

## APPENDIX A EQUATION DEFINITIONS

### A. Huber Loss

The definition of the huber loss,  $h\{\}$  used in our paper is given as

$$h\{x, \delta\} = \begin{cases} \frac{1}{2}x^2, & \text{if } |x| \leq \delta, \\ \delta(|x| - \frac{1}{2}\delta), & \text{otherwise.} \end{cases}$$

The delta values used in the constrained inverse kinematics objective function (Equation (2)) of the accompanying paper are given in Appendix B as,  $\delta_1$ ,  $\delta_2$  and  $\delta_3$ .

## APPENDIX B PARAMETER VALUES

The parameters and hyperparameters were determined empirically by systematically incrementing one parameter while holding all others constant. Computational speed and the error metrics in Table I of the accompanying paper were considered during this process. Parameter selection occurred prior to the experiments in the accompanying paper and all parameters were held constant throughout the user studies.

TABLE I: Parameter Values Implemented on the dVRK

Parameter Description	Parameter Symbol	Parameter Value
Regularization Terms	$w_1, w_2, w_3, w_4, w_5$	15.0, 30.0, 25.0, 2.0, 0.5
Huber Loss Thresholds	$\delta_1, \delta_2, \delta_3$	0.01, 0.17, 0.02

## APPENDIX C USABILITY ANALYSIS NASA-TLX RESULTS

Qualitative results of the pilot study (N=6) where participants completed the single-handed wire-chaser task are given in Fig. 1. Participants completed five trials of each condition (ENDO, STAT, and AUT), and their self-reported feedback was assessed after every condition using the NASA-TLX questionnaire. No statistically significant differences are found between conditions. Notably, physical and temporal demand was lower for the autonomous auxiliary camera condition compared to using only the endoscope (ENDO) or the endoscope plus a stationary auxiliary camera (STAT). Effort and mental demand were similar across all conditions. The autonomous camera condition also led to lower self-reported performance than the ENDO condition, and higher frustration than both the ENDO and STAT conditions.

## APPENDIX D CONFIDENCE INTERVALS

The confidence intervals for each variable of interest have been plotted for each of the three groups. The means for each variable fall within the 95% confidence interval for all other conditions, suggesting that there could be no statistically significant difference between them.

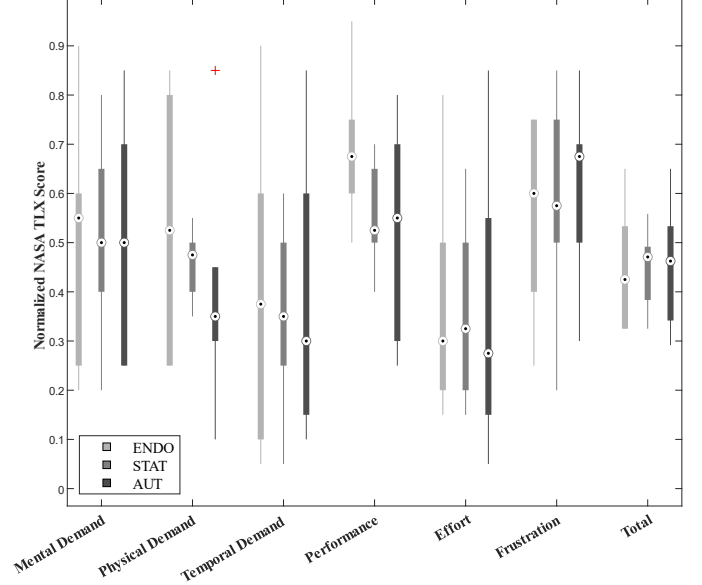


Fig. 1: Qualitative NASA-TLX results of usability analysis (N=6) comparing: 1) teleoperating from endoscopic camera only (ENDO), 2) teleoperating from stationary auxiliary camera (STAT), 3) teleoperating from AutoCam (AUT).

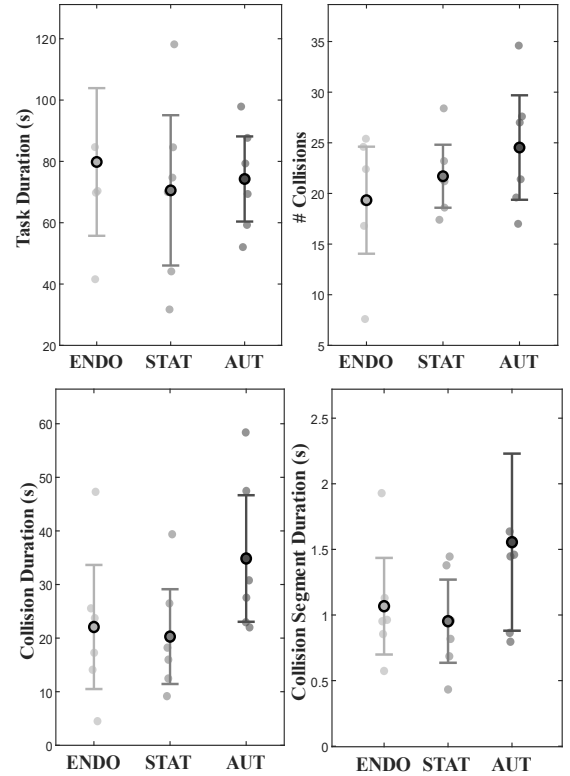


Fig. 2: Confidence Intervals (95%) for User Study Groups