

# USER EXPERIENCE RESEARCH FOR THE P300 SPELLER: DESIGNING AN OPTIMAL KEYBOARD

BY: JAKE TOMPKINS

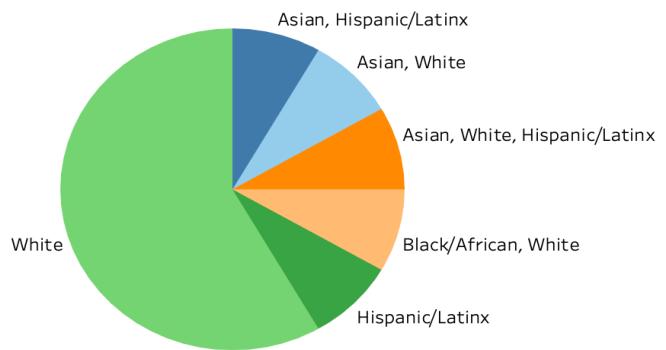
# INTRODUCTION

- P300 Speller helps “locked-in” patients communicate
  - Lacks desirable speed and accuracy for patients with ALS to use
- P300 Speller interface currently uses an alphabetical keyboard layout
  - One subject during research claimed they had a difficult time finding the target letter because they were used to the QWERTY keyboard layout
- Could changing the design of the keyboard improve the user experience, making typing faster and more accurate?

# USERS

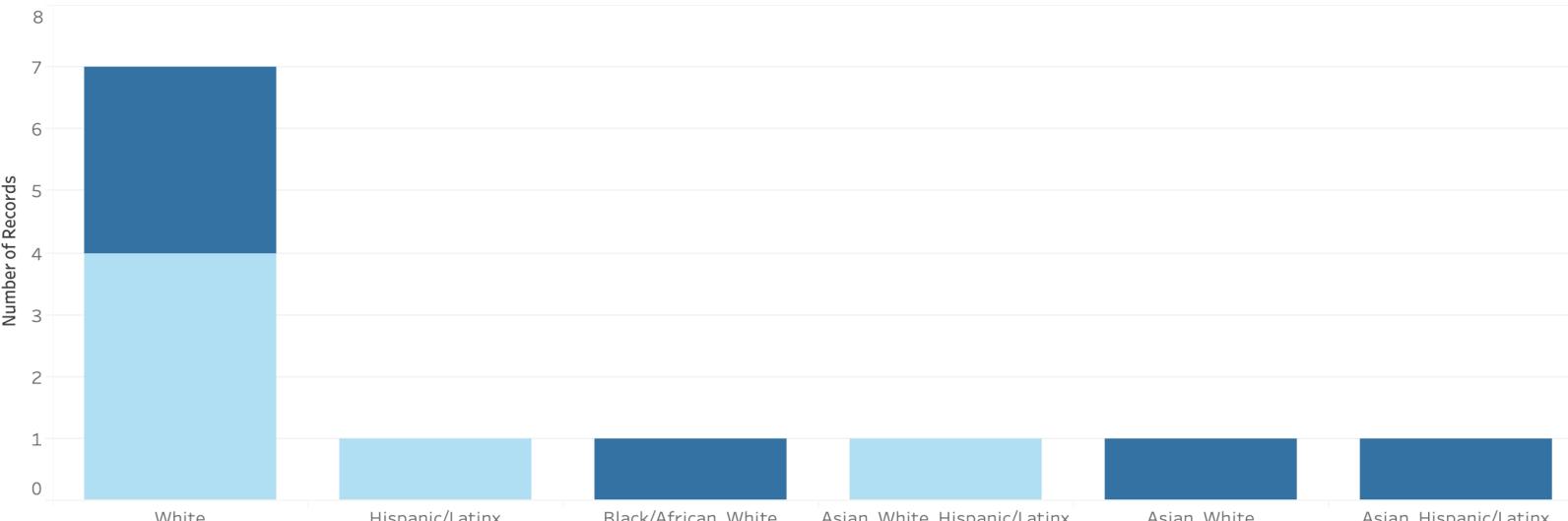
- Screened 35 total participants using an online test to capture their typing behaviors and demographic information
- Recruited 12 diverse participants for remote moderated A/B testing
  - Typing speed
  - Race
  - Age
  - Education level

## Race of Users

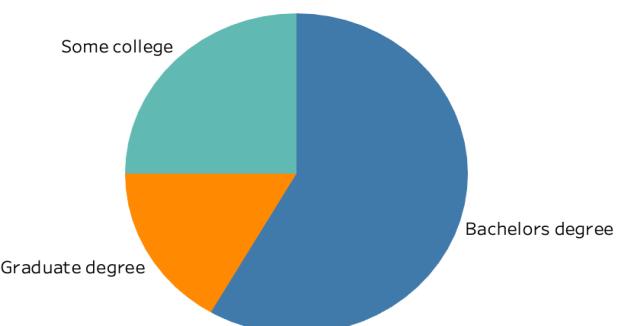


Speed category:  
Fast (Dark Blue)  
Slow (Light Blue)

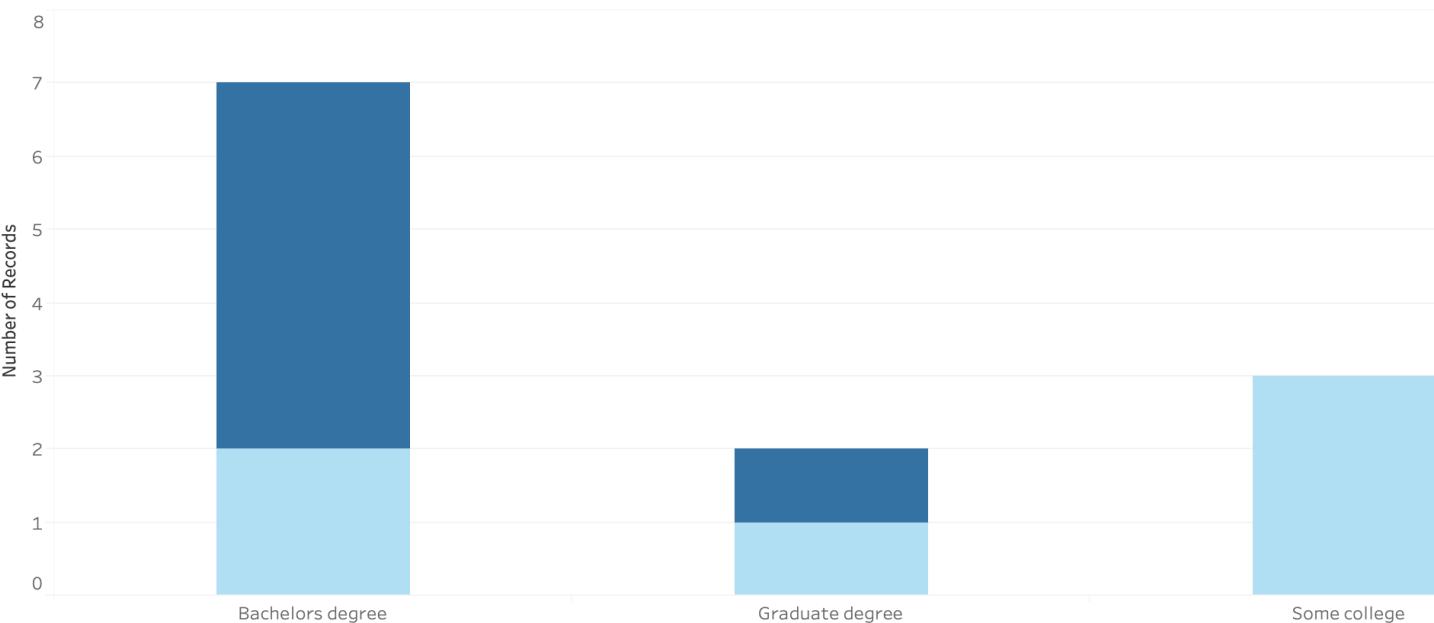
## Breakdown of Typing Speeds by Race



## Education of Users



## Breakdown of Typing Speeds by Education Level



# METHODS

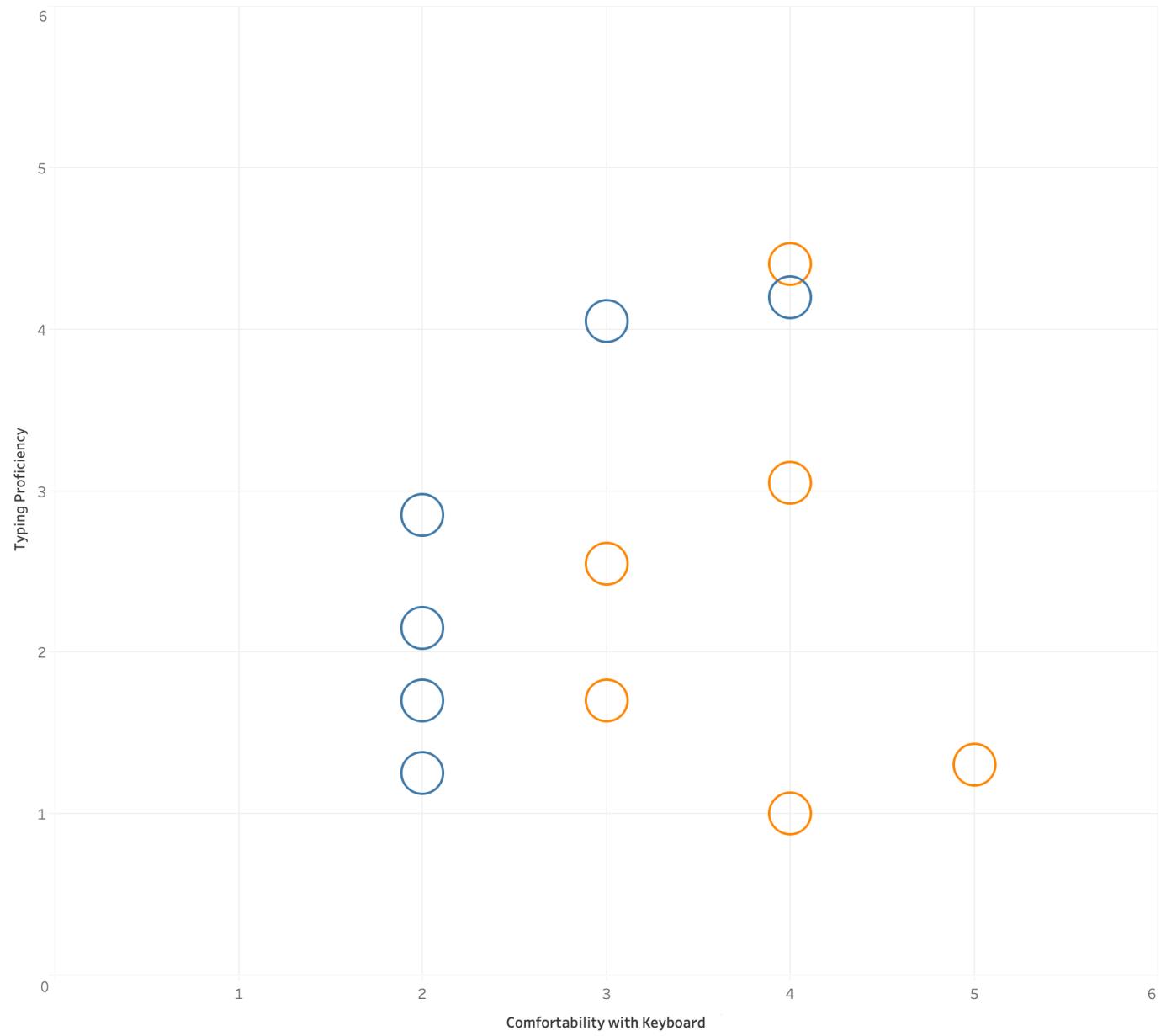
- Remote moderated A/B testing using different keyboard designs
  - Alphabetical vs QWERTY
  - Used Zoom screen sharing
- Users completed a series of 3 timed typing tasks using a virtual keyboard
- A brief survey was given afterwards for contextual inquiry
- This method slightly deviates from UX best practice
  - Conducted remotely instead of directly in person
  - Significantly smaller user population than desirable

# DATA ANALYSIS

- Used Google Forms as a standardized format to collect and record data
  - Google Forms offer data export into CSV format with Google Sheets
- Data analysis was completed using Tableau to make visualizations

Which keyboard was used?  
Alphabetical Keyboard  
QWERTY Keyboard

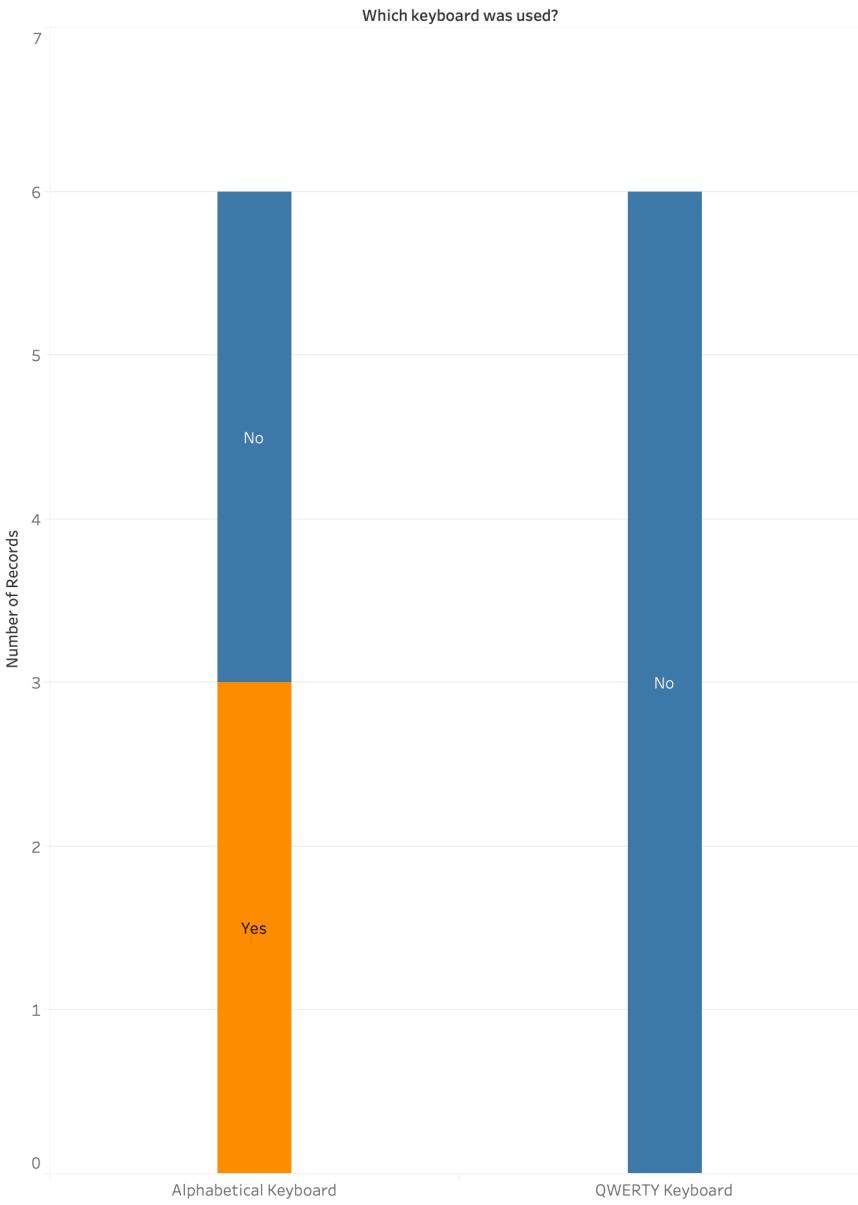
Quadrant Map



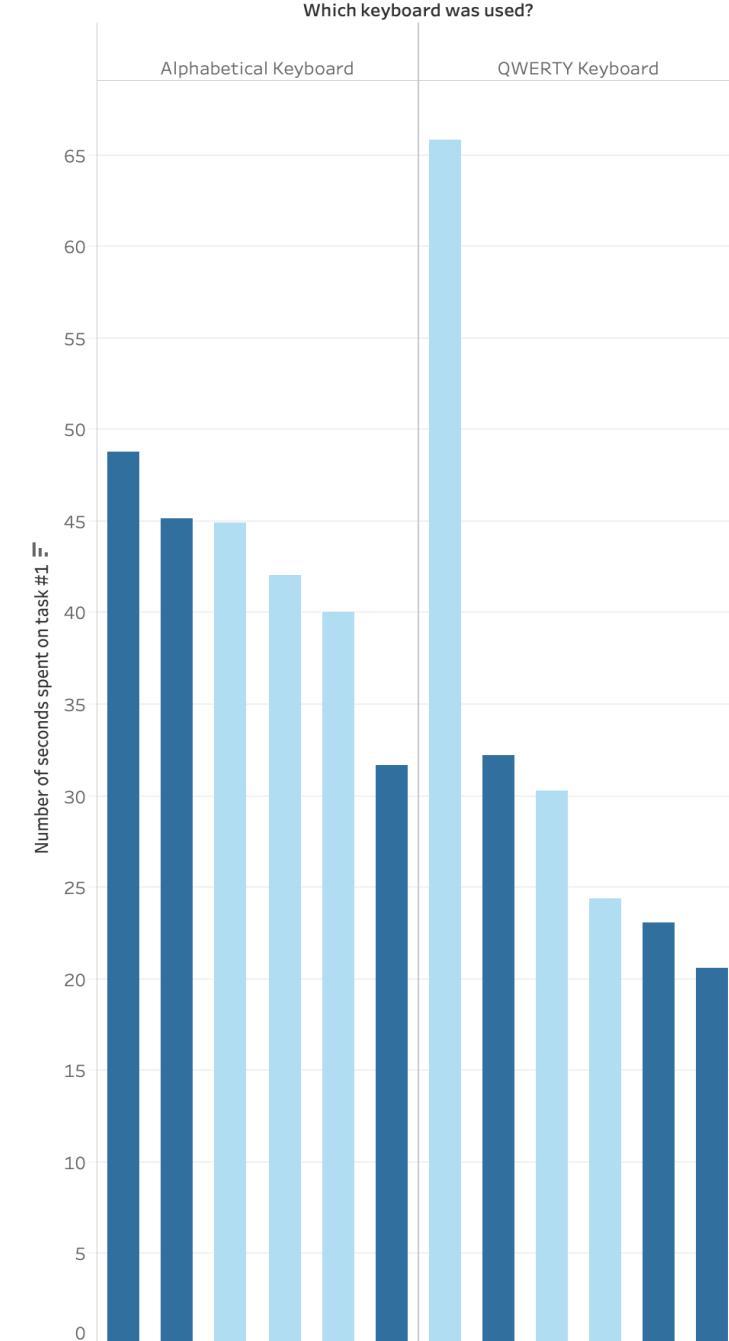
Which keyboard was used?

- Alphabetical Keyboard
- QWERTY Keyboard

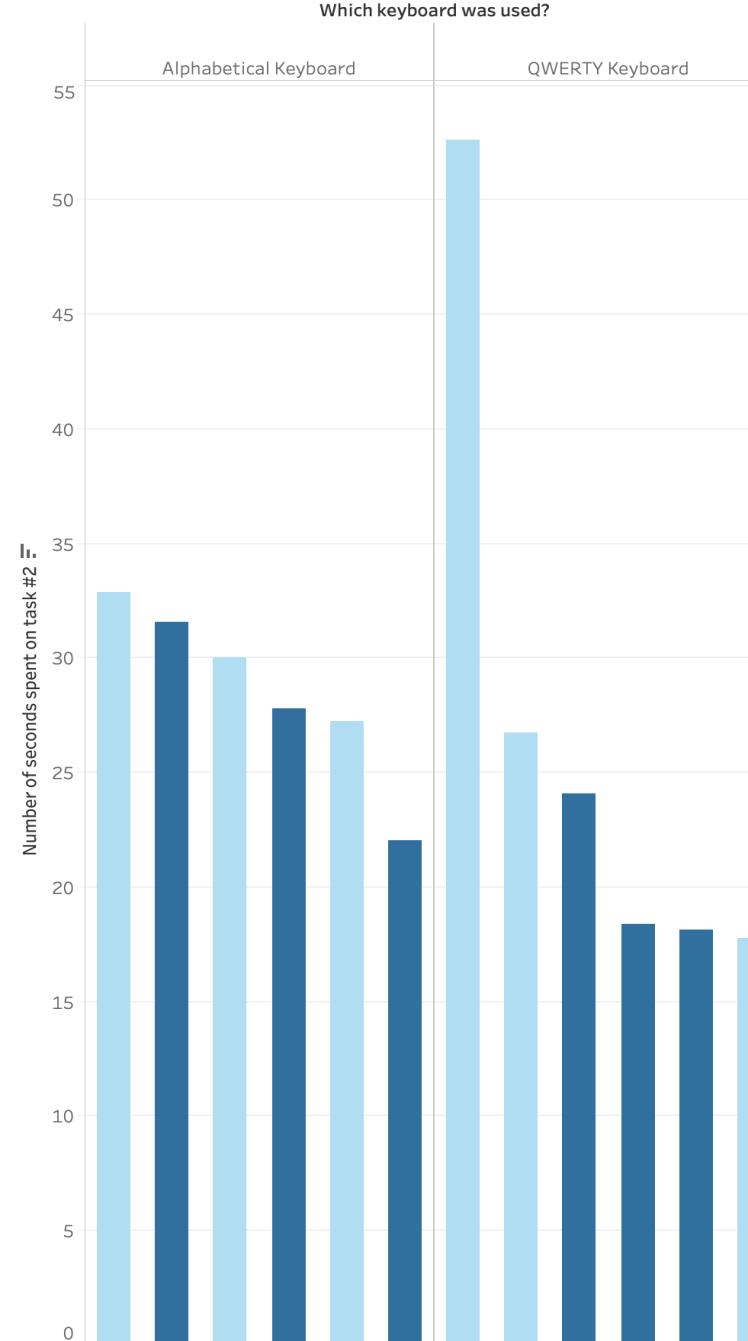
Did you find the keyboard confusing?



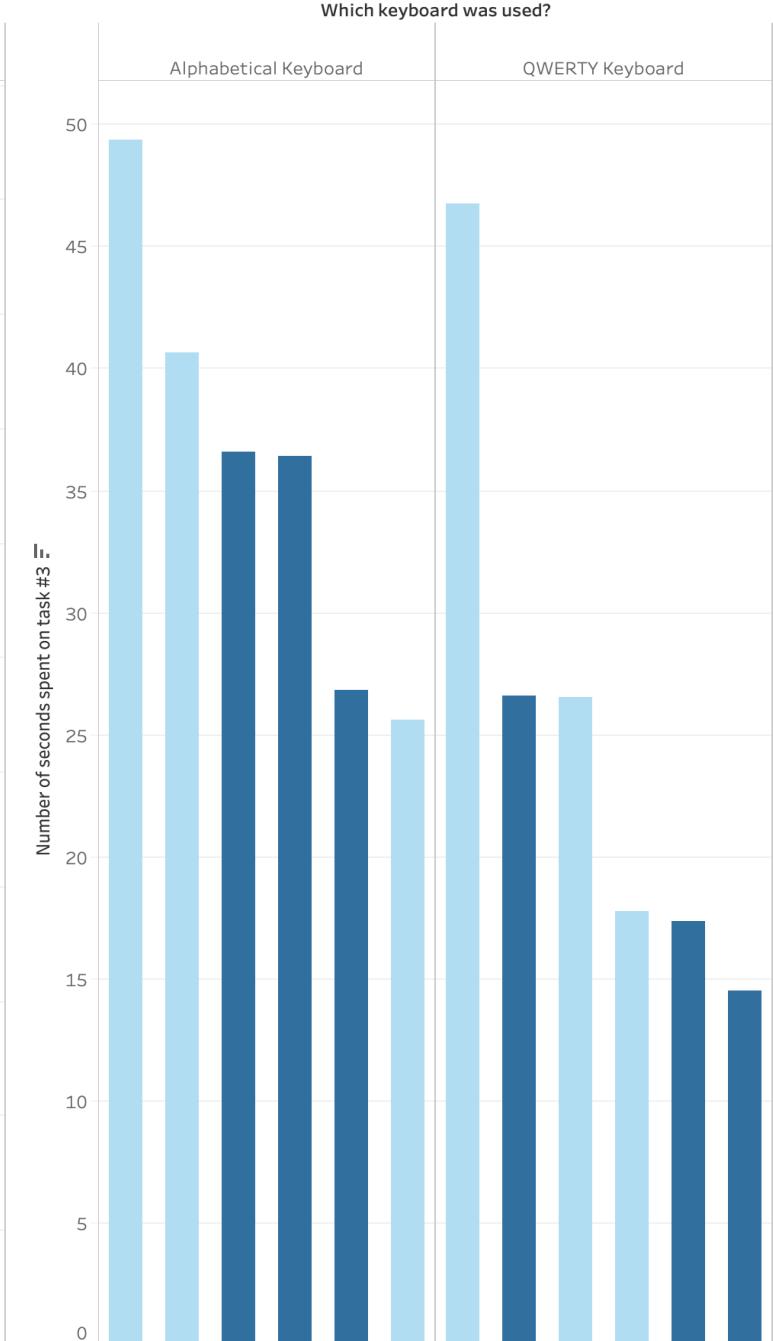
Typing Task #1



Typing Task #2



Typing Task #3



Speed category:

- Fast
- Slow

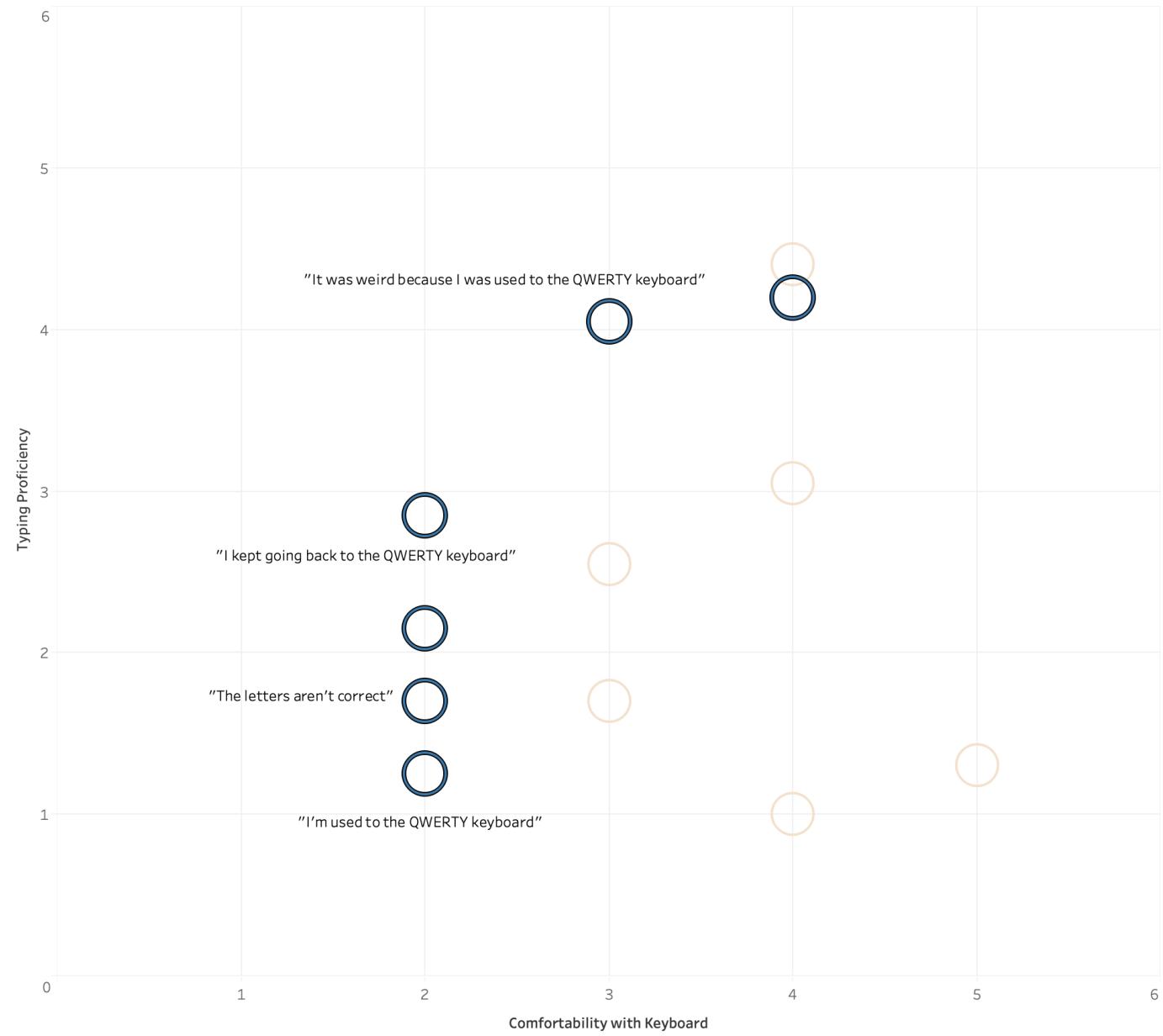
# RESEARCH FINDINGS

- Qualitative data indicates that the preferred keyboard for typing is the traditional QWERTY layout
  - Feedback from users claimed it felt familiar and was more comfortable to operate
  - More users felt the alphabetical layout was confusing to use
- Quantitative data from the timed task analysis supports this claim
  - Users who completed the tasks using the QWERTY design typically finished quicker than users with the alphabetical keyboard
  - User feedback suggests the QWERTY keyboard is more familiar to them and easier to navigate for identifying target letters

Which keyboard was used?

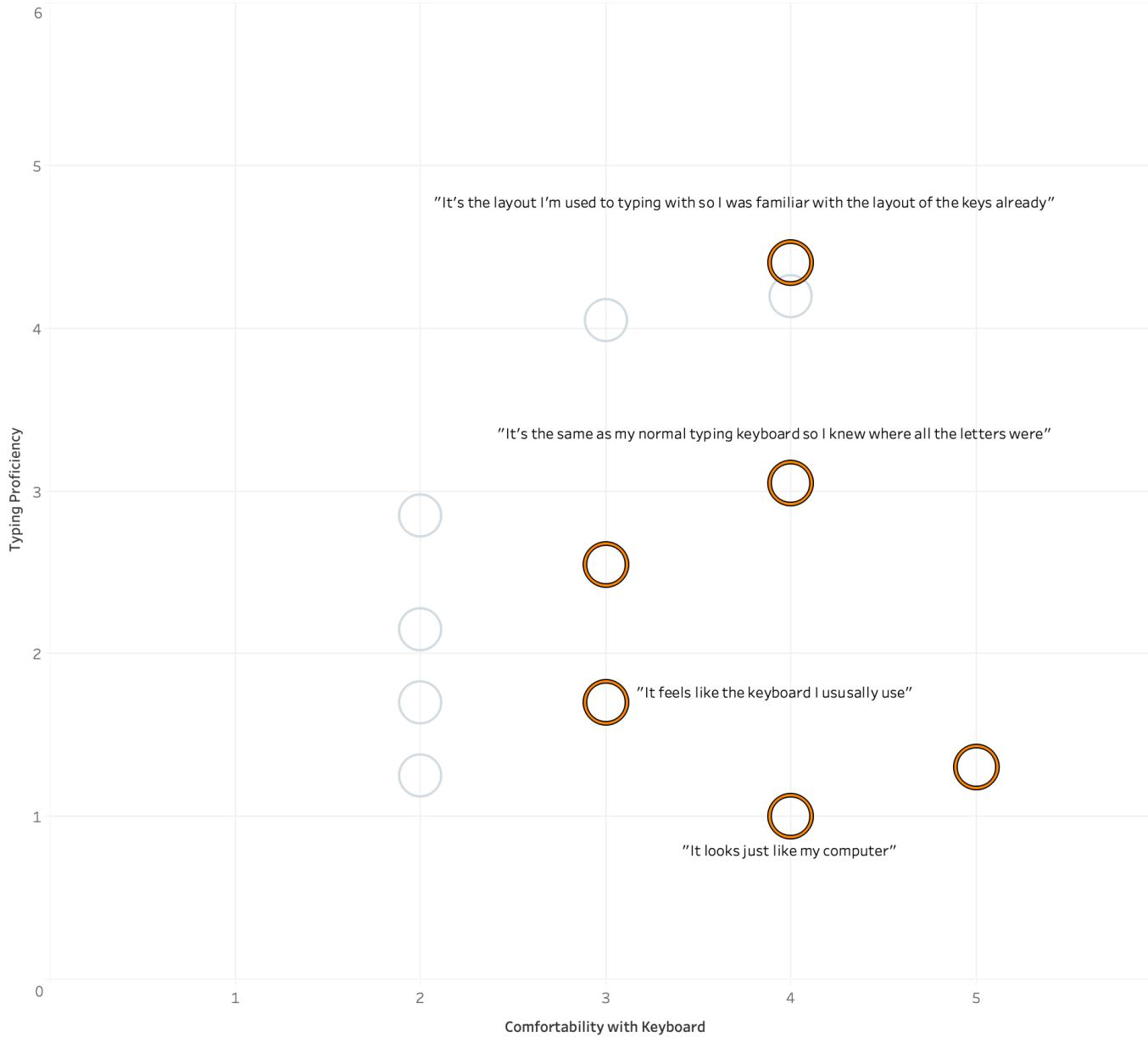
- Alphabetical Keyboard
- QWERTY Keyboard

## Quadrant Map



Which keyboard was used?  
■ Alphabetical Keyboard  
■ QWERTY Keyboard

### Quadrant Map



# RECOMMENDATIONS

- While the current P300 Speller interface is successful, the keyboard design could potentially be improved
- Recommended to remodel the keyboard after a QWERTY design rather than the current alphabetical layout
  - This redesign could help users feel more comfortable operating the P300 Speller device and improve their typing speed
  - Some design limitations given the row/column flashes to signal neural responses for the user's EEG to simulate keyboard input

## LIMITATIONS

- Stay-at-home orders led to adaptation of UX methods
- Unable to access target user population (ALS patients)
- Substituted the P300 Speller equipment with a virtual keyboard simulator