

# CROWDING MAGNITUDES AND SERIAL SEARCH TASKS IN LETTER IDENTIFICATION

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## Introduction

- People afflicted with central vision loss due to macular disease often adopt a method of eccentric viewing while reading.
- Studies have shown that using the peripheral retina to read results in decreased reading speeds, despite adequate magnification.
- The increased crowding, and a narrowed visual span (number of letters, arranged horizontally as in text, that can be recognized reliably without moving the eyes) have been cited as reasons for the observed reduction in reading speed.<sup>1</sup>
- This study investigated the role of crowding and perceptual processing time, specifically as they relate to the recognition of letter elements at pre lexical sites.

## Methods

### Stimuli

- Letters were selected randomly from the 26 letters of the English Alphabet and were rendered in black, high contrast (0.84), lowercase, standard-boldness Courier font, subtending 0.4 degrees, with an inter-letter spacing of ~1.16X the width of a lowercase “x”.
- Letters were presented against a white background (131cd.m<sup>-2</sup>) on a Dell Trinitron CRT monitor using the Psychophysics Toolbox and Matlab™ at a distance of 0.57m with a fixed duration of 150ms.

### Subjects

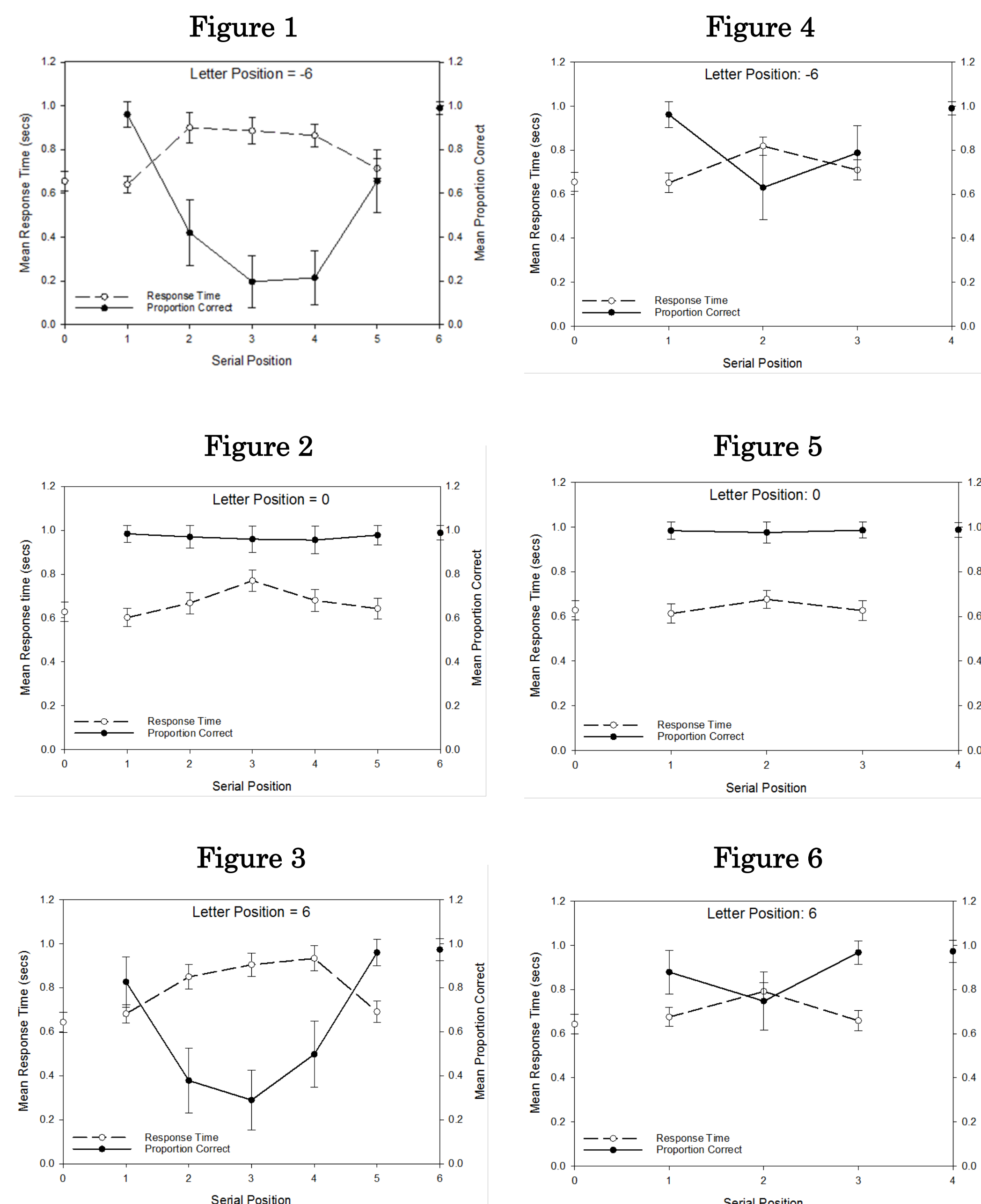
- The participants were 11 college students between the ages of 19 and 23, with visual acuity of 20/20 or better in each eye, normal binocular vision, and performed at or above a 12 GLE (Grade Level Equivalent) on the WJ III Diagnostic Reading Battery test™.

### Procedure

- Letter recognition accuracy and key-entry response times were measured for each of the three stimulus conditions: isolated letters, trigrams, and pentagrams.
- Each stimulus condition was presented randomly at 13 viewing eccentricities or letter positions relative to fixation (six letter positions to the right and left of fixation including fixation).
- Subjects were instructed to identify the letter that was presented using the keyboard. In the case of trigrams and pentagrams, subjects were instructed prior to a given experimental block to report the letter occupying a specific serial position within the letter string.

## Results

All error bars in all figures represent intervals of +/- 1SEM. Figures 1-6 demonstrate Mean Proportion correct and Mean Response time (in seconds) plotted as a function of serial letter position of the target letter presented at varying letter positions, or eccentricities. The data points plotted at abscissa values 0 and 6 represents the Mean Response time and Mean Proportion correct for isolated letters. Figures 1-3 represent pentagrams, while figures 4-6 represent trigrams.



## Conclusions

- Neither response time nor response accuracy varied significantly with increasing eccentricity for isolated targets.
- The results suggest that letter recognition accuracy declines with increasing string length from three to five letters, most significantly for letter positions nearer the retinal periphery and for the middle serial positions.
- The inner-outer asymmetry noted with both string length conditions for the -6 and +6 viewing eccentricities also parallel previous reports of an inner outer asymmetry noted with crowding.<sup>2,3</sup>
- Response times for letters presented at fixation increase with a higher number of flanking targets, which is consistent with the Eriksen Flanker Effect.<sup>4</sup>
- Further inquiry into the effects of crowding versus serial search tasks could unveil whether the two processing delays are combined, or if one plays a more significant role in prelexical delays.

## References

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