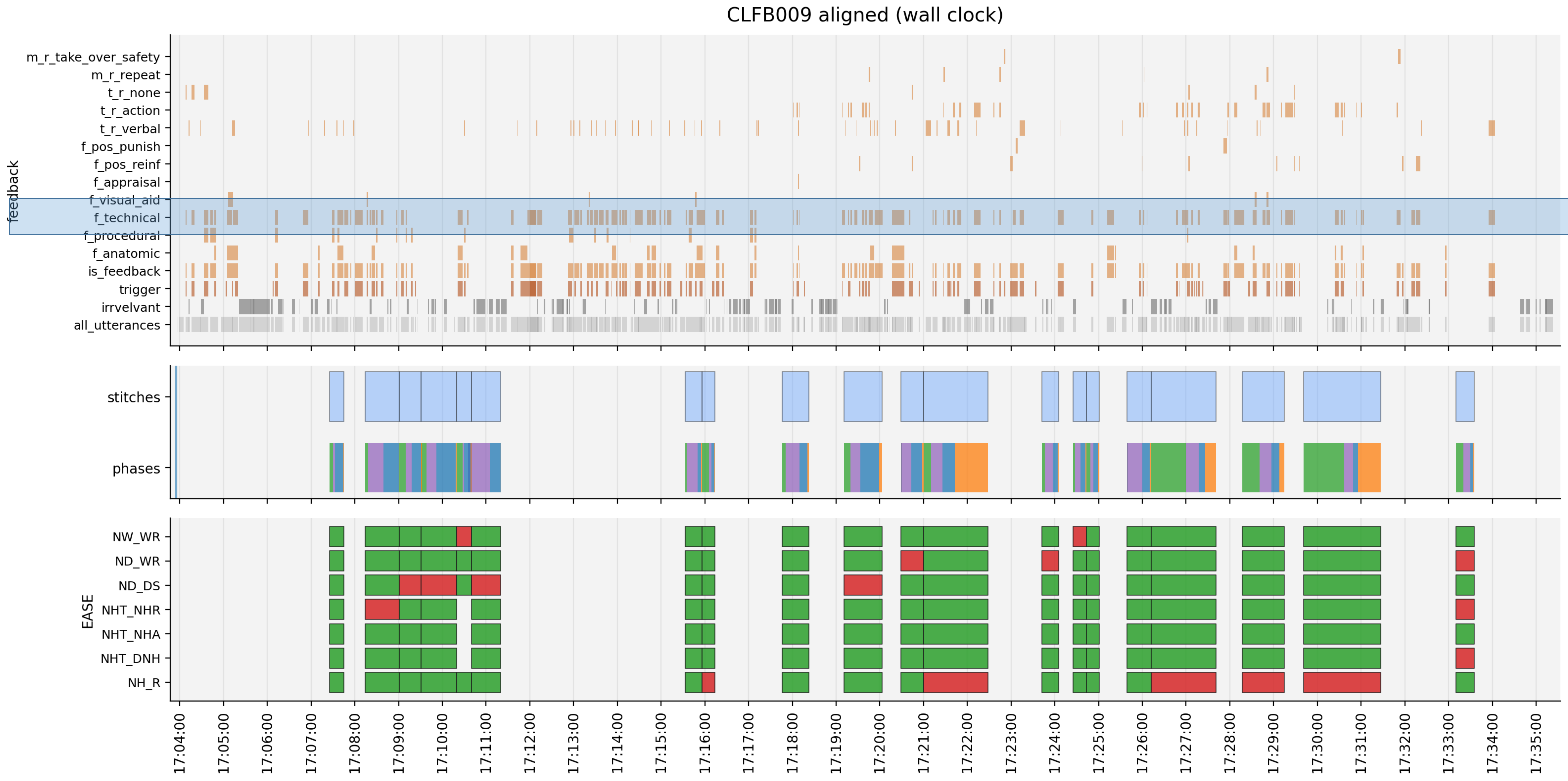
Skill Assessment x Live Surgical Feedback



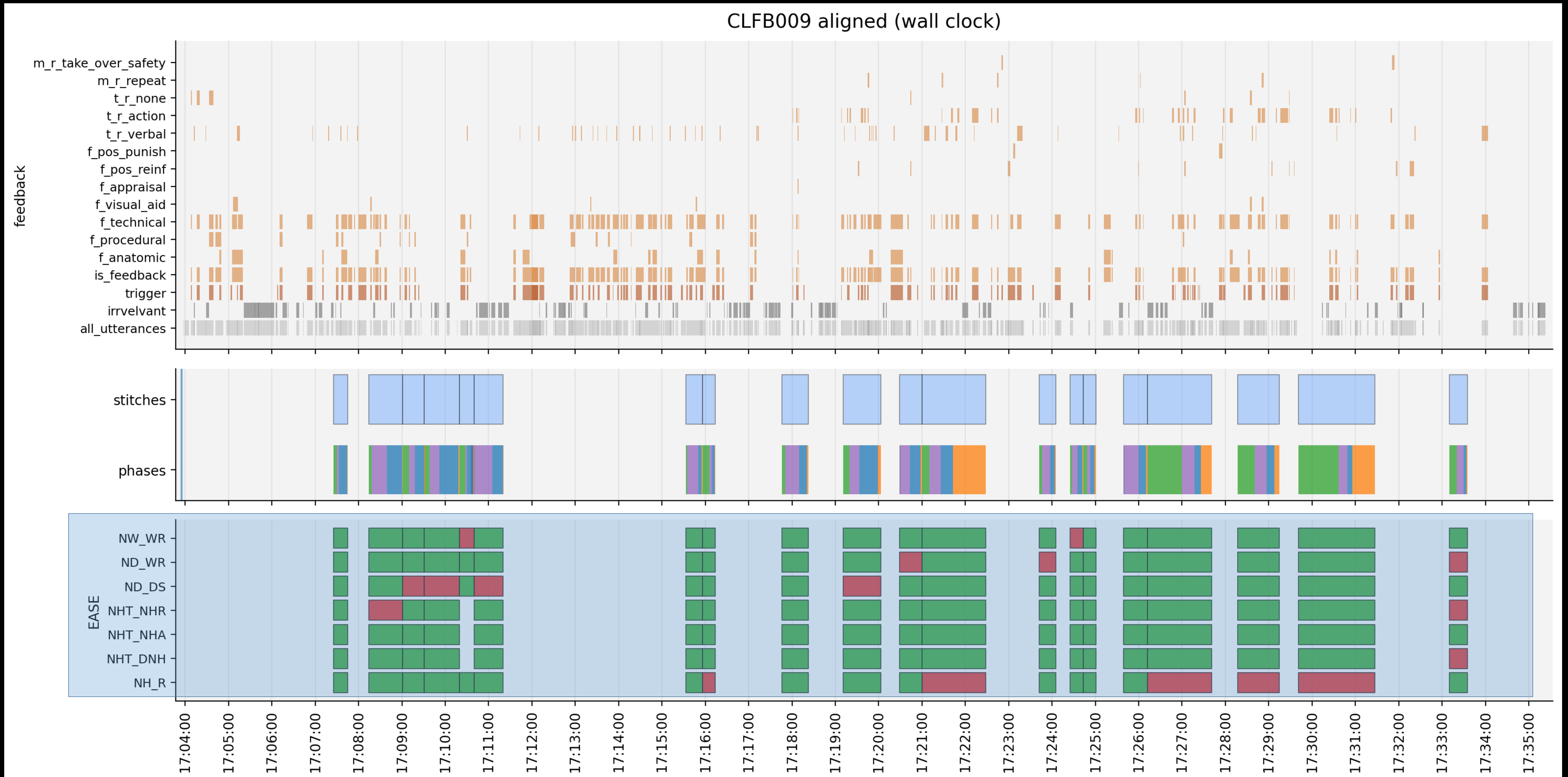
Skill Assessment x Live Surgical Feedback



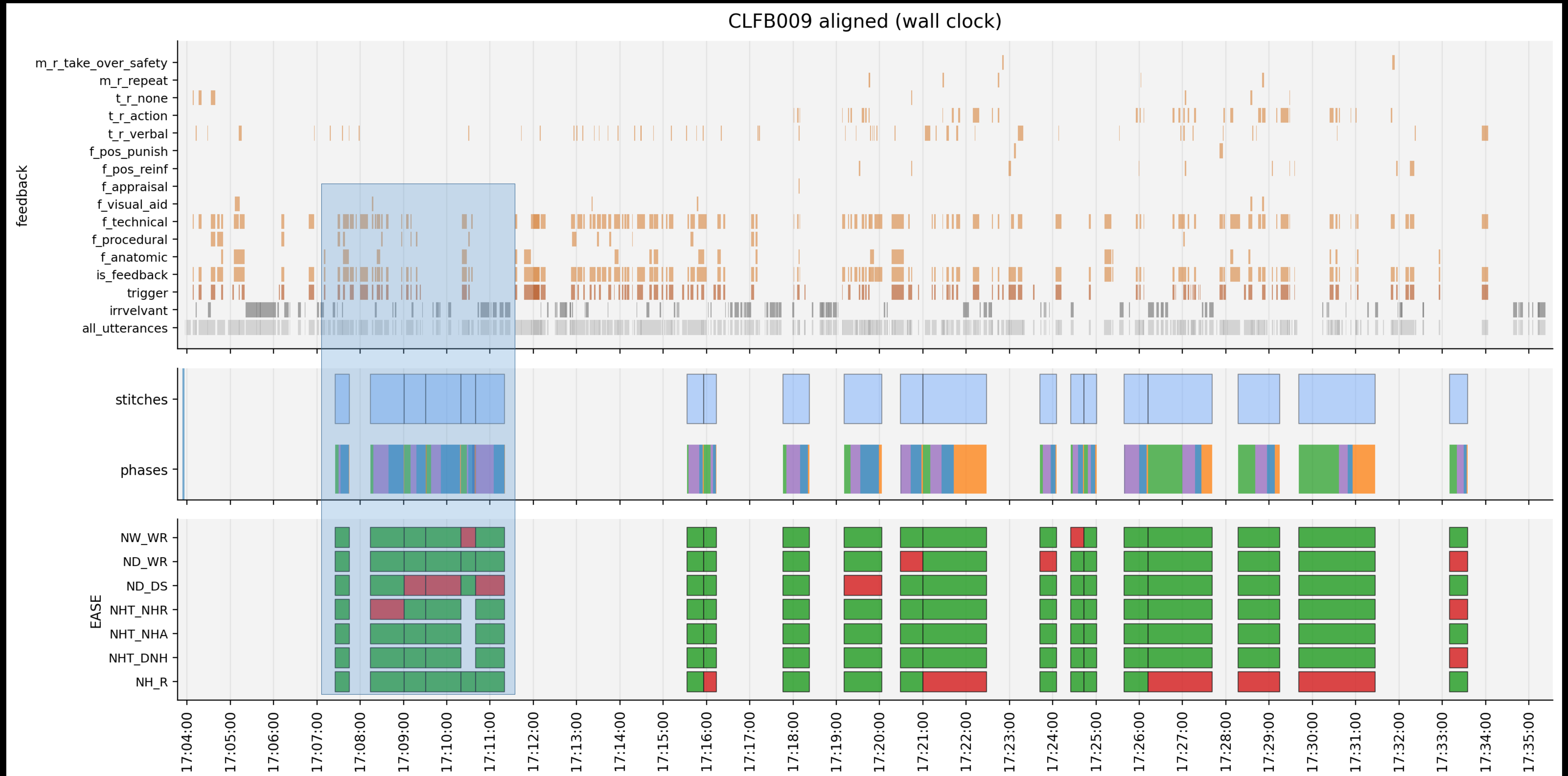
Skill Assessment x Live Surgical Feedback



Skill Assessment x Live Surgical Feedback



Skill Assessment x Live Surgical Feedback





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