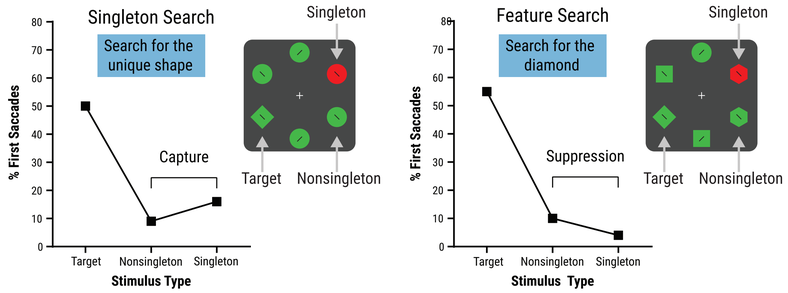
INVESTIGATING ATTENTIONAL SUPPRESSION OF REWARD-RELATED DISTRACTORS

Daniel Pearson, Janice Tang, Poppy Watson, & Mike Le Pelley

School of Psychology, UNSW Australia, Sydney, Australia

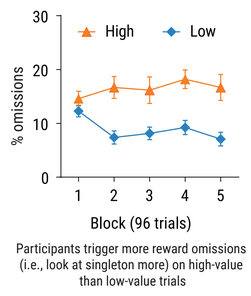
BACKGROUND

- There has been a long debate in the literature about whether or not physically salient stimuli automatically capture attention.
- The ***signal-suppression hypothesis***[1] proposes that physically salient stimuli automatically generate an attentional priority signal, which can be suppressed by an ***active suppression mechanism***.
- Recent studies suggest that attention to salient singletons is suppressed when engaging in ***feature search*** (i.e., search for the target defining feature) rather than ***singleton search*** (i.e., search for a discontinuity in the display)[2,3]

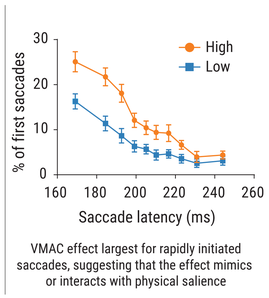


Data from Gaspelin, Leonard, & Luck (2017; Attention, Perception, & Psychophysics)

- However, there are factors other than physical salience that influence attentional capture. Stimuli associated with high-value rewards capture attention and gaze more often than stimuli associated with low-value rewards, even when attending to the reward-associated stimuli is counterproductive[4,5].
- This effect has been labelled ***Value-Modulated Attentional Capture (VMAC)***.



Participants trigger more reward omissions (i.e., look at singleton more) on high-value than low-value trials



VMAC effect largest for rapidly initiated saccades, suggesting that the effect mimics or interacts with physical salience

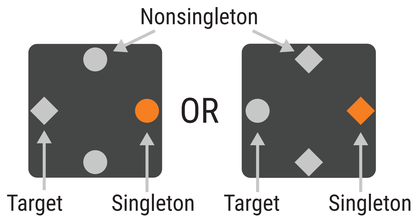
The current study aimed to investigate whether ***overt attentional capture*** by stimuli associated with ***high-value rewards*** (i.e., the ***VMAC effect***) could be suppressed under conditions promoting ***feature-search***

METHOD

SINGLETON SEARCH

Saccade to the ***unique shape***

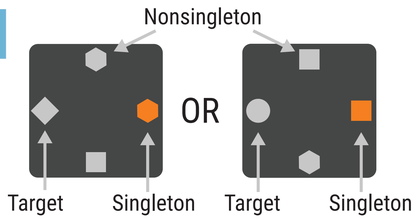
- Target is the only shape singleton, can be located by looking for discontinuity (i.e., "singleton search mode")
- n = 32



FEATURE SEARCH

Saccade to the ***circle or diamond***

- Multiple shape singletons in the display, target located by searching for defining features (i.e., "feature search mode")
- n = 32



Orange singleton = 500 points available — **High-value trials**

Blue singleton = 10 points available — **Low-value trials**

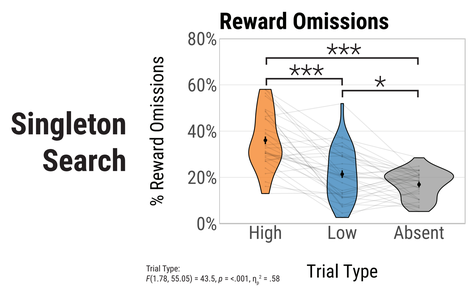
(colour-reward counterbalanced)

No singleton = 10 points available — **Singleton Absent trials**

Points converted to $$$ reward

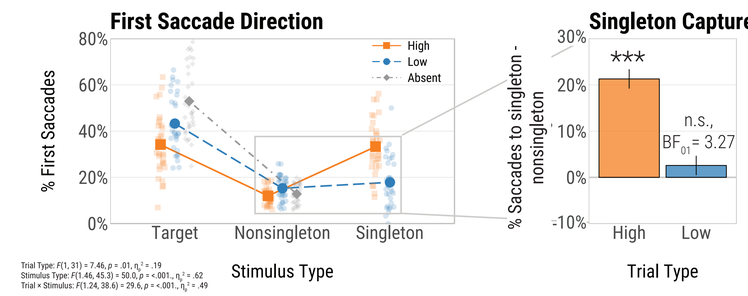
on singleton = **reward omission**

RESULTS



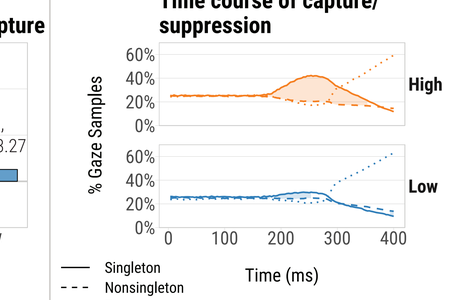
- Both groups — more reward omissions (i.e., more capture by singleton) on high-value trials than low-value trials (***VMAC effect***)
- Singleton search — ***capture*** by low-value singleton
- Feature search — ***suppression*** of low-value singleton

(A) Percentage of trials where a reward omission was triggered, for high-value, low-value and singleton absent trials. Black points show the mean with within-subjects SEM. Grey points and lines show individual subject performance. * p < .05, *** p < .001



- Singleton search — ***more*** first saccades to high-value singleton than average nonsingleton (***capture***), no evidence of capture by low-value singleton
- Feature search — ***more*** first saccades to high-value singleton than average nonsingleton (***capture***), ***less*** first saccades to low-value singleton than average nonsingleton (***suppression***)

(B) Percentage of trials with the first saccade directed towards the target, the average nonsingleton distractor and the singleton distractor, by trial type. Larger solid points show the mean with within-subjects SEM. Smaller faint points show individual subject performance.



(C) Singleton capture calculated as the percentage of first saccades directed towards the singleton distractor minus the those directed towards the average nonsingleton distractor. Positive values indicate saccades were more likely to be directed towards a singleton, negative values indicate saccades were more likely to be directed towards a non-singleton than the singleton distractor. Error bars show within-subjects SEM. * p < .05, *** p < .001

- Singleton search — ***rapid capture*** for high-value and low-value singleton
- Feature search — ***rapid capture*** for high-value singleton with subsequent suppression, ***slower suppression*** for low-value singleton

(D) Percentage of gaze samples in three areas of interest (target, singleton distractor, average nonsingleton distractor) at each time point for the first 400 ms of each trial. Shaded regions indicate periods of time where the capture/suppression effect is statistically significant with a paired samples t-test.

CONCLUSIONS

- We replicated previous findings that overt attention to colour singleton distractors can be ***suppressed*** under conditions promoting ***feature search***
- Singletons associated with ***high-value*** rewards continue to ***capture*** overt attention (***VMAC effect***) under conditions promoting ***feature search***
- This suggests ***limits*** to distractor suppression proposed by the signal-suppresion hypothesis

Scan for a digital copy:

References:
1. Sawaki, R., & Luck, S. J. (2010). Capture versus suppression of attention by salient singletons: Electrophysiological evidence for an automatic attend-to-me signal. *Attention, Perception, & Psychophysics, 72*(6), 1455–1470.
2. Gaspelin, N., Leonard, C. J., & Luck, S. J. (2015). Direct Evidence for Active Suppression of Salient-but-Irrelevant Sensory Inputs. *Psychological Science, 26*(11), 1740–1750.
3. Gaspelin, N., Leonard, C. J., & Luck, S. J. (2017). Suppression of overt attentional capture by salient-but-irrelevant color singletons. *Attention, Perception, & Psychophysics, 79*(1), 45–62.
4. Le Pelley, M. E., Pearson, D., Griffiths, O., & Beesley, T. (2015). When goals conflict with values: Counterproductive attentional and oculomotor capture by reward-related stimuli. *Journal of Experimental Psychology: General, 144*(1), 158–171.
5. Pearson, D., Donkin, C., Tran, S. C., Most, S. B., & Le Pelley, M. E. (2015). Cognitive control and counterproductive oculomotor capture by reward-related stimuli. *Visual Cognition, 23*(1-2), 41–66.