Perception and Action Effects on Causal Judgment

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INTRODUCTION

- Seemingly irrelevant perceptual and motor factors affect performance on purely symbolic cognitive tasks -- i.e., effects of embodiment (e.g., Brouillet, et al., 2010; Landy & Goldstone, 2007).
- Other research demonstrates that conceptual overlap in the spatial representation of stimulus and response characteristics facilitates response time -- e.g., polarity correspondence (Proctor & Cho, 2006)
- Here, we investigated whether a spatial overlap in perceptual, action, and conceptual information – what we refer to as PAC overlap – affects performance on a symbolic cognitive task: causal judgment from contingency data. We did so using a causal discounting paradigm.

Causal Discounting

- Occurs when people perceive a moderately effective cause to be less effective – i.e., devaluing the strength of a target cause – when learned about in the presence of a strong alternative, even when not normatively appropriate to do so (Goedert & Spellman, 2005).
- Causal discounting may have a spatial component:

  Discounting was eliminated when participants performed a concurrent spatial working memory task during contingency learning (Goedert, Harsh & Spellman, 2005).
- We hypothesize that while discounting relies on spatial working memory, which shares perceptual spatial codes with perception and action, discounting is also moderated by attention, which may be allocated on the basis of overlap in conceptual/categorical spatial codes in the perceptual, action, and conceptual domains.

Current Prediction

Causal discounting will be reduced or eliminated when there is an overlap in the perceptual, action, and conceptual requirements of the task – that is, when there is a PAC overlap.

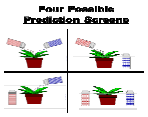
METHOD

87 participants learned about two potential causes of a common outcome

Procedure

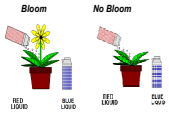
36 trials. On each trial:

1) See one of four possible prediction screens:



2) Predict whether plant will bloom with mouse-press using left and right thumbs. Mouse held centrally in lap. Varied mapping of yes/no to right/left buttons.

3) Receive feedback on whether plant bloomed:



Design

- Strength of target cause held constant at *phi* (Φ) = 0.33

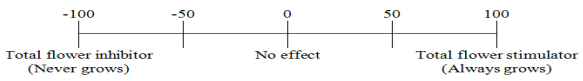
Manipulated

- Strength of the Alternative Cause: Strong: Φ = 0.67 or Weak: Φ = 0 *(within-groups)*
- Target Location: left or right side of screen *(between-groups)*
- "Yes" Response Location on predictions: left or right mouse button *(between-groups)*

		Target Location: Left	Target Location: Right
Yes Response	Left	Match	Mismatch
	Right	Mismatch	Match

Dependent Measures

- Causal judgments made separately for the target and alternative at the end of each 12-trial block using the following scale:

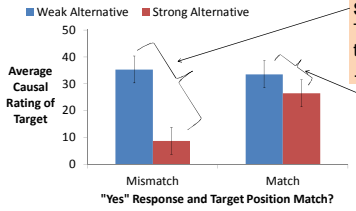


- Proportion of "yes" responses for predictions on the target-only trials of the prediction task.

RESULTS

Causal Ratings of Target

Consistent with prediction, when PAC overlap – i.e., Spatial Match – No Discounting in causal judgments for the target.

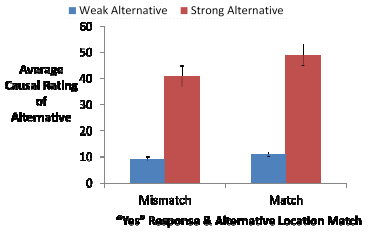


Spatial Mismatch=Discounting
Target rated less causal with strong than with weak alternative (p < .001).

Spatial Match=NO Discounting
Target rated similarly in strong and weak alternative conditions (p = .201).

Causal Ratings of Alternative

Participants accurately discriminated the strong and weak alternative conditions regardless of Match/Mismatch.

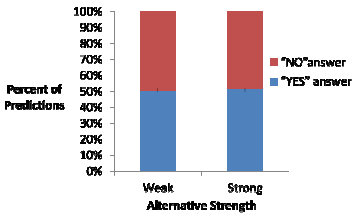


Alternative Rated
- More causal when strong.
- Less causal when weak.

No effects involving response/target location match (*ps* >.492).

Ruling out Motor Cueing Explanation

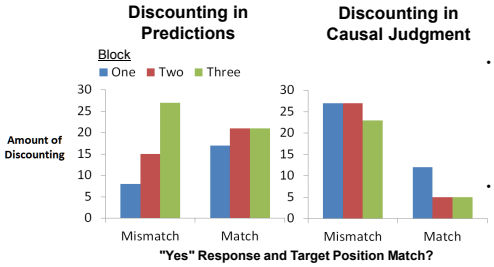
Do people tend to say "yes" more than "no" when making predictions? If so, the PAC overlap that eliminated discounting could merely be due to "responding more" to the target location – i.e., an action effect only.



Answer: NO
No Evidence of Motor Cueing
- Looking across all trial types, there was an equal propensity to predict yes and no. Thus, equal use of left and right thumbs.

Trial-by-Trial Predictions

Benefit of PAC Overlap not observed for trial-by-trial predictions.



- Discounting was calculated by subtracting rating (for judgments) or percent of "yes" responses to the target (for predictions) in the weak alternative condition from those in the strong alternative.
- Causal judgment data is same as above, represented here by learning block for comparison to predictions.

CONCLUSION

- Causal judgments varied as a function of whether there was a match between the side of screen the target appeared on and the thumb a participant used to respond "yes" – an effect of perceptual, action, and conceptual overlap.
- Given that overall, participants made a similar number of yes and no responses, a motor-cueing effect does not explain the results.
- We speculate that an overlap in conceptual (i.e., categorical) spatial codes representing the stimulus, the response locations, and the conceptual information facilitates attention to the conceptual information with positive polarity (see Proctor & Cho, 2006) – in this case, the "yes" response. Further experimental work is needed to confirm this hypothesis.

REFERENCES

Brouillet, T., et al. .(2010). *Acta Psychologica, Vol 134,*. 310-317;
Goedert, K.M., et al. (2005). *Psychological Science, 16,* 590-595;
Goedert, K.M., & Spellman, B.A. (2005). *Learning & Behavior, 33*, 197-210;
Landy, D., & Goldstone, R. L.(2007). *JEP: LMC, 33*, 720-733;
Proctor, R.W., & Cho, Y.S. (2006). *Psychological Bulletin, 132*, 416-442.