



Visual/Cognitive Processing Demands of Keyboard Layouts for Individuals With & Without TBI

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Purpose/Rationale

After severe traumatic brain injury (TBI), some literate individuals who require augmentative and alternative communication (AAC) to support communication, use onscreen keyboards to generate text (Beukelman & Mirenda, 2013; Britton & Baarslag-Benson, 2007; Fager Hux, Beukelman, & Karantounis, 2006). A range of layouts are available in specialized communication software. However, limited objective information is available on the visual-cognitive processing demands of these layouts to guide clinical decision-making for keyboard selection. Individuals who have had a TBI often experience changes in their visual and cognitive capabilities which can affect their ability to use different keyboard layouts (Fager, Doyle, & Karantounis, 2007). Eye tracking analysis can provide insight into the visual-cognitive processing requirements of AAC interface layouts and content (Thiessen, Beukelman, Ullman, Longenecker, 2014; Wilkinson & Light, 2014; Light & McNaughton, 2014; Brady, Anderson, Hahn, Obermeier, & Kapa, 2014; Gillespie-Smith & Fletcher-Watson, 2014).

Research Question

Is there a difference in the visual-cognitive processing demands between a QWERTY and ABC (alphabet) onscreen keyboard for individuals who have a TBI and for typical individuals?



Method

Participants

- 10 individuals with TBI; Ranchos Los Amigos Level 8-10 (Hagan, 1997)
- 10 typical (neurologically intact) individuals

Hardware/Software

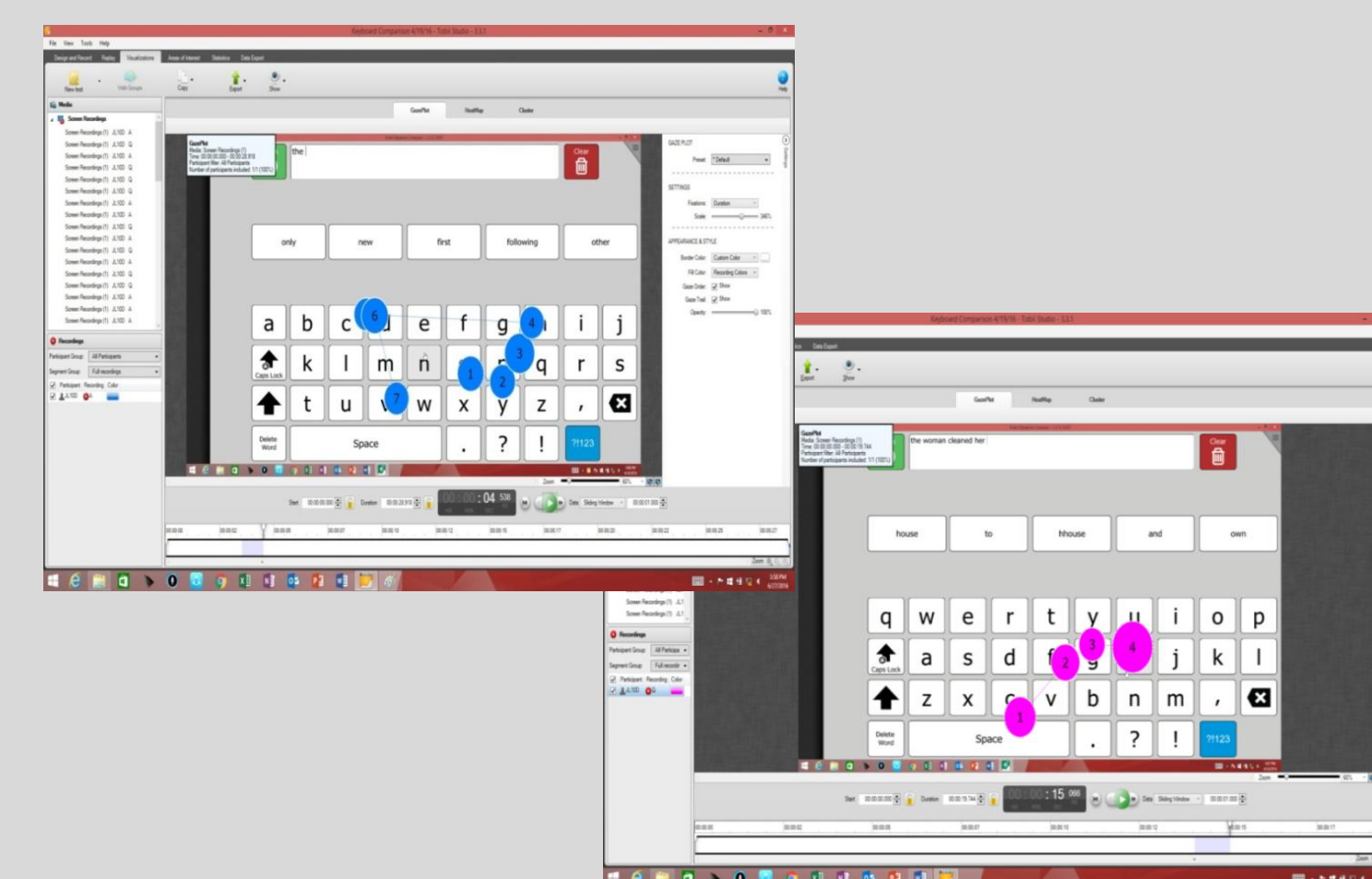
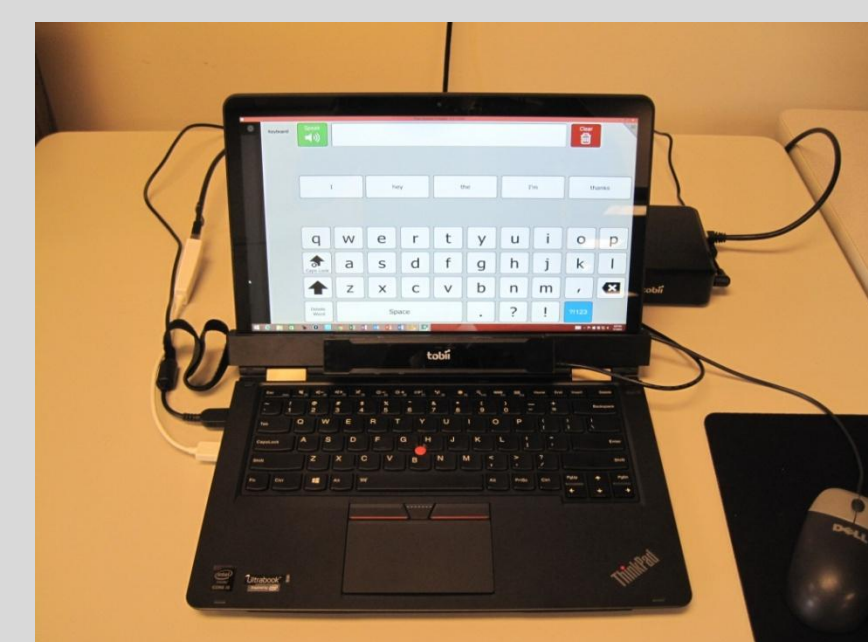
- Tobii X2-60 eye tracker
- Tobii Studio analysis software
- Keyboard layouts-Tobii/Dynavox Compass

Procedures

- Calibrated using Tobii X2-60
- Controlled cursor with standard mouse
- Typed sentences using mouse with ABC or QWERTY (10 sentences for each onscreen keyboard layout randomized per participant)
- Data collected regarding keyboard type preference, and prior experiences using onscreen keyboards.

Analysis

- Keyboard = area of interest (AOI)
- Eye gaze metrics:
 - Fixation Count (number of fixations within an AOI)
 - Total Fixation Duration (the sum of the duration for all fixations within an AOI)
- Means/standard deviations, t-test= between group per keyboard type, paired t-tests=within group between keyboard type

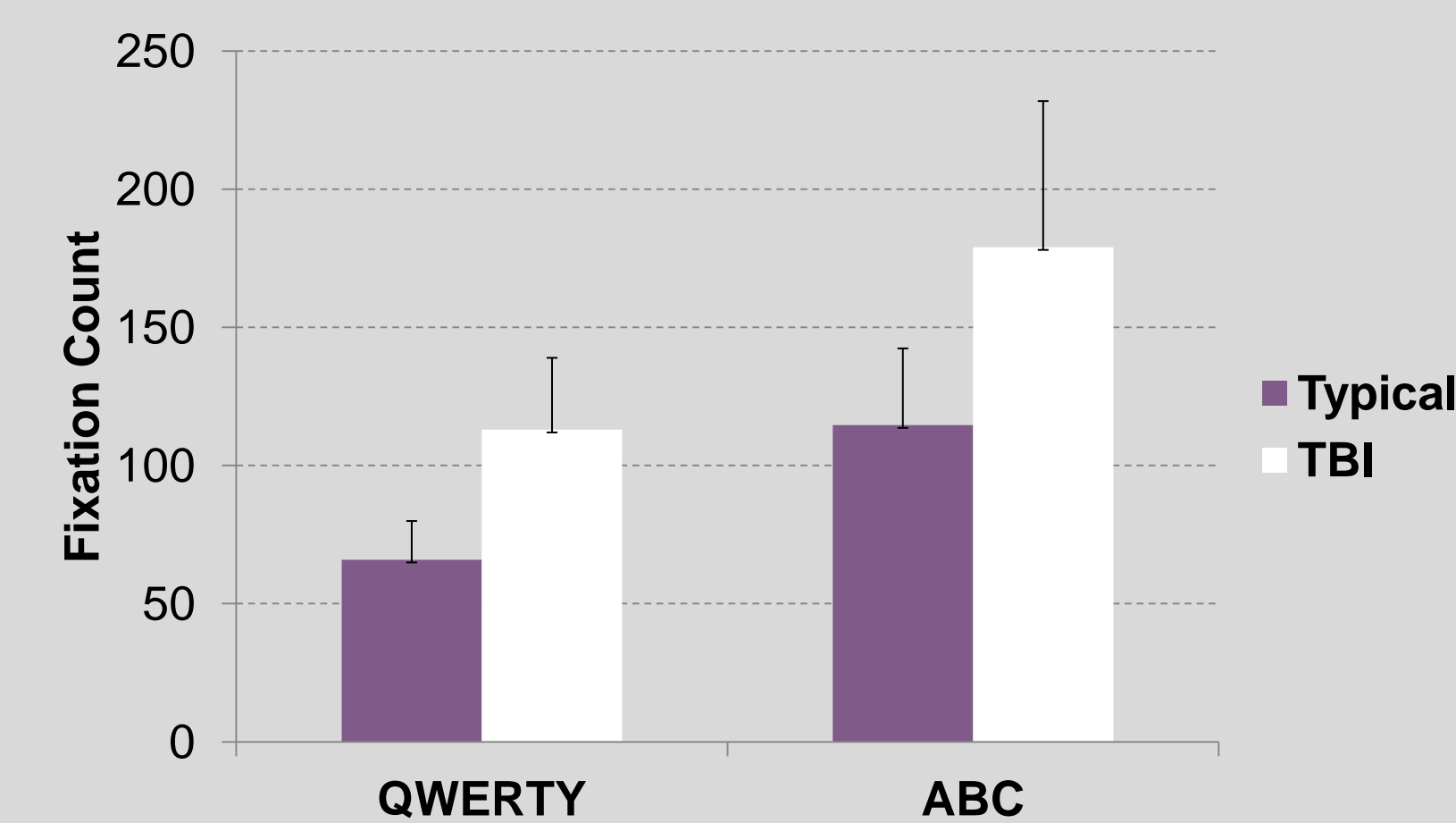


Results

Fixation Count

(average per sentence)

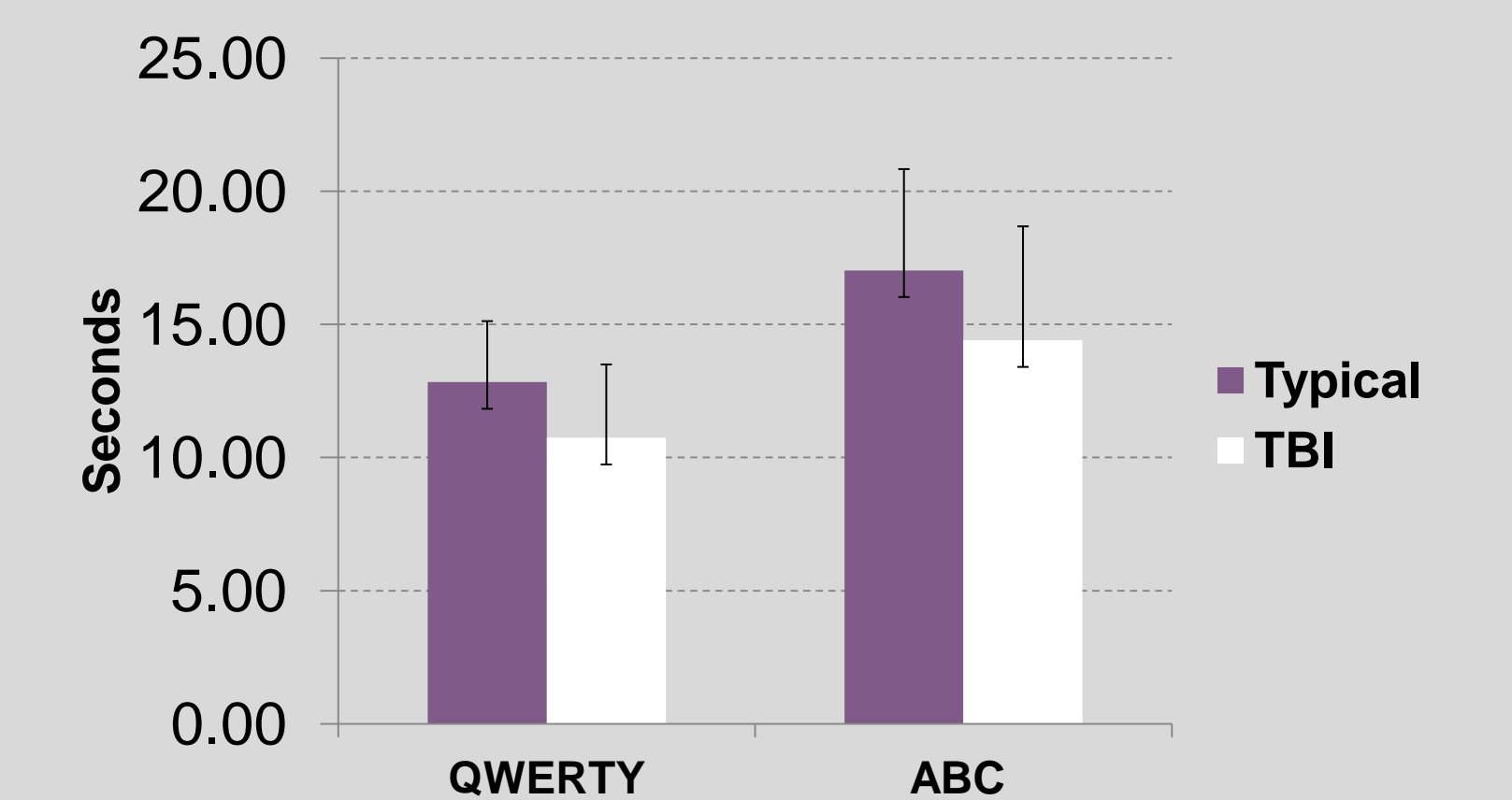
- Typical
 - QWERTY: 66 (SD = 14)
 - ABC: 115 (SD = 26)
 -differences between keyboard type was statistically significant ($p = 0.001$)
- TBI
 - QWERTY: 112 (SD = 28)
 - ABC: 179 (SD = 53)
 -differences between keyboard type was not statistically significant ($p = 0.074$)
 - Statistically significant difference between typical and TBI for QWERTY keyboard only ($p = 0.023$)



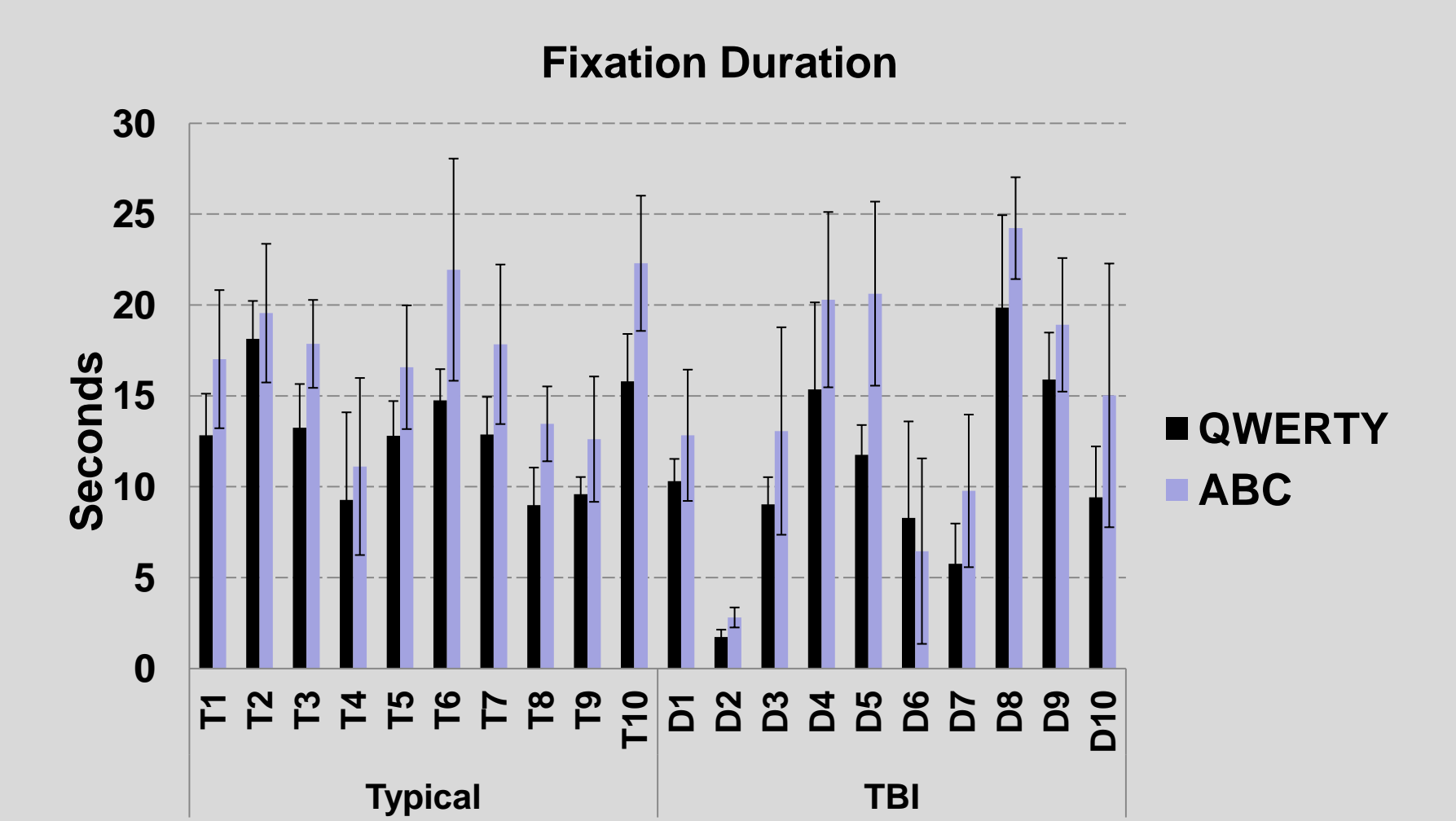
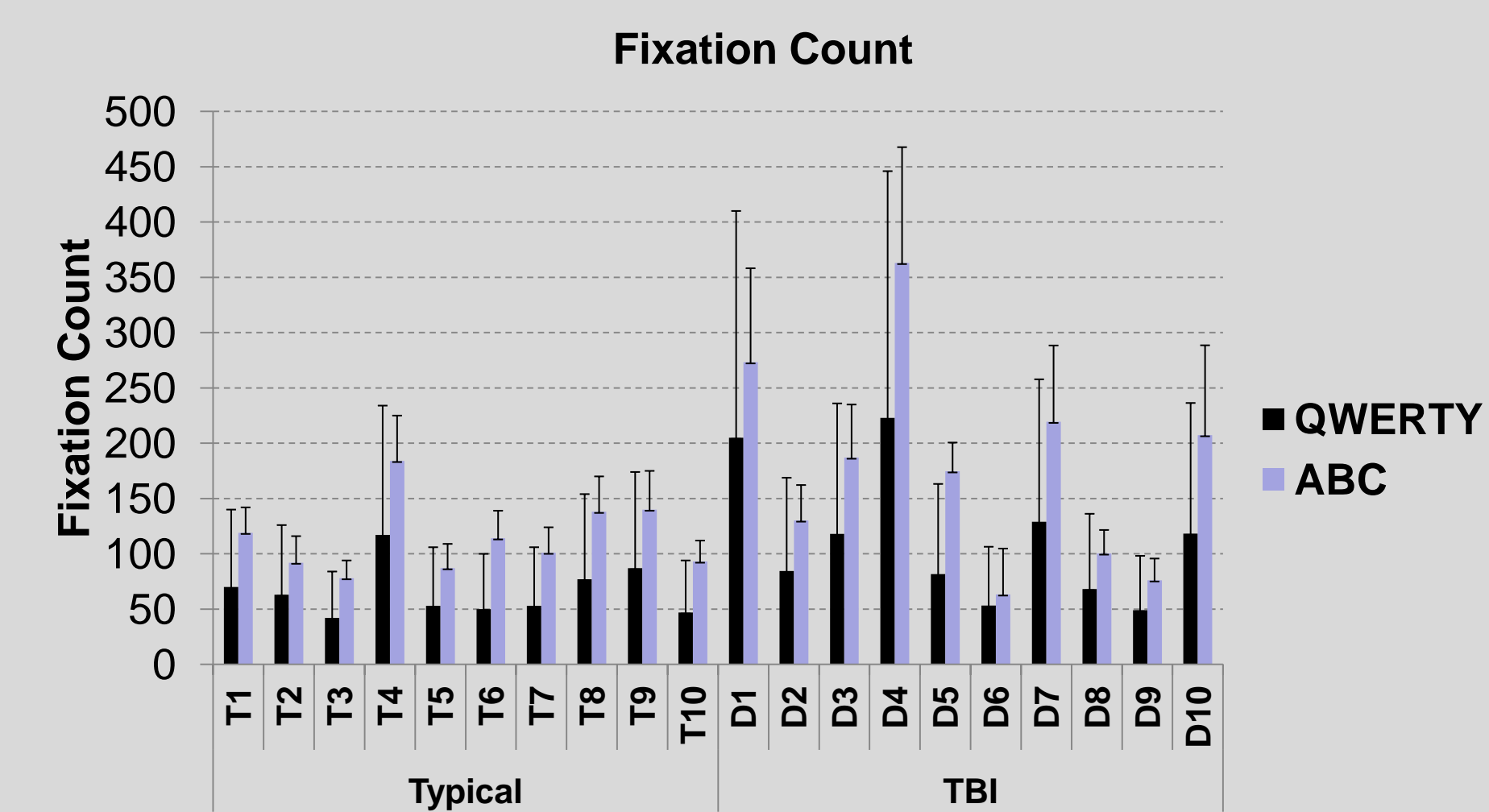
Total Fixation Duration

(average per sentence)

- Typical
 - QWERTY: 12.83 (SD = 2.29)
 - ABC: 17.03 (SD = 3.80)
 -differences between keyboard type was statistically significant ($p = 0.012$)
- TBI
 - QWERTY: 10.74 (SD = 2.76)
 - ABC: 14.40 (SD = 4.28)
 -differences between keyboard type was not statistically significant ($p = 0.194$)
 -no statistically significant difference between typical and TBI for either keyboard type (QWERTY- $p = 0.288$, ABC- $p = 0.298$)



Individual Differences across Participants with and without TBI



Discussion

- Performance matched perceptions and preferences for QWERTY over ABC layout
- Prior experiences using different technology interfaces may provide guidance for layout selection
- TBI participants- greater number of fixations and shorter duration of these fixations compared to typical; greater variability compared to typical

Acknowledgements

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