

Text Input Performance with a Mixed Reality Head-Mounted Display (HMD)

Derby, J., Rarick, C., & Chaparro, B.

Department of Human Factors & Behavioral Neurobiology, Embry-Riddle Aeronautical University, Daytona Beach, FL



EMBRY-RIDDLE
Aeronautical University
DAYTONA BEACH, FLORIDA

Introduction

- The Microsoft HoloLens is a Mixed Reality (MR) Head-Mounted Display (HMD) device that has been dubbed the “workplace of the future” (Wright, 2018)
- In a previous study, to understand the general utility of this device as an office tool, we learned that text entry tasks were the most difficult to complete and were reported as inaccurate, slow, and undesirable for typing long messages (Shelstad et al., 2019)
- Text entry can be done using gestures, voice, and a clicker to interact with a virtual QWERTY keyboard, seen in figures 1 & 2
- The current study assesses the usability, performance, and user preference for two text input methods (Gesture and Clicker)
- We hypothesized that participants would prefer the clicker method over the gesture method because it would be more efficient and less physically demanding



Figure 1. Gesturing with the Microsoft HoloLens.

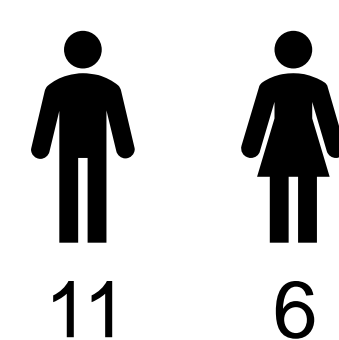


Figure 2. Microsoft HoloLens with Clicker.

Method

Participants

N = 17, 11 Males 6 Females
Ages 18-24 (M = 19.82, SD = 1.91)
N = 11 had VR experience (Mdn = 1 hour, IQR = 1)



Measures

Typing Speed & Accuracy – Words per Minute (WPM), adjusted WPM (adjWPM), and Word Error Rate (WER)

Perceived Exertion – The Borg CR10 with a Body Map

Perceived Workload – NASA TLX-R

Perceived Eye Strain – Six 5 point Likert-scale questions

Perceived Usability – System Usability Scale (SUS)

User preference & recommendations – User Comments and rating of input methods (0-50 scale)

Procedure

- HoloLens Gesture Tutorial
- Randomly assigned to either the Gesture or Clicker input method
 - Entered 5 practice phrases and 15 test phrases from the MacKenzie phrase set (MacKenzie & Soukoreff, 2003)
- Questionnaires (SUS, NASA-TLX R, BORG CR10, and eye strain)
- Completed 2 & 3 with the other input method
- Rated their preference (0-50 scale) and gave open-ended feedback

The HoloLens' current text entry methods (using a Gesture or Clicker) are slow, exhausting, and have poor usability.

Gesturing is worse than using a Clicker. But both should be redesigned.

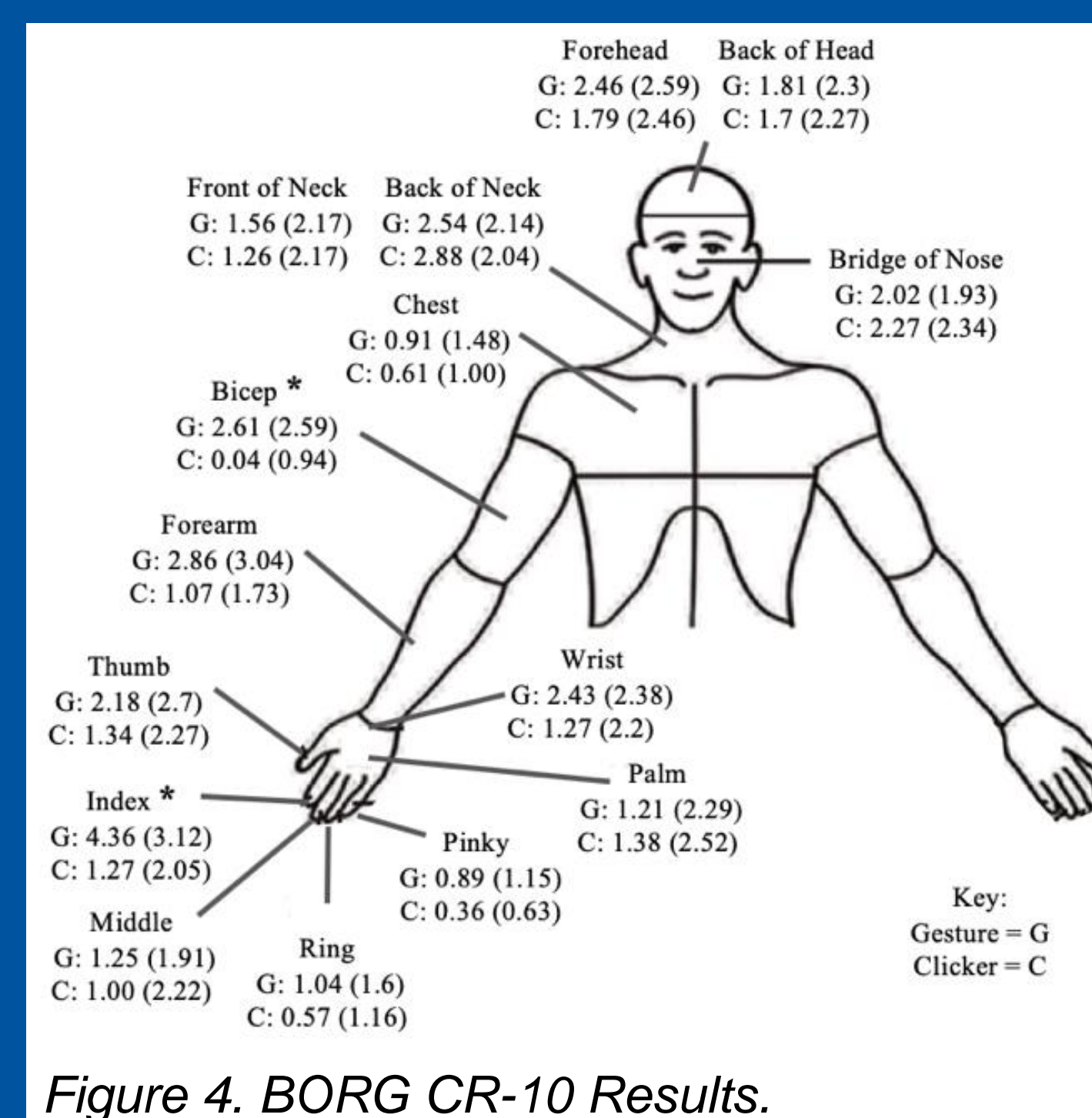


Figure 4. BORG CR-10 Results.

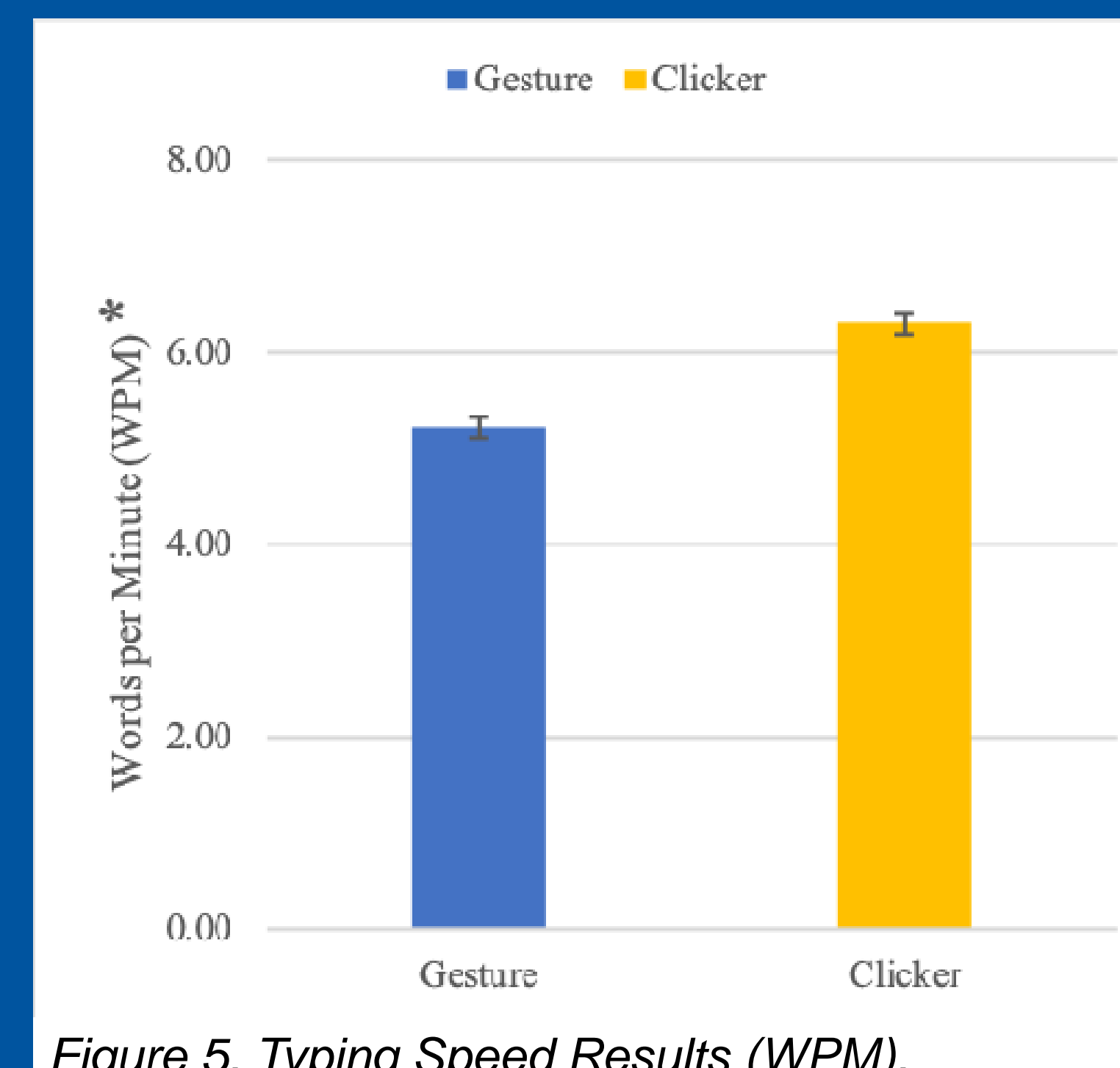


Figure 5. Typing Speed Results (WPM).

Procedure

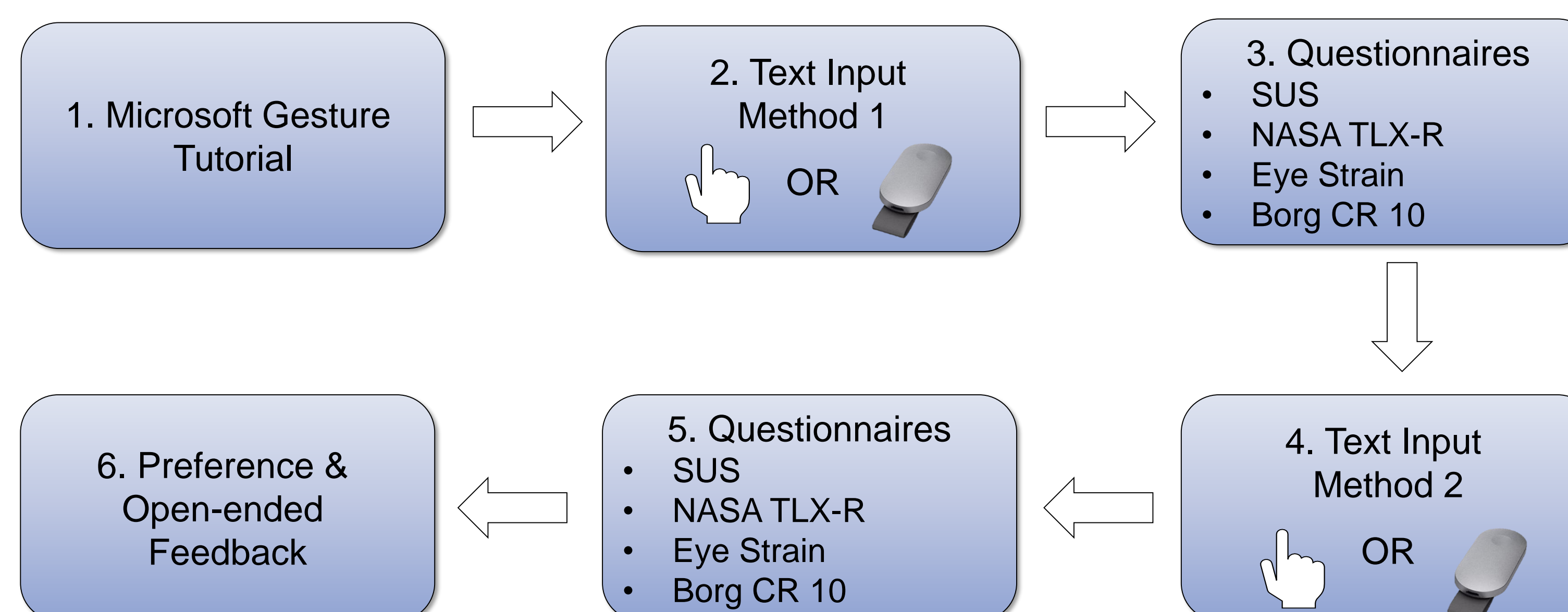


Figure 3. Procedure.

Results

Typing Speed & Accuracy

- The Clicker method was significantly faster (6.58 WPM) and adjWPM rate (6.46 adjWPM) than the Gesture method (5.41 WPM and 5.28 adjWPM).

58 WPM
(Sears, 1991)

5.5-7 WPM
(Perrinet et al., 2011)

- Both methods were somewhat accurate (WER 10-12%)

Perceived Exertion

- The Clicker method showed less exertion in the right bicep and right index finger in right handed participants than the Gesture method

Perceived Workload & Eye Strain

- No differences were found

Perceived Usability

- The Clicker method was given a “OK” score $M=65$
- The Gesture method was given a “Poor” score $M=45.29$

User Preference & Recommendations

- 15 out of 17 participants preferred the clicker method, stating it was faster, more accurate, and less fatiguing
- Recommendations included: make clicker feedback consistent, increasing the FoV, & create a gesture that is less fatiguing

Discussion

- Both methods were reported as easy to learn, but slow and cumbersome
- The Clicker method was faster than the Gesture method, but was just as accurate
- Most participants preferred the Clicker method
- Improvements can be made for both input methods:
 - Create a new gesture that decreases the amount of time users hold up their arm while typing
 - Increase the FoV
 - Make headtracking sensitivity adjustable or introduce eye tracking
- Voice will be investigated in future research

References

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