

Introduction

When presented with conflicting visual and verbal information, individuals differ in the information they use to make decisions, and these differences have been related to neural organization for semantic concepts presented in either modality.¹

In two experiments using the Card Sorting Task (CST) we examine how and why individuals make decisions when presented with conflicting information.

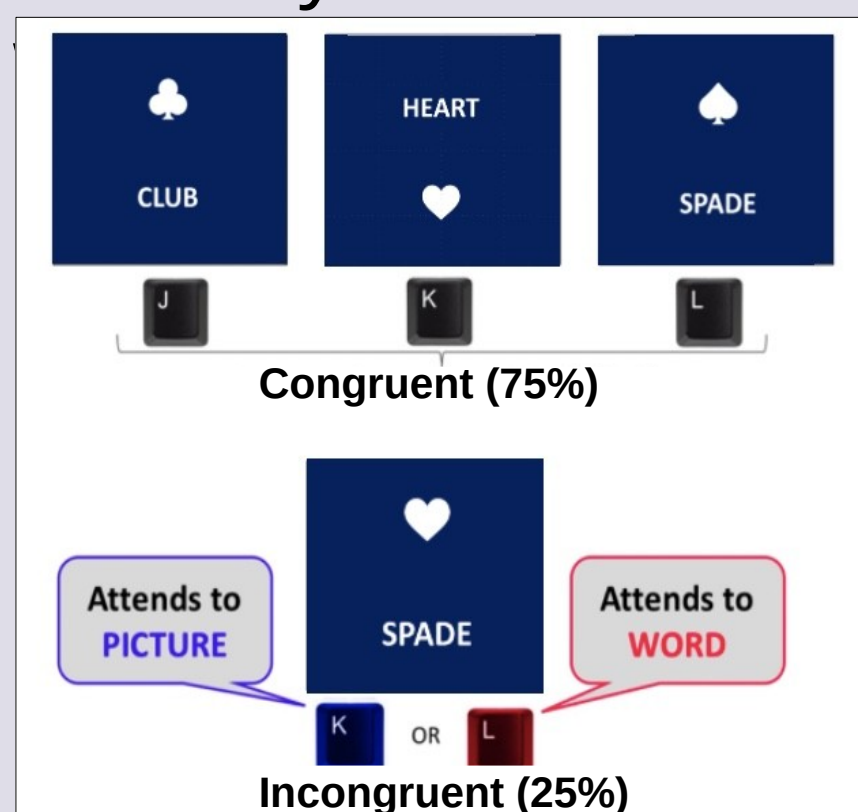


Figure 1. Upper panel shows congruent trials and the keys that correspond to each suit as presented during instructions. Lower panel shows an example of an incongruent trial (adapted from 1).

Prior research using responses to conflict trials has established that individuals differ in their reliance on picture vs. word information (“format”).¹ The degree to which the strength of that preference (“format bias”) varies across individuals remains less understood.

Experiment 1:

Do individual differences in strength of bias influence sensitivity to conflict?

Hypothesis: Individuals with a stronger bias toward one format will be less likely to notice conflicting information in the other format and thus slow down less in conflicting trials, resulting in a smaller incongruency effect.

Methods

Picture and Word Bias Task

N=185, M=40.05 years, 140 female; 4 blocks of 48 trials.

Bias Group Categorization

Biased Group: >90% of trials picked in one format.

Neutral Group: ≤90% or less trials picked in one format.

Absolute Bias: Bias percentages collapsed so sensitivity to conflict magnitudes appear on one side of the distribution. RT- Congruent RT

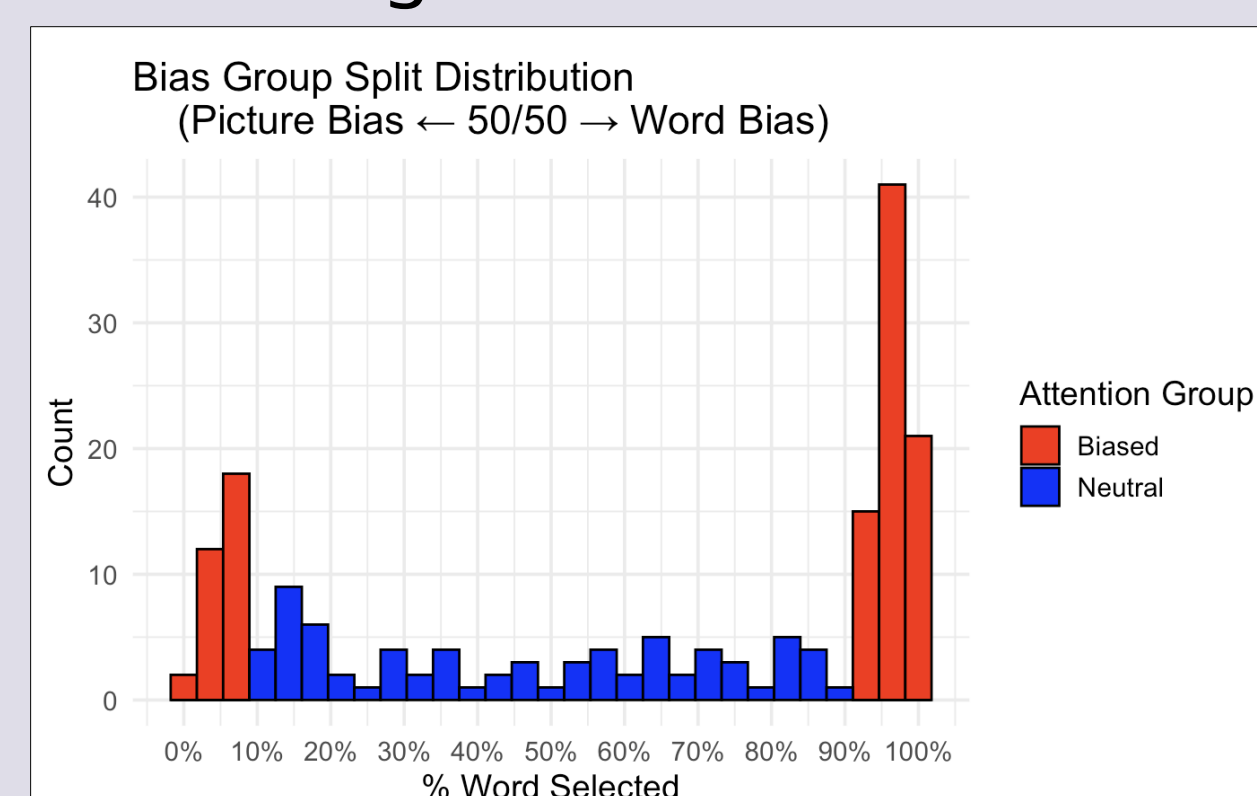


Figure 2. Participant distribution of picture vs. word selection during the CST.

Results

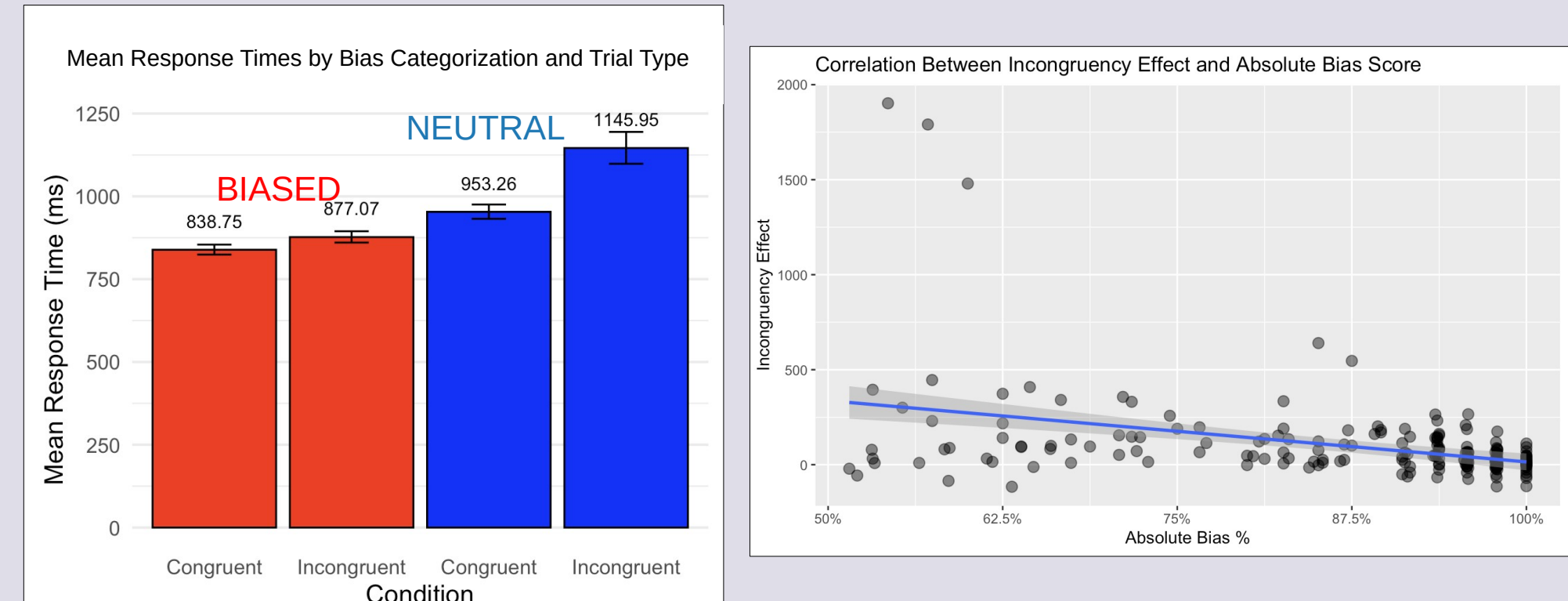


Figure 3 (Left). CST response times by format bias group.

Figure 4 (Right). Correlation between incongruency effect and absolute bias score.

- **Main effect** of group (biased group faster overall): $F(1,179) = 26.27, p < 0.001$
- **Main effect** of trial type (congruent faster than incongruent): $F(1,179) = 99.40, p < 0.001$
- **Interaction:** $F(1,179) = 15.16, p < 0.001$
- **Format Bias and Incongruency Effect Correlation:** $r(180) = -0.38, p < 0.001$

Discussion

- As predicted, more format biased individuals showed smaller incongruency effects.
- Format biased individuals were also faster overall.

Experiment 2:

Are differences in CST decisions under conflict driven by relative skills with formats or by a more general decision strategy?

Hypotheses

Relative Skill: Greater skill with one format makes it faster and easier to process, resulting in less competition from the other.

General Decision Strategy: Lenient or strict decision strategies drive the likelihood that one checks all information before sorting.

Methods

- N=45 (to date)
- CST (2 blocks of 48 trials)
- Rule-Based Card Sorting Task (4 blocks of 48 trials, 2 word-rule, 2 picture-rule).

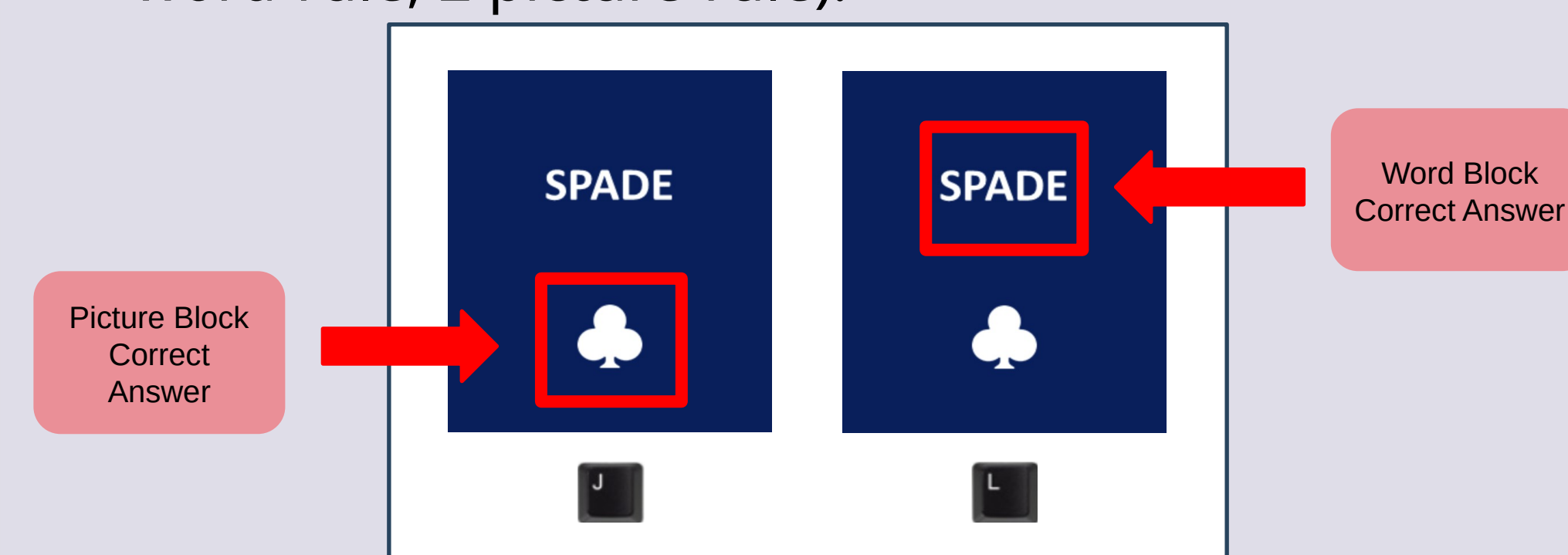


Figure 5. Example of an incongruent trial in the Rule-Based Card Sorting Task modification in two conditions: asked to select the picture and asked to select the word.

Results: RT Replication

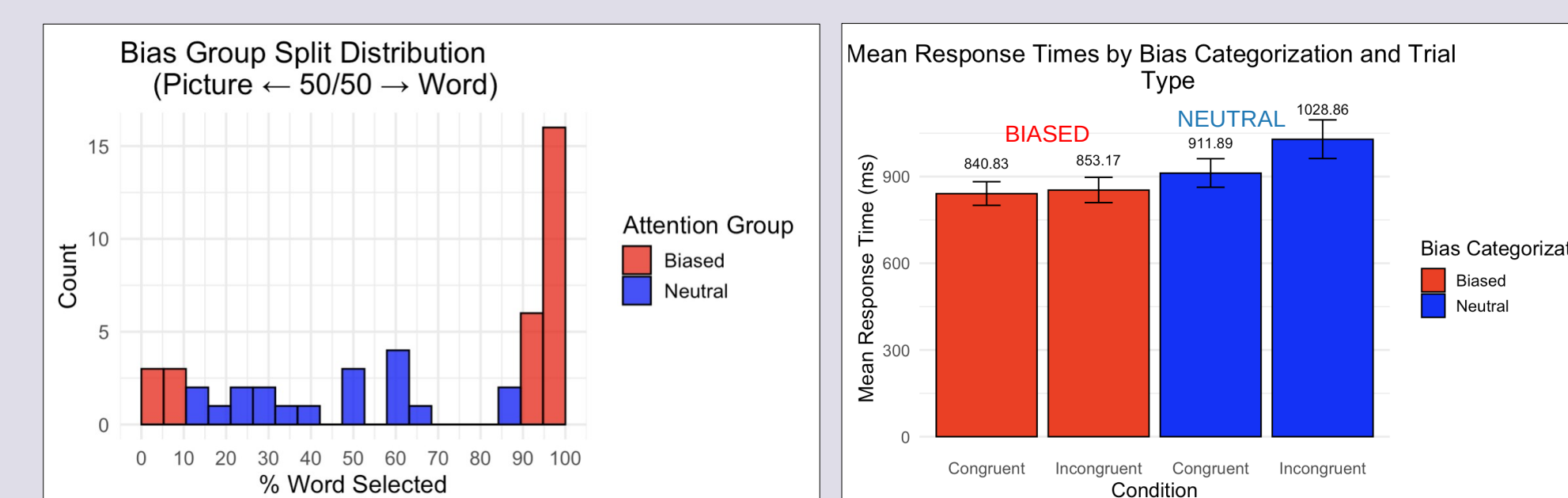


Figure 6 (Left). Shows participant distribution of picture vs. word selection during the CST.

Figure 7 (Right). Bar graph comparing biased and neutral group mean response times during congruent and incongruent trials in the CST.

- With only two blocks of CST and fewer participants, we replicate the finding that biased responders are less sensitive to conflict (**interaction:** $F(43) = 5.83, p = 0.02$) and observe a trend toward them being faster than neutral attenders (**trending main effect** of group: $F(43) = 8.90, p = 0.072$). We also observed a **main effect** of congruency $F(43) = 3.40, p = 0.005$.

Drift Diffusion Modeling (DDM)

- DDM evaluates decision-making as the accumulation of evidence over time toward one of two responses, where the rate of accumulation, decision threshold, and stimulus encoding time account for variation in RT and accuracy.
- Analyzed Rule-Based Card Sorting Task (RBCST) data for word and picture format sorting conditions to examine differences in evidence accumulation (“drift rate”) between picture and word format groups and for differences in decision strategies (“decision threshold”) between neutral and biased groups.

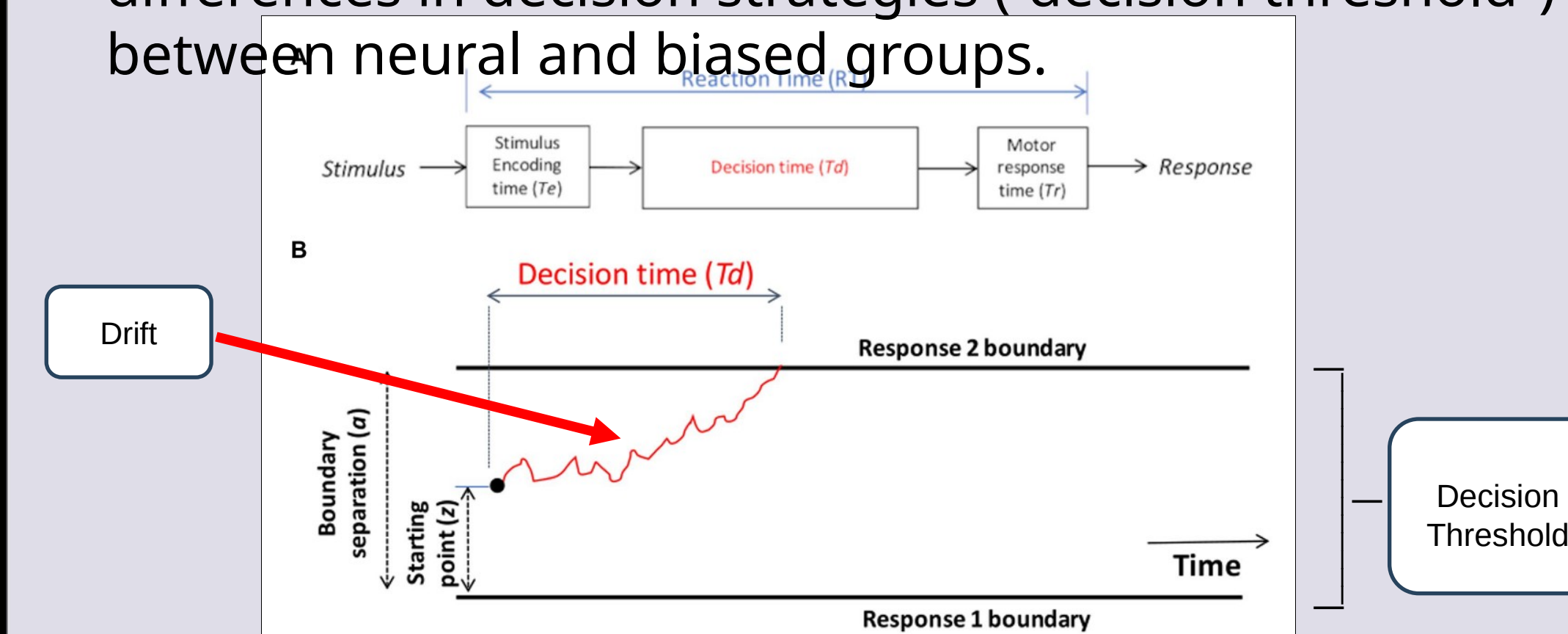


Figure 8. A) Schematic of reaction time process. B) Theoretical depiction of drift rate reaching a decision threshold (adapted from 3).

Results: DDM

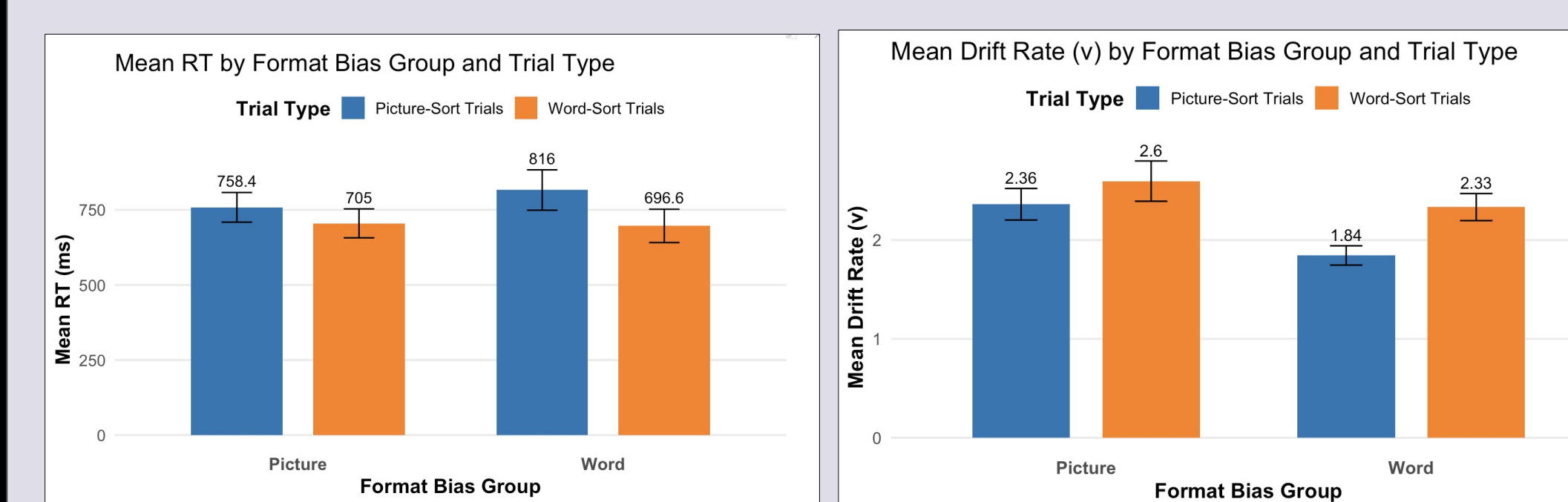
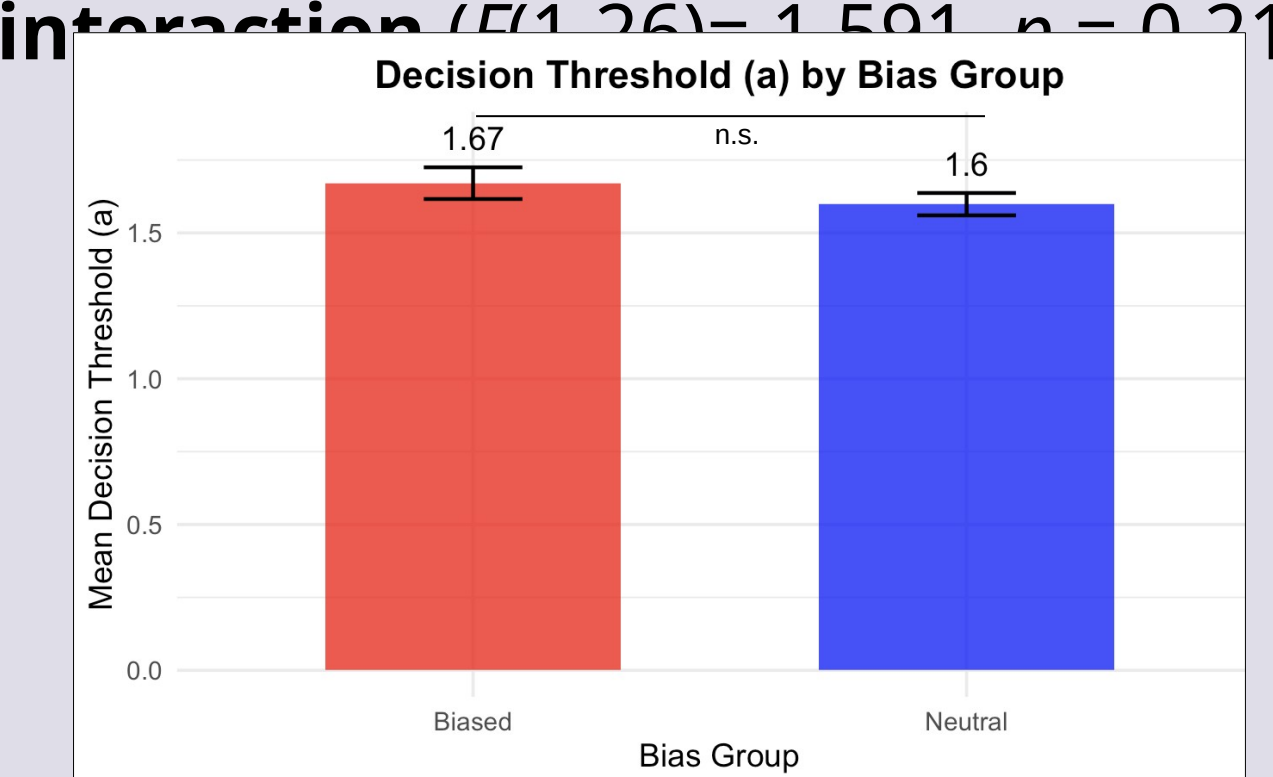


Figure 9 (Left). Compares word and picture biased group response times in RBCST.

Figure 10 (Right). Compares drift rates for word and picture biased groups in RBCST.

Response Time ANOVA

- Word-sort blocks were *faster* than picture-sort blocks (**Main effect** of block type: $F(1,26) = 55.78, p < 0.001$)
- This difference was *biggest* in word bias group (**Interaction:** $F(1,26) = 8.35, p = 0.007$)
- No differences in word biased versus picture biased (**No main effect** of format bias: $F(1,26) = 0.23, p = 0.88$)
- *Faster* drift rates on word-sort blocks (**Main effect** of block type: $F(1,26) = 9.20, p < 0.001$)
- *Trend toward faster* drift rates in picture bias group (**Trending main effect** of format bias: $F(1,26) = 2.965, p = 0.097$)
- **No interaction** ($F(1,26) = 1.591, p = 0.218$)



Discussion

- Across both experiments, individuals differed in the information format they attended to and the strength of their decision-making bias.
- More biased deciders tended to be faster and less sensitive to conflicting information.
- Both word and picture biased groups responded faster to word-sort blocks. This is likely due to words being processed more readily.
- Contrary to the General Decision Strategy Hypothesis, preliminary DDM results suggest that biased and neutral groups do not differ in decision threshold.
- Word-biased participants were faster in word-sort blocks than in picture-sort blocks, but the reverse was not true for picture-biased participants.
- These preliminary results are partially consistent with the Relative Skill Hypothesis, as ease of processing words affects drift rate overall, but

word/picture bias

- ## References
1. Alfred, K. L., Hayes, J. C., Pizzie, R. G., Cetron, J. S., & Kraemer, D. J. M. (2020). Individual differences in encoded neural representations within cortical speech production network. *Brain Research*, 1726, 146483. <https://doi.org/10.1016/j.brainres.2019.146483>
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 3. Myers, C. E., Interian, A., & Moustafa, A. A. (2022). A practical introduction to using the drift diffusion model of decision-making in cognitive psychology, neuroscience, and health sciences. *Frontiers in Psychology*, 13. <https://doi.org/10.3389/fpsyg.2022.1039172>

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