One less is enough: Evidence for redundancy masking in the fovea

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INTRODUCTION

Contextual visual information profoundly influences detection and discrimination. Objects surrounded by neighboring objects are harder to identify than the same object in isolation especially in the periphery: A mechanism called crowding. Crowding affects target identification and appearance.

Observers perceive three letters but *discriminating* the middle letter is reduced.

o X

o TXT

In the special case of identity crowding target and flankers are identical:

o TTT

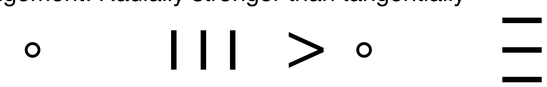
Recent work showed that in such cases observers *detect* only two letters (here two T's).

The phenomenon of not detecting one or multiple identical items in a display was recently termed "**redundancy masking**" (Sayim & Taylor 2019; Yildirim et al. 2020).

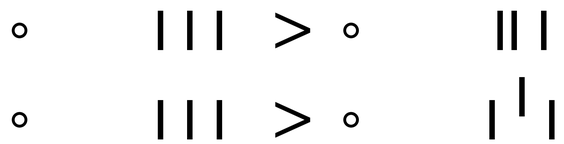
Characteristics of redundancy masking:

depends on spacing: Stronger with denser spacing

on arrangement: Radially stronger than tangentially



on regularity: Stronger with regular spacing than jittered



on line thickness: Stronger with thinner lines than thicker

FURTHER READINGS

Yildirim et al. (2020) "Redundancy masking: The loss of repeated items in crowded peripheral vision." *Journal of Vision.*

Sayim & Taylor. (2019). Letters lost: Capturing appearance in crowded peripheral vision reveals a new kind of masking. *Psychological Science.*

RESEARCH QUESTION & GOALS

Can redundancy masking (perceived reduction of the number of presented items) also be observed in the fovea?

Esp. under conditions in which perception is vague (small stimuli and short persentation times)

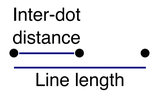
PILOT EXPERIMENT

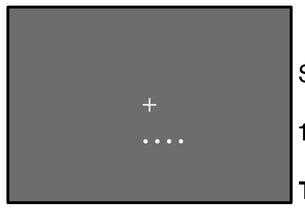
Methods & Results

Stimuli: Lines of dots (3-5 dots), each dot 2x2 px (0.032° vis. ang., 1.9')

3 line orientations: tangential: + radial: + oblique: +

Random variations of line length & inter-dot distance:



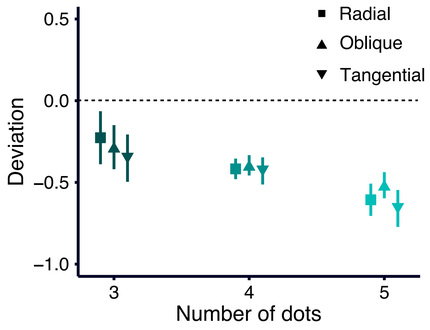


Stimuli presented 1-2° around fixation

100ms presentation time

Task: Indicate the number of presented dots

Deviation: Perceived number of dots – correct number of dots



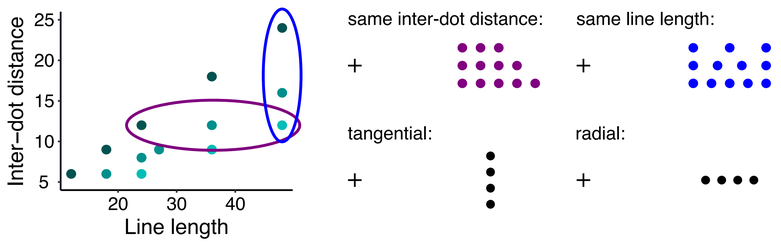
Results show a reduction in the perceived number of dots around fixation

No effect of dot arrangement on the strength of redundancy masking

MAIN EXPERIMENT

Methods

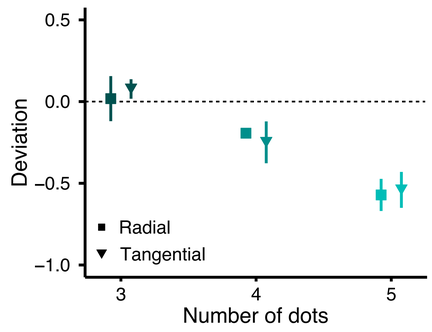
Systematic variation of line length and inter-dots distance and only two dot arrangements: tangential and radial



All other parameters same as in the pilot experiment

RESULTS MAIN EXPERIMENT

Effect of dot arrangement on redundancy masking:



Results show a reduction in the perceived number of dots around fixation (in particular for 4 and 5 dots)

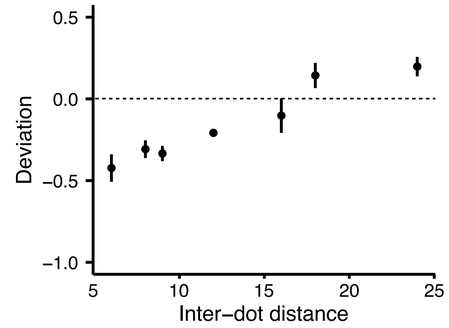
In the periphery: Strongest reduction found for 2 lines

No effect of dot arrangement on the strength of redundancy masking

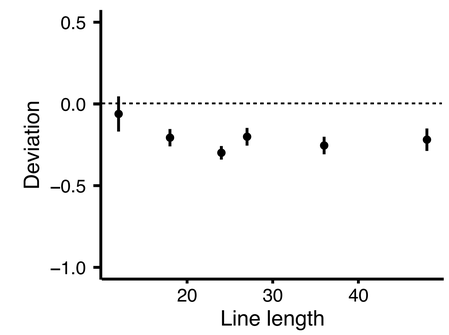
Effect of line length and inter-dot distance on redundancy masking:

Smaller spacing induces stronger redundancy masking

In the periphery: Similar results found, showing that smaller spacing induces stronger redundancy masking



No effect of line length on redundancy masking Reduction in the number of perceived dots found for all line lengths



CONCLUSIONS

We did observe a reduction in the perceived number of dots in the subitizing range, when stimuli are briefly presented around fixation:

Strongest effects currently found for 4 and 5 dots

Redundancy masking did not depend on the dot arrangement, in contrast to the results found in the periphery but it did depend on the inter-dot distance (spacing of dots).

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