Pure False Pop Out, "Anti-Metamers" and Visual Salience

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What is False Pop Out (FPO)?

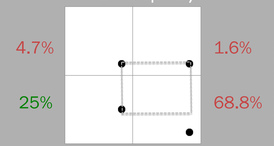
Pop out is traditionally attributed to basic feature differences, but emergent feature differences (especially symmetry) can cause distractors to be more visually salient than targets.

Why it happens: Breaking higher-order patterns

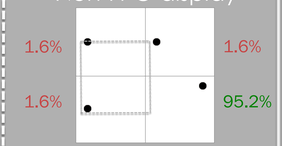
With 4 items:

Subjects used squares/ rectangles not presented in the displays to find the target (sometimes to their detriment).

FPO display

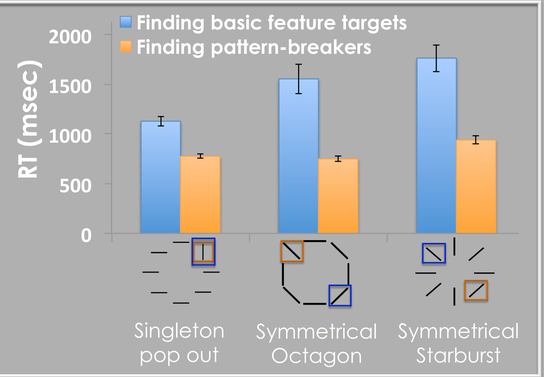


Non-FPO display



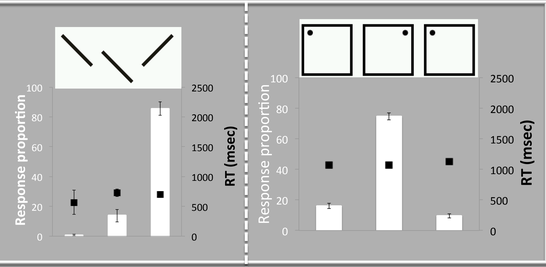
With 8 items:

Subjects were faster at finding pattern-breaking targets (orange box), than unique (i.e., basic feature) targets (blue box).



With 3 items…?

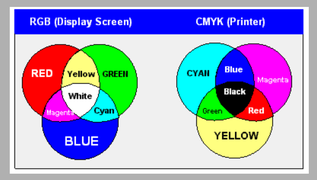
FPO was not as strong in these displays, but RTs were still equal for true and false targets. We speculate that this is due to multiple axes of symmetry.



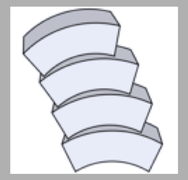
Metamers and Anti-metamers: Inducing FPO

Metamers: Physically different stimuli that are perceived as identical.

Anti-metamers: Physically identical stimuli that are perceived as different.



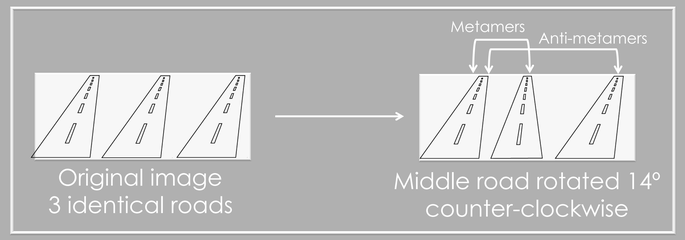
Yes, they're the same!



The original Jastrow

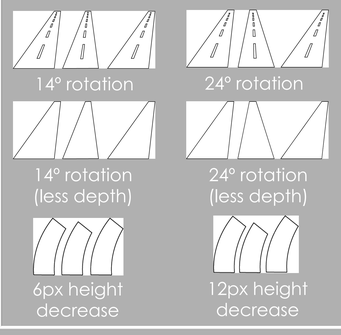
Pure FPO = 2 anti-metamers + 1 metamer

For 5 of 7 participants, a 14° ccw rotation of the center road yielded the PSE for the two leftmost roads. This was also perceived to strengthen perceptual isolation of the rightmost road.

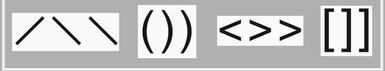


Stimuli

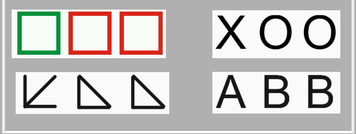
Stimuli for exploring Pure FPO



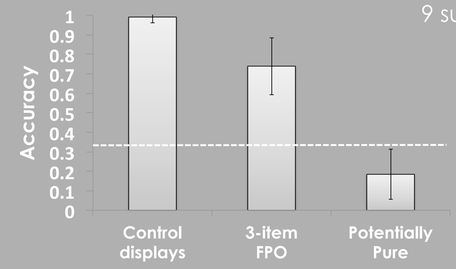
3-item stimuli producing FPO



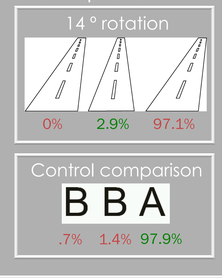
Control stimuli (traditional PO)

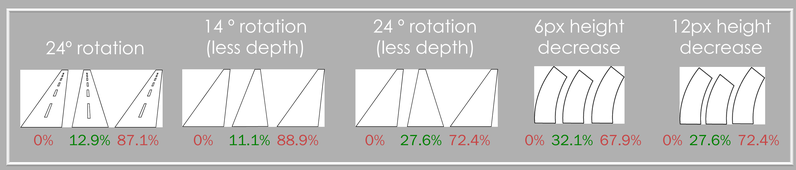


Results: Accuracies

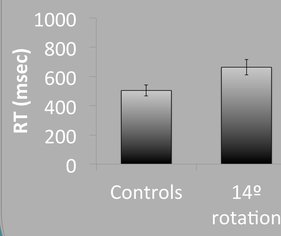


9 subjects: 1s presentation time

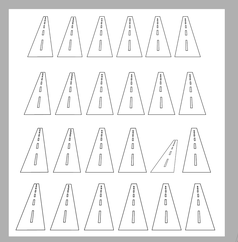




Further Directions



Although RTs are slightly slower for FPO displays, (left), we predict that flat search slopes will be found for increasingly larger, completely heterogeneous displays (right).



Conclusions

Singleton pop out, although traditionally attributed to the salience of basic feature differences, is more likely the result of inter-item grouping and symmetry-breaking, as claimed by the Theory of Basic Gestalts (Pomerantz & Portillo, 2011). As demonstrated with Pure FPO, basic feature differences do not determine salience in vision.

References

- Pomerantz, J. R., & Portillo, M. C. (2011). Grouping and Emergent Features in Vision: Toward a Theory of Basic Gestalts. Journal of Experimental Psychology: Human Perception and Performance, 37(5), 1331-1349.
- Metamer image ©2004, The Computer Language Co. Inc.
- Leaning Tower Illusion (Kingdom et al.): winner of VSS Illusion of the Year 2007
- 3-Road stimulus ©Akiyoshi Kitaoka (2010)

Pomlab