Regularity and Stimulus Salience Jointly but Independently Shape Attentional Prioritization

Shuo Li, Yi Jiang, Ying Wang*

State Key Laboratory of Cognitive Science and Mental Health, Institute of Psychology, Chinese Academy of Sciences, Beijing, China

Department of Psychology, University of Chinese Academy of Sciences, Beijing, China

Introduction

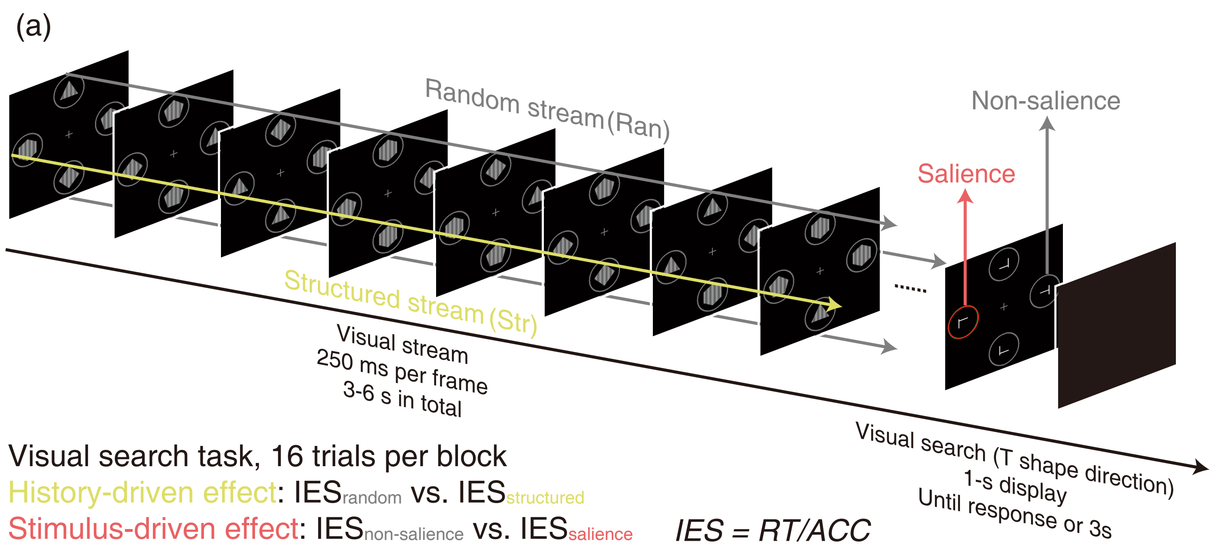
Selection history built on statistical learning has been proposed as a third factor guiding attention, parallel to goal-driven and stimulus-driven selections [1-3].

Within this framework, how history-driven factors (e.g., statistical regularities) interact with stimulus-driven effects (e.g., physical salience) to influence attentional selection remain largely unclear.

Thus, the current research investigated the mutual impacts between regularity and stimulus salience on attentional selection (Experiment 1) and the way these attentional effects interact to shape attentional priority computation (Experiment 2).

Procedure

Experiment 1a & 1b: Mutual influences

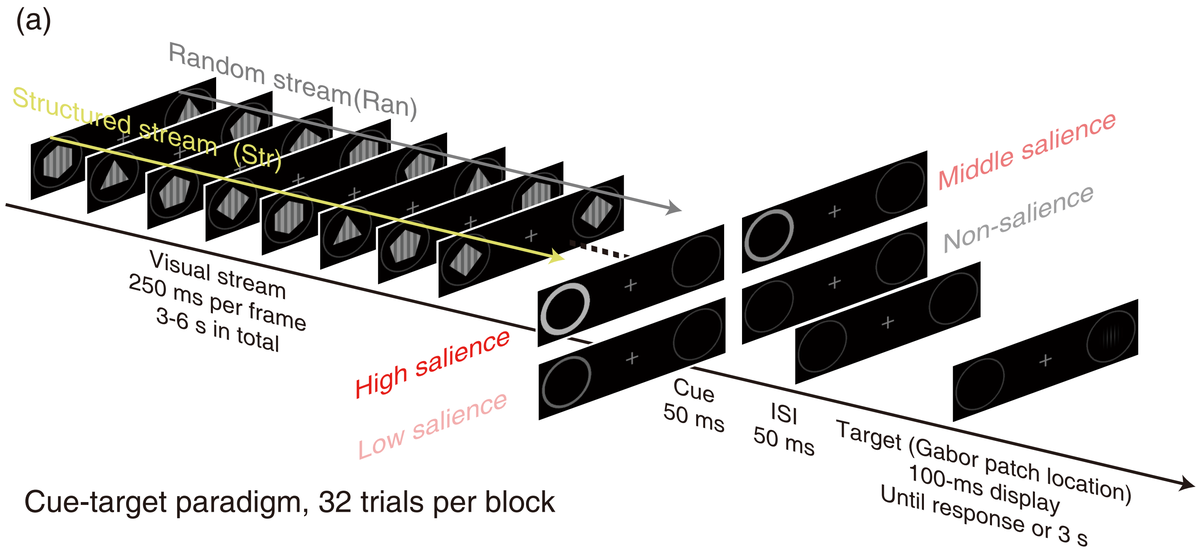


Visual search task, 16 trials per block

History-driven effect: IES_{random} vs. $IES_{structured}$

Stimulus-driven effect: $IES_{non\text{-}salience}$ vs. $IES_{salience}$ *IES = RT/ACC*

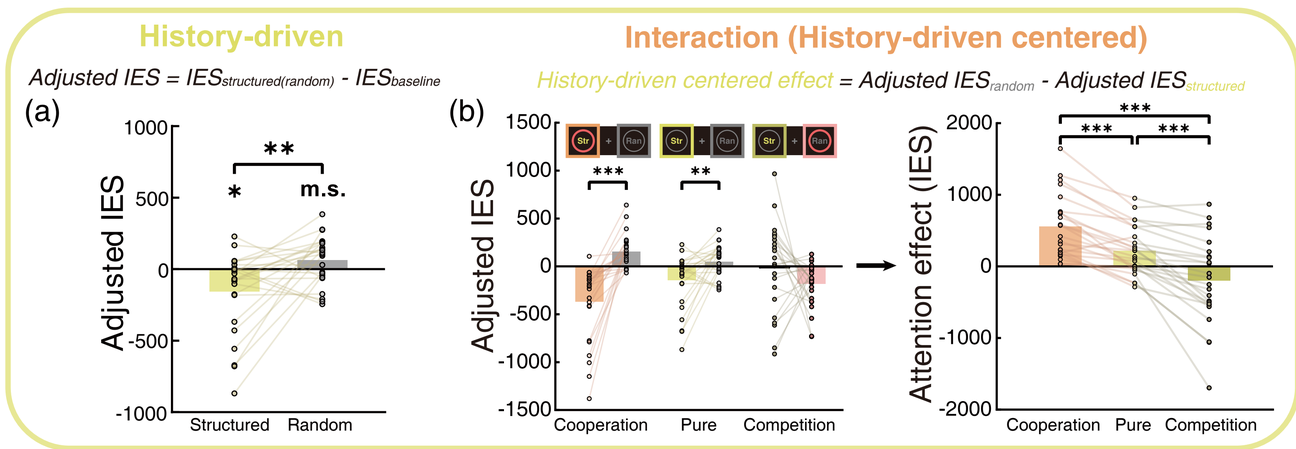
Experiment 2: Interaction mode



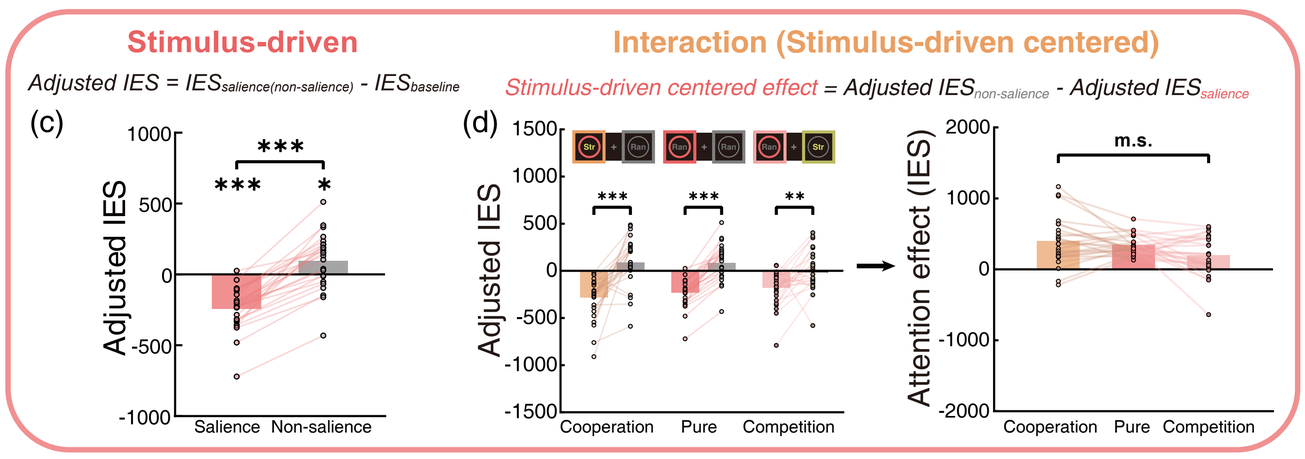
Cue-target paradigm, 32 trials per block

Results

Experiment 1a

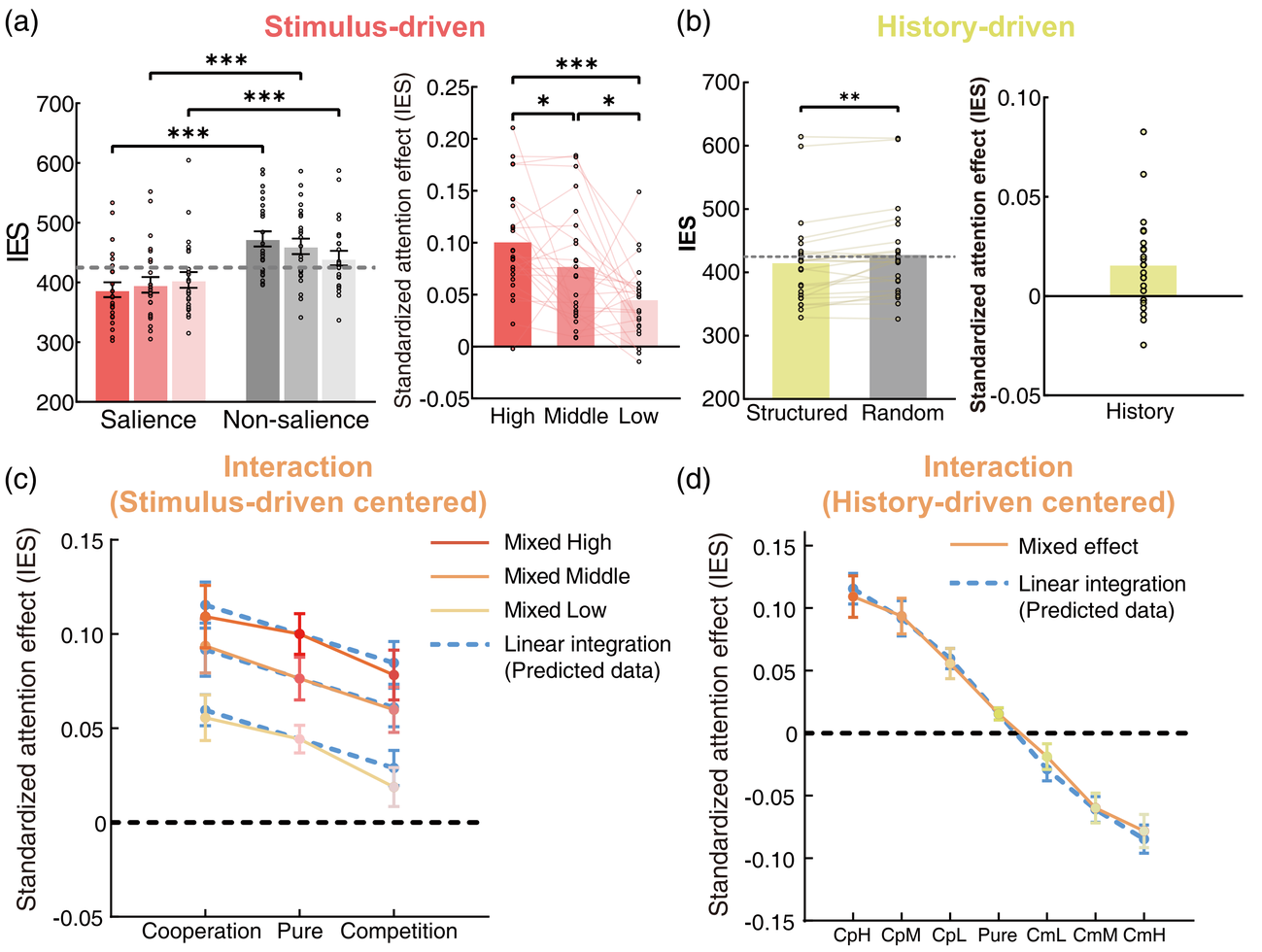


Experiment 1b



- When operating separately, both regularity and cue salience elicited prioritized attention selection.
- When the two factors coexisted, they exhibited mutual yet asymmetric impacts:
  The attention effect was augmented during cooperation but diminished during competition, where history-driven selection exerted a weaker influence than stimulus-driven selection.

Experiment 2



- History- and stimulus-driven selections jointly shape attention priority without being modulated by the level of stimulus salience.
- The mixed attention effects in the cooperation/competition condition can be predicted by the linear combinations (sum/difference) of the two observed attention effects.

Conclusion

- Statistical regularity and physical salience jointly but independently guide attentional prioritization in an additive manner.
- These results provide novel insights into how selection history and present information work in tandem to shape attentional priority computation.

References

[1] Awh, E., Belopolsky, A. V., & Theeuwes, J. (2012). Top-down versus bottom-up attentional control: A failed theoretical dichotomy. *Trends in Cognitive Sciences, 16*(8), 437–443. https://-doi.org/10.1016/j.tics.2012.06.010

[2] Theeuwes, J., & Failing, M. (2020). Attentional Selection: Top-Down, Bottom-Up and History-Based Biases. Cambridge University Press. https://doi.org/10.1017/9781108891288

[3] Zhao, J., Al-Aidroos, N., & Turk-Browne, N. B. (2013). Attention Is Spontaneously Biased Toward Regularities. *Psychological Science, 24*(5), 667–677. https://doi.org/10.1177/0956797612460407

Contact: lishuo@psych.ac.cn