Impact of crowding on visual appearance in Amblyopia

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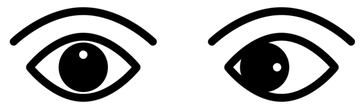
Introduction

- **Amblyopia**: Developmental disorder of spatial vision characterized by a **reduction of visual acuity (VA).**

E.g.,

Anisometropia

Strabismus



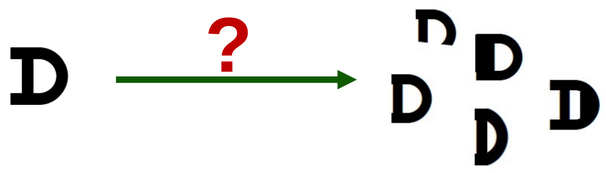
- **VA:** Ability to resolve spatial detail (commonly evaluated with identification tasks, e.g., with a chart of letter optotypes).
- **Crowding:** Flanking stimuli deteriorate performance; stronger in amblyopes than normals.

Target: A

Fixation: +

Target: XAX

- **Appearance:** How stimuli look to observers.



We investigated visual appearance of isolated and flanked stimuli in amblyopic and control observers.

Method

Participants

- 11 amblyopes (M_{age} = 39 ± 18) and 11 controls (M_{age} = 23 ± 4)
- 5 Anisometropes; 5 Strabismic; 1 Form deprivation (cataract)
- Decimal visual acuity (VA)*:

	Amblyopes	Controls
Dominant eye (DE)	1.23 (*SD* = 0.41)	1.51 (*SD* = 0.34)
Non-dominant eye (NDE)	0.82 (*SD* = 0.28)	1.17 (*SD* = 0.33)

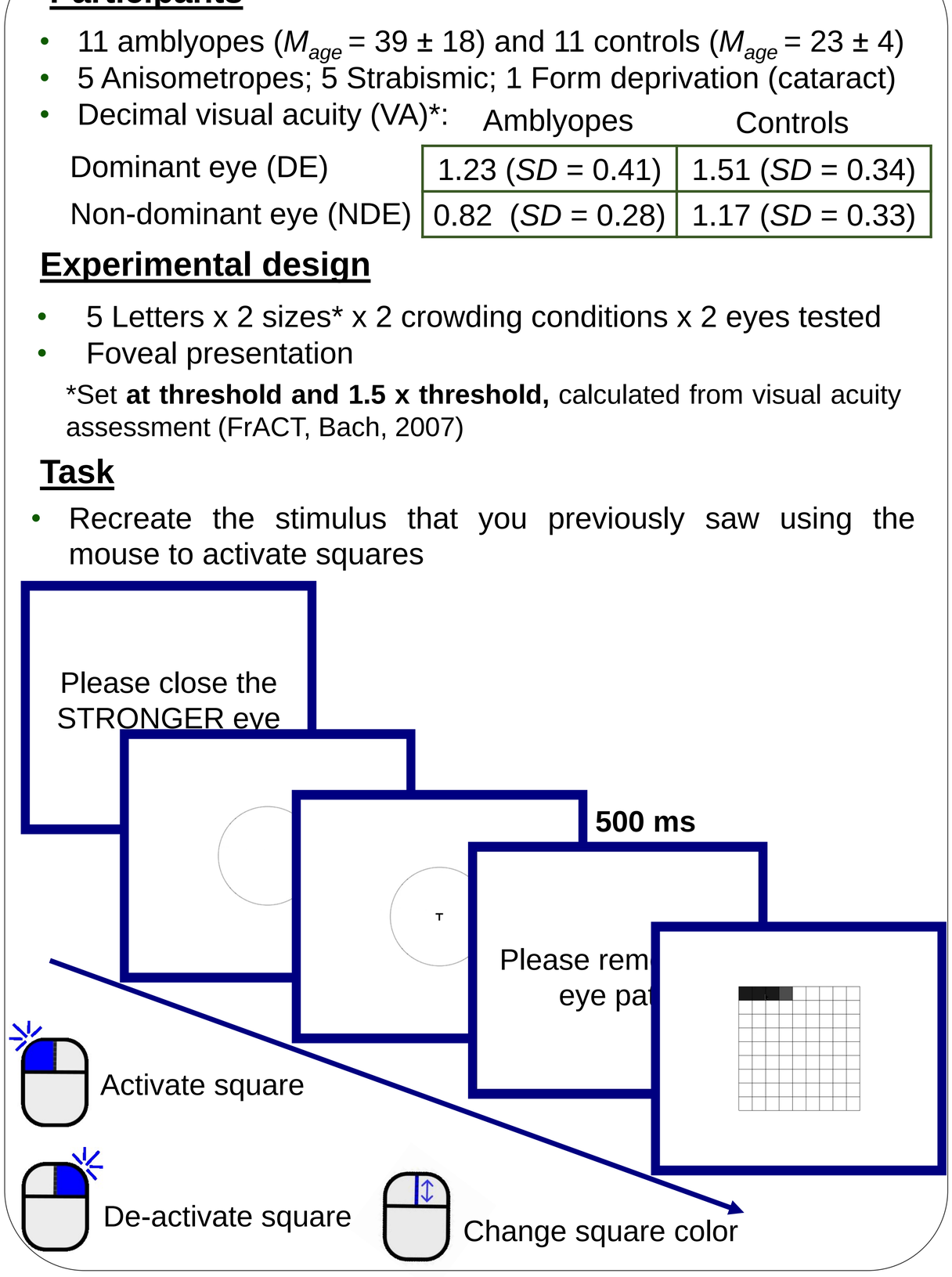
Experimental design

- 5 Letters x 2 sizes* x 2 crowding conditions x 2 eyes tested
- Foveal presentation

*Set **at threshold and 1.5 x threshold,** calculated from visual acuity assessment (FrACT, Bach, 2007)

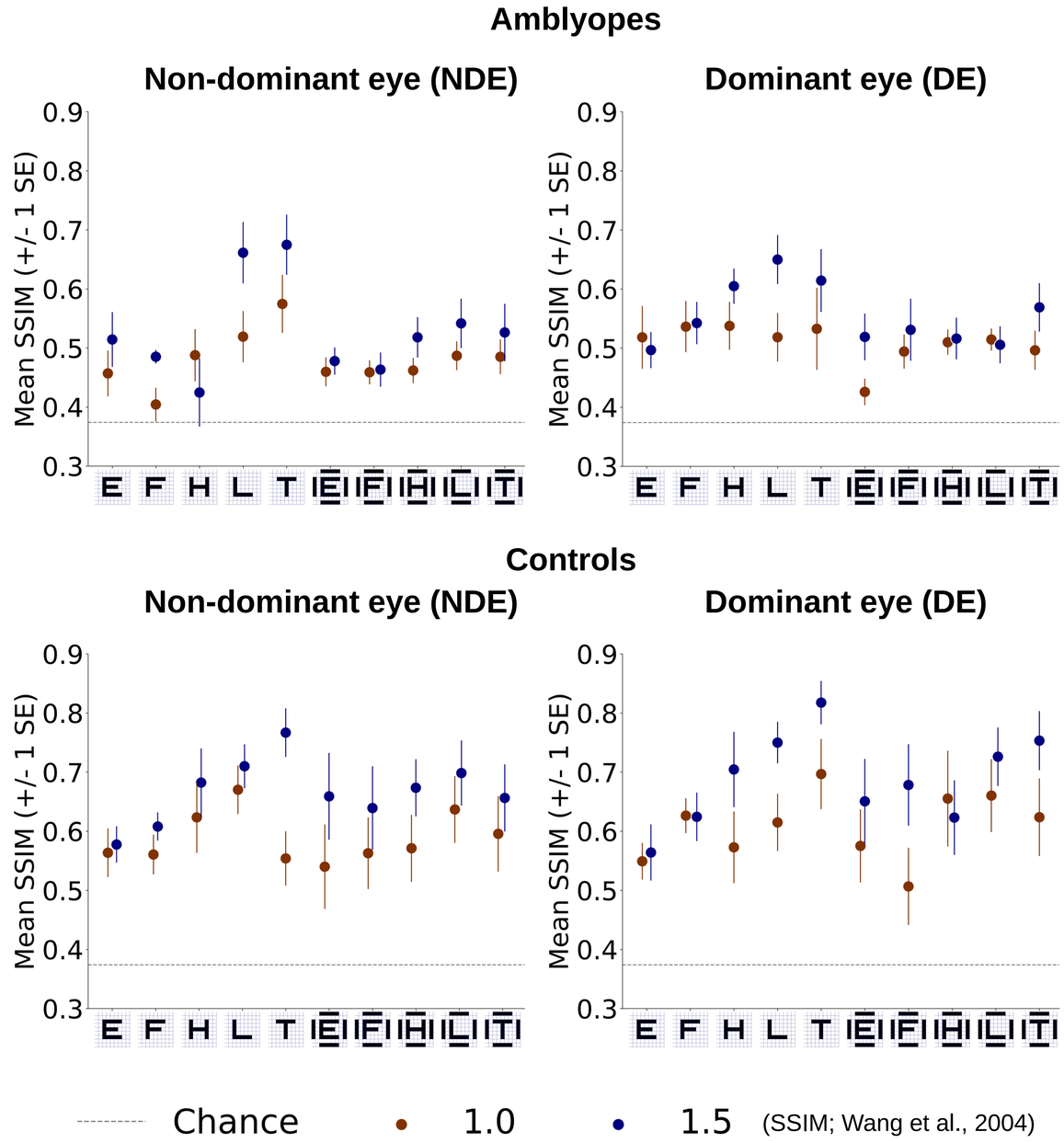
Task

- Recreate the stimulus that you previously saw using the mouse to activate squares



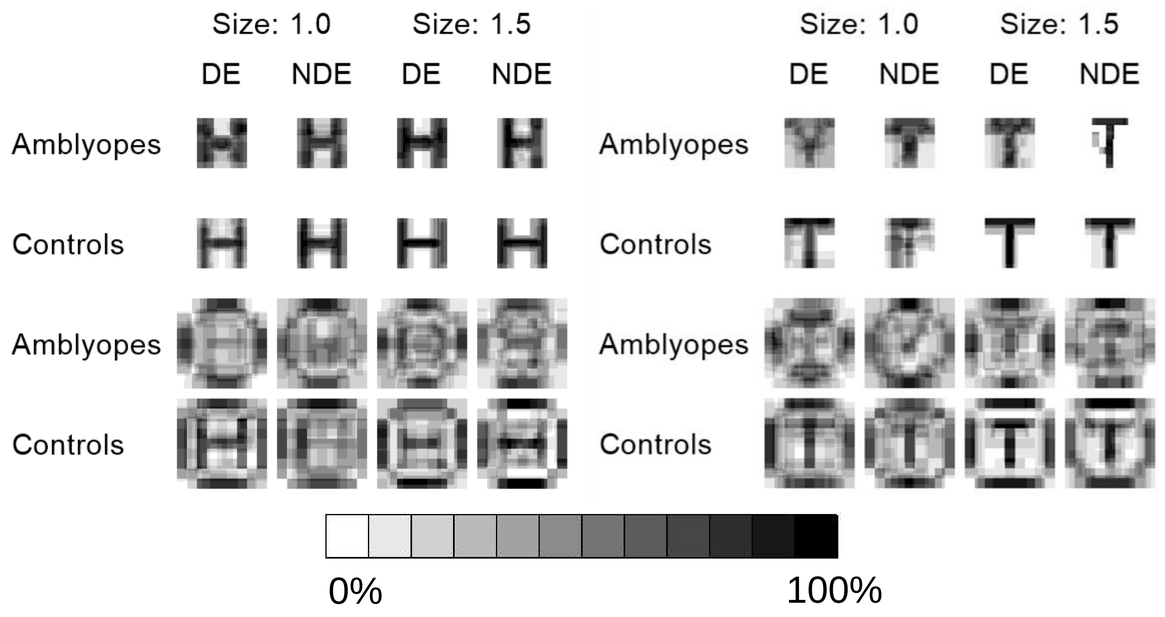
Results

Structural similarity of responses and target letters



- SSIMs were lower for:
  - Amblyopes compared to controls ($p < .001$)
  - Small compared to large stimuli ($p < .001$)
  - Flanked compared to isolated letters ($p = .03$)
  - DEs compared to NDEs ($p = .003$)
- Interaction: Group (amblyopes & controls) x tested eye ($p < .001$)

Captured appearance: Mean responses



Grey levels represent the mean pixel selection across observers.

Discussion & conclusion

- Structural similarity between targets and responses was lower for amblyopes compared to controls.
- This effect was observed despite controlling for VA differences (adjusting sizes at individual thresholds).
- Crowding was not stronger for amblyopes than controls.
- Capturing appearance is key to better understand amblyopic vision.

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