Drift diffusion modeling informs how affective factors affect visuospatial decision making

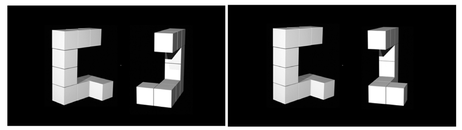
Yaxin Liu and Stella F. Lourenco
Emory University

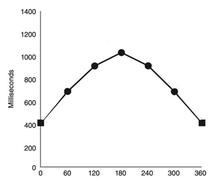
Lourenco Lab

Anxiety, confidence, and motivation affect decision making. But how?

- Affective factors (e.g., anxiety, confidence, motivation) can enhance or impair perceptual decision-making
- Whereas anxiety tends to impair performance on accuracy, confidence and motivation tend to enhance it
- However, the mechanisms underlying these effects remain poorly understood, especially under speed-accuracy tradeoff
- Here we use drift diffusion modeling to inform how anxiety, confidence, and motivation affect mental rotation performance

Same Different/mirror





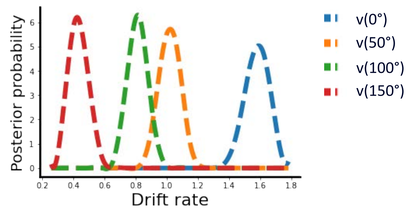
Participants performed a mental rotation task and rated their affect

- 96 trials on 2AFCT[2]: same/different judgments
  - "Respond as quickly and as accurately as possible"
- Randomly-selected rating trials: 7-point Likert scale (24 trials total)

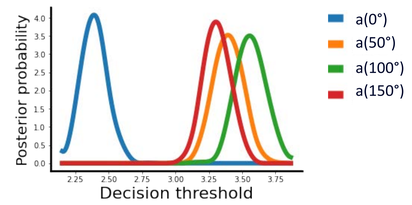
How anxious/confident/motivated were you on the previous trial?

Not at all 1 2 3 4 5 6 7 *Extremely*

Drift rate and decision threshold change as function of angular disparity

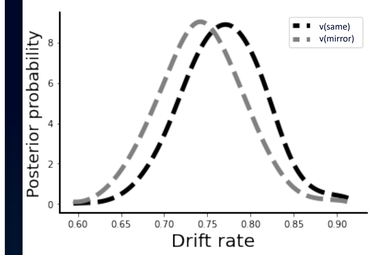


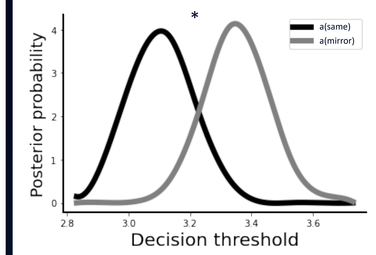
Drift rates decreased monotonically as angular disparity increased, suggesting lower processing efficiency as trials increased in difficulty



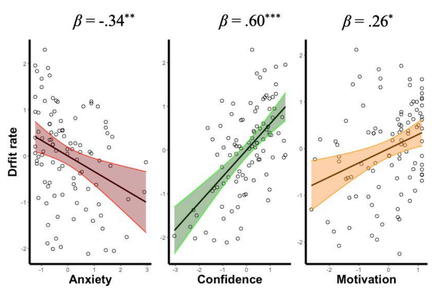
Decision thresholds increased as angular disparity increased, suggesting greater evidence accumulation as trials increased in difficulty

Same vs. different (mirror) trials differed in decision threshold, but not drift rate

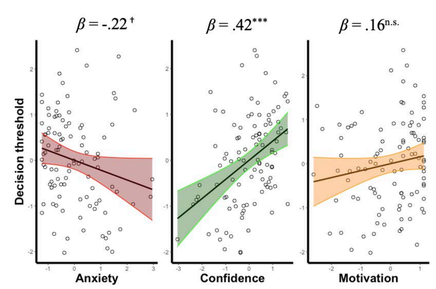




Affective factors are associated with drift rate and decision threshold



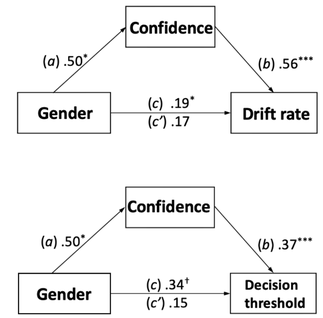
Anxiety was associated with lower drift rates, whereas confidence and motivation were associated with higher drift rates



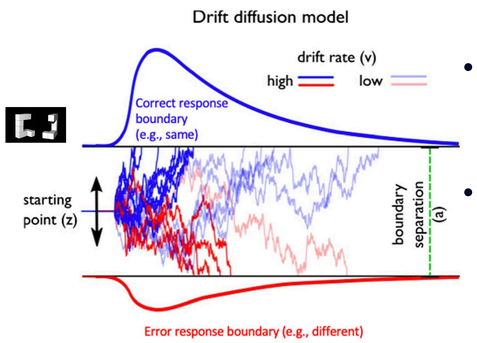
Anxiety was associated with lower decision thresholds, whereas confidence was associated with higher decision thresholds

Gender differences

- Male participants had higher drift rates and larger decision thresholds compared to female participants[6]
  - However, such gender differences were mediated by confidence
    - Indeed, when controlling for confidence, the gender differences were no longer significant
- Motivation, but not anxiety, moderated the mediating role of confidence in gender → drift rate and gender → decision threshold



Drift Diffusion Modeling (DDM) Approach[3,4]

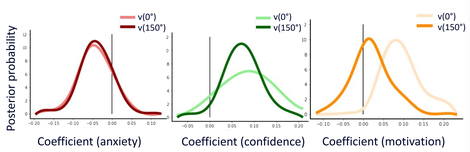


- **Drift rate (*v*)** - processing efficiency of the mental rotation stimuli
- **Decision threshold (*a*)** - amount of evidence accumulation before judging same or different

Rotational processes vs. decision stage processes

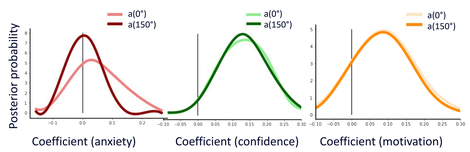
Affective factors predict drift rate and decision threshold from one trial to the next

Posteriors of regression coefficients for trial-wise regressors.
Significant if posterior probability > 95% (different from zero)



v(0°):	86%n.s.	93%†	99%*
v(150°):	87%n.s.	97%*	72%n.s.

Confidence and motivation increased drift rates, though the effect of motivation was specific to the easier trials (confidence affected both easy and hard trials)



a(0°):	73%n.s.	98%*	92%†
a(150°):	57%n.s.	97%*	95%*

Confidence and motivation increased decision thresholds, though the effect of motivation as specific to the harder trials (confidence affected both easy and hard trials)

Conclusions

- Affective factors differentially impact processing efficiency and evidence accumulation when performing a mental rotation task
  - Confidence had significant effects on both drift rate and decision threshold, and even mediated the gender differences for both
  - Anxiety and motivation both affected drift rate, but their effects on decision threshold were less consistent
- These findings demonstrate how affective factors may impact visuospatial decision making, particularly in relation to the decision stage processes

References

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@Yaxin__Liu
@LourencoLab