Modified Receptive Field & Crowding: Possible early indicators of orthographic knowledge and reading ability?

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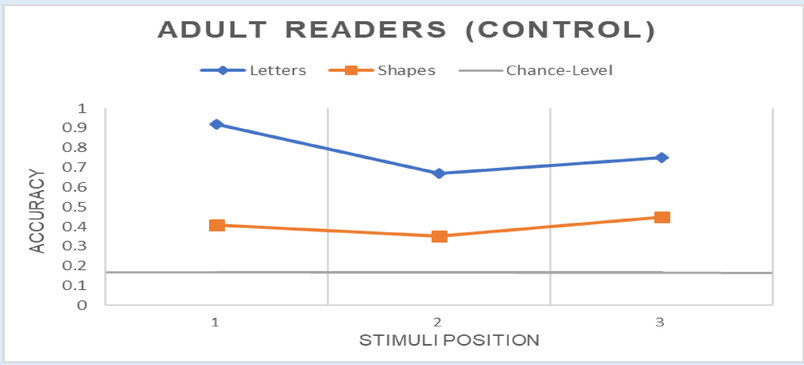
Purpose

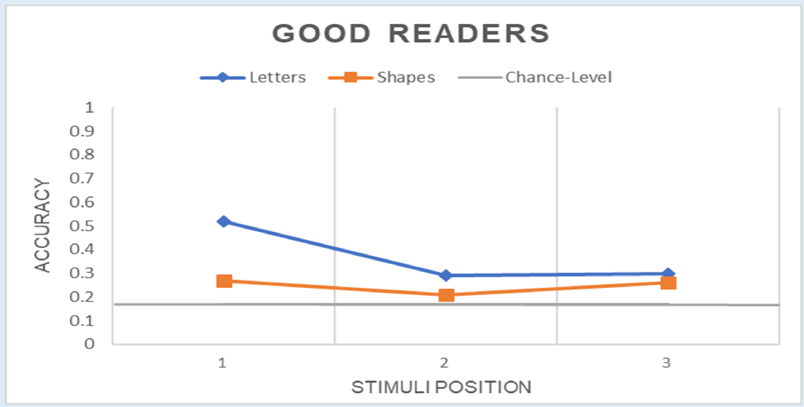
- How are letter-detector receptive fields (RFs) formed?
- Examining modified RFs and susceptibility to crowding in good and poor readers.
- Do poor readers experience a developmental delay when acquiring modified letter-detector RFs?

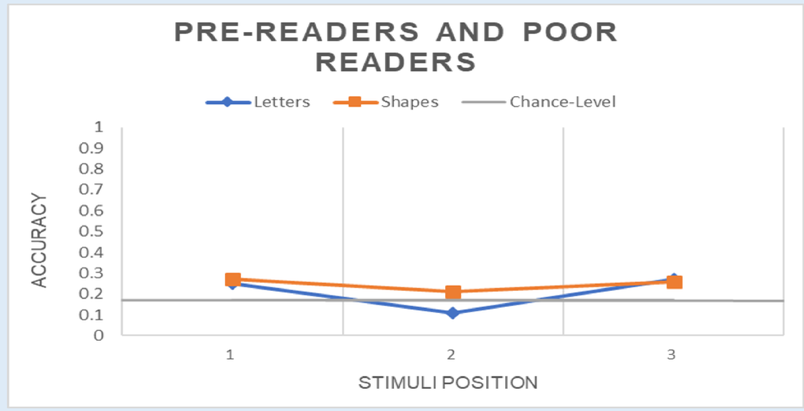
Hypotheses

- MRF depends on reading exposure.
- Poor readers and pre-readers will :
  1. Show no first-letter advantage.
  2. Be more-susceptible to crowding.

Expected Results





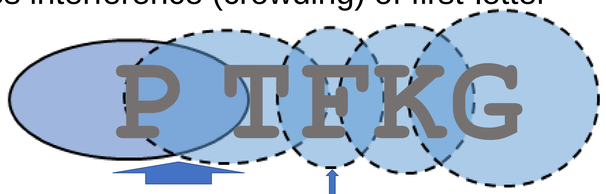


What is a Modified Receptive Field (MRF)?

In the visual cortex

- RFs are brain areas that receive visual signals[1]
- Some become specialized with experience
- Reading *modifies* some RFs to be sensitive to letters
  - First-letter RT elongates leftward[1]
  - Reduces interference (crowding) of first-letter[1]

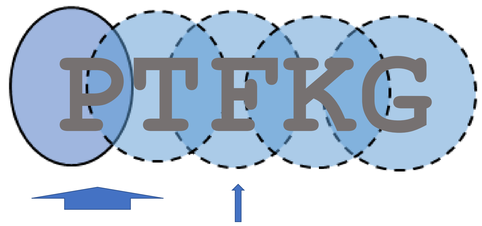
Receptive Fields of Good Readers



First-Letter RF Modified (First-Letter Advantage)

Fixation

Receptive Fields of Pre- and Poor-Readers



First-Letter RF *Not* Modified (No Advantage)

Fixation

Crowding

- Related to reading ability[2]
- Poor readers are more susceptible to crowding
  "C A T" ok; "CAT" not ok
  - Sluggish orienting of spatial attention may result in excessive crowding in poor readers in visual periphery[3]

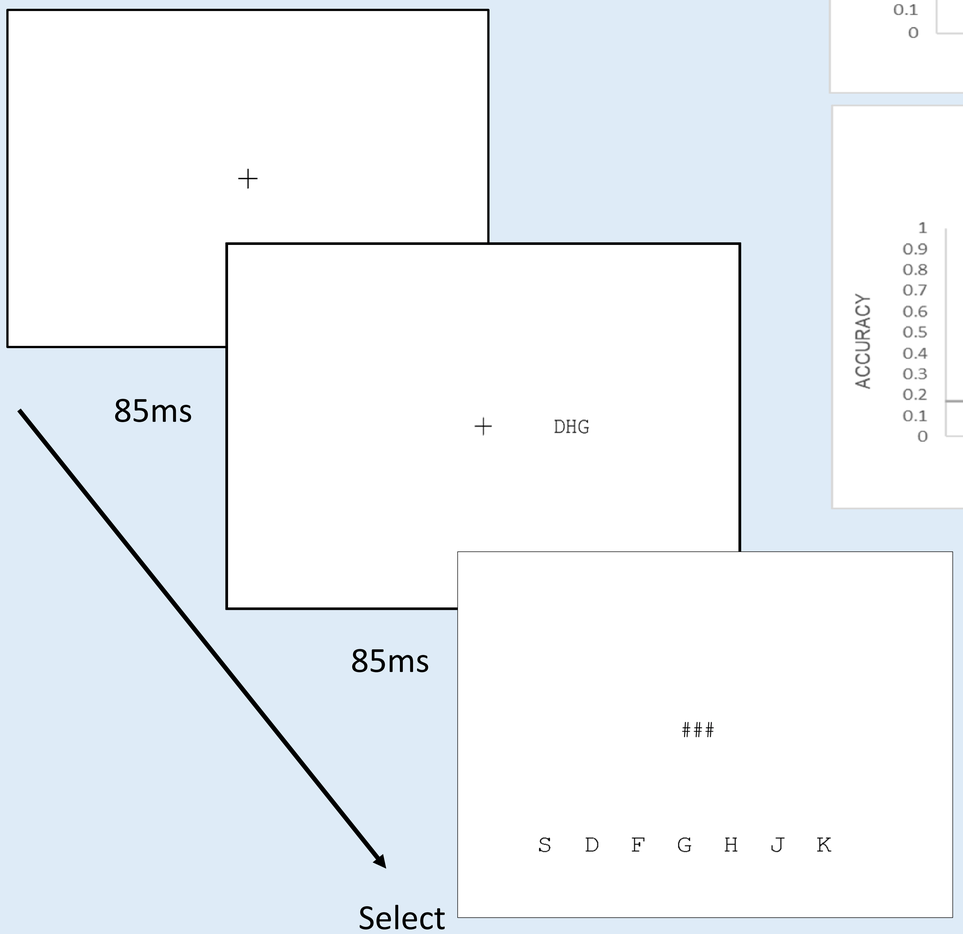
Method: Trigram String Task[4]

- Trigrams of letters or shapes

S D F G H J K

☆ △ □ ○ ♡ ☾ ✠

- Presented in Left or Right Visual Field.
- Participants select the 3 letters or 3 shapes they saw.



Next Steps

- Correlate first-letter-advantage findings with visual attention and spelling ability.
- Show stronger first-letter advantage is related to more-efficient attention, better spelling.

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3. Grainger, J., Bertrand, D., Lété, B., Beyersmann, E., & Ziegler, J. C. (2016). A developmental investigation of the first-letter advantage. *Journal of Experimental Child Psychology, 152*, 161-172. doi:10.1016/j.jecp.2016.07.016
4. Callens, M., Whitney, C., Tops, W. and Brysbaert, M., 2013. No Deficiency in Left-to-Right Processing of Words in Dyslexia but Evidence for Enhanced Visual Crowding. Quarterly Journal of Experimental Psychology, 66(9), pp.1803-1817.