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

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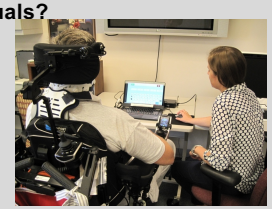
Purpose/Rationale

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 an QWERTY and ABC (alphabet) onscreen keyboard for individuals who have a TBI and for typical individuals?



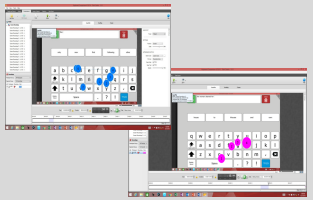
Method

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, paired t-tests=within group between keyboard type

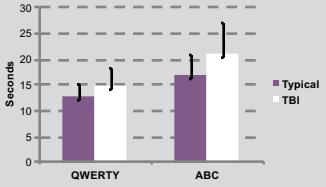


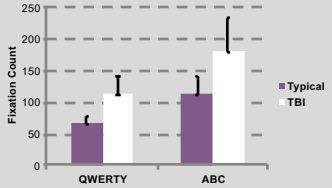
Results

Total Fixation Duration
- Typical
  - QWERTY: 12.83 (SD = 2.29)
  - ABC: 17.02 (SD = 3.80)
- TBI
  - QWERTY: 14.81 (SD = 3.59)
  - ABC: 21.01 (SD = 6.09)

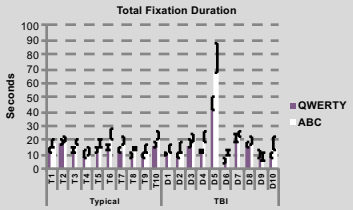
Fixation Count
- Typical
  - QWERTY: 66 (SD = 16)
  - ABC: 115 (SD = 26)
- TBI
  - QWERTY: 112 (SD = 28)
  - ABC: 179 (SD = 53)

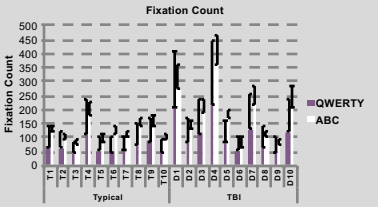
*no significant difference between participant groups
*significant differences for keyboard type for both groups at p <0.05





Individual Differences across Participants with TBI





Discussion

- QWERTY keyboard use resulted in shorter total fixation durations and fewer fixation counts than ABC keyboard
- Performance matched perceptions and preferences for QWERTY over ABC layout
- Prior experiences using different technology interfaces may provide guide layout selection
- TBI participants- more variability in performance across participants compared to typical participants

Acknowledgements

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