Study Report: Impact of Hand Dominance on Pointing Performance in WebFit

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Introduction

The primary objective of this study was to examine the effects of hand dominance on pointing performance within the WebFit platform. Hand dominance, the preference for using one hand over the other, is known to affect fine motor skills. To investigate this phenomenon, we adopted a within-subjects design and randomly selected four participants. This approach eliminates potential participant bias and enhances the study's objectivity.

Participants

Sample Size and Selection
The study involved four participants, all randomly selected to ensure impartiality and minimize potential participant bias. This approach aimed to enhance the study's objectivity and reduce the impact of any pre-existing hand dominance preferences.

Randomized Ages
To maintain the randomness of participant selection, the study included participants with diverse ages, selected randomly. The age range of the participants is as follows:

Participant 1: 29 years old
Participant 2: 43 years old
Participant 3: 35 years old
Participant 4: 45 years old
This wide age range reinforces the study's inclusivity and its ability to capture potential age-related differences in pointing performance.

Monitoring and Support
Throughout the study, participants were closely monitored and provided with support over the Discord platform. This approach was implemented to ensure that participants fully understood the tasks and what was expected of them. By offering guidance and clarifications, the monitoring process aimed to reduce potential sources of error and enhance the reliability of the collected data.

STUDY DESIGN

Tasks:

Participants were presented with a series of pointing tasks on the WebFit platform. These tasks were designed to evaluate their pointing performance with both their dominant and non-dominant hands.
Each participant completed a set of tasks with their dominant hand and then with their non-dominant hand. The tasks included selecting targets of varying sizes and distances on the WebFit interface.

Study Setting:

The study was conducted in a controlled environment to minimize external factors that could affect performance. All participants used modern web browsers (e.g., Chrome, Safari, Opera) on their respective Mac, Windows, or Linux computers to access the WebFit platform.

Data Collection:

Upon completing each session (one with the dominant hand and one with the non-dominant hand), the WebFit platform automatically initiated the download of a zip file containing log files for that session. The log files were in CSV (comma-separated values) format, allowing for easy analysis using spreadsheet programs and python.

Study Duration:

On average, it took each participant approximately 10 minutes to complete all the tasks with both their dominant and non-dominant hands.

STUDY RESULTS

Descriptive Statistics:

Average completion time and error rates for each participant were calculated for both dominant and non-dominant hand conditions.
Graphs were created to visualize these results, showing how performance metrics varied across different blocks and conditions.
Analysis revealed trends, differences, or patterns in completion time and error rates between the dominant and non-dominant hands.

1. T-Tests

Completion Time (ms)

A t-test was conducted to compare the "Completion Time (ms)" between conditions C1 and C2.
The t-test result for "Completion Time (ms)" is statistically significant (p-value = 1.9929947472919306e-28).
This suggests a significant difference in "Completion Time (ms)" between C1 and C2.

Error Rate
Another t-test was performed to compare the "Error Rate" between conditions C1 and C2.
The t-test result for "Error Rate" is not statistically significant (p-value = 0.21627172303773398).
There is no significant difference in "Error Rate" between C1 and C2.

2. One-Way ANOVA
A one-way ANOVA was used to examine the "Completion Time (ms)" across multiple conditions.
The ANOVA result is statistically significant (p-value < 0.05).
This indicates a significant difference between at least two conditions within the study.

3. Two-Way ANOVA
A two-way ANOVA was performed to investigate the interaction between "Hand" and "Session" in relation to "Completion Time (ms)."
The ANOVA table shows that the "Hand" factor has a highly significant effect on "Completion Time."
However, the interaction between "Hand" and "Session" does not significantly impact "Completion Time."

4. Post-Hoc Testing
Post-hoc analysis was conducted using Tukey's Honestly Significant Difference (HSD) test to identify which conditions within the study are significantly different from each other.
The test reveals that there is a significant difference in "Completion Time (ms)" between conditions C1 and C2.

5. Visualizations
Several visualizations were created to explore and present the study findings.
These include line plots comparing "Average Completion Time" and "Error Rate" for each session and participant, as well as box plots to compare variances in "Completion Time."
These results provide valuable insights into the study, indicating differences in "Completion Time" between conditions and the impact of different factors on this metric. Additionally, the visualizations offer a clear representation of the data, making it easier to interpret and communicate the study outcomes.

REFLECTION

Conducting this study as a team of two has been an enlightening experience. We faced challenges in participant recruitment, ensuring a diverse pool of participants from different demographics. However, the study's core goal, which is to investigate the impact of hand dominance on pointing performance in the WebFit platform, remained a fascinating subject of exploration. Working in a controlled environment provided a structured approach to data collection, and using contemporary web browsers and technology streamlined the process. The diversity among our participants enriched the study's findings. In conclusion, collaborating on this research has been intellectually stimulating and rewarding, despite the inherent challenges.