The Effect of Affect on Cognitive Control and Sentence Processing

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Background & Hypotheses

The Role of Cognitive Control in Sentence Processing: Psycholinguistic studies[1,2] emphasize the importance of cognitive-control during sentence processing, especially when readers/ listeners must override early, incorrect interpretations.

The Interplay of Emotion and Cognitive Control: Emotional states can influence cognitive control.[3] Negative affective state impairs performance on verbal working memory tasks, but improves performance on non-verbal working memory tasks. The reverse is true of positive affective states.

Predictions: Compared to the control group, anxious individuals should have:
1. Greater difficulty on syntactic ambiguity resolution (compared to unambiguous forms not requiring revision).
2. Better performance on non-verbal, visual-spatial tasks requiring response revision (i.e., Antisaccade).

Methods

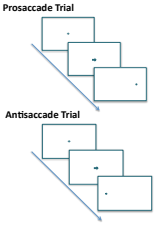
Apparatus: Online reading time measures acquired using an Eyelink 1000 Tower Mount monocular eye tracker at a 1000 Hz sampling rate

Linguistic Material: Reflexive Absolute Transitive Verb Sentence Constructions[5]

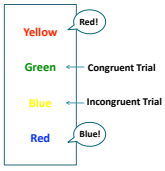
- 12 Ambiguous Sentences: *While Anna dressed the cute and cuddly baby [spit up on the bed].*
- 12 Unambiguous Sentences: *The cute and cuddly baby spit up on the bed while Anna dressed.*
- Comprehension Question used to probe for the lingering garden path effect: *Did Anna dress herself?*

Stroop Task → Evaluative Anxiety Manipulation[4] → Sentence Processing Tasks → Antisaccade Task

Non-verbal Cognitive Control Task: Antisaccade



Verbal Cognitive Control Task: Stroop

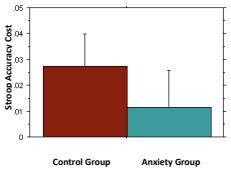


Results

N = 21 (11 Control; 10 Anxious)

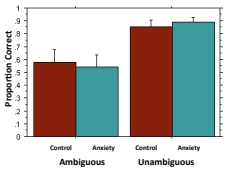
Error Bars = SEs

No Pre-Anxiety Manipulation Group Differences on Stroop



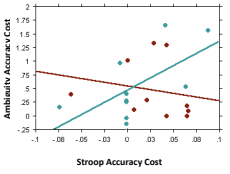
Stroop Cost = $Incongruent_{Acc}$ – $Congruent_{Acc}$

Offline Effect of Lingering Garden Path, No Effect of Anxiety



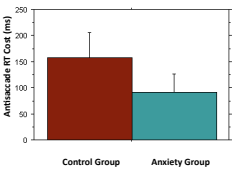
Ambiguity Cost = $Unambiguous_{Acc}$ – $Ambiguous_{Acc}$

Performance on the Stroop Predicts Ambiguity Accuracy for Anxious Ss



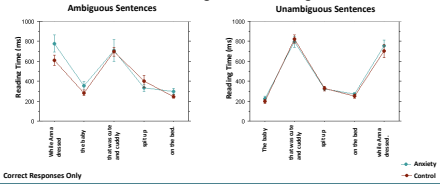
Anxiety: $R^2 = 0.398$ Control: $R^2 = 0.039$

Anxious Ss Perform the Antisaccade Task Better than Non-Anxious Ss

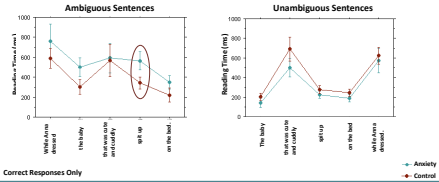


Antisaccade Cost= $Antisaccade_{RT}$ – $Prosaccade_{RT}$

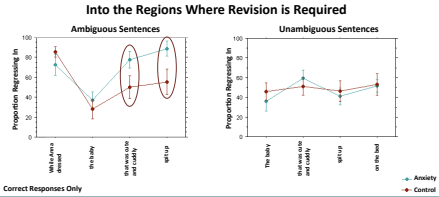
First Pass Time Reveals no Differences Between Anxious and Non-Anxious Ss for Ambiguous or Unambiguous Sentences



Second Pass Time Reveals that Anxious Ss Spend More Time Rereading Ambiguous Sentences in the Disambiguating Region



Anxious Ss have a Higher Probability of Regressing Into the Regions Where Revision is Required



Summary & Conclusions

1. Anxious participants (as compared to the non-anxious group) have improved performance on the Antisaccade task, but impaired performance on the online processing of ambiguous sentences.
2. Specifically, anxious participants spend more time rereading the disambiguating region of ambiguous sentences, and have more regressive eye movements to regions that are critical for revision (i.e., the disambiguating region and the region immediately preceding the disambiguating region).
3. Accuracy performance on the Stroop task is related to accuracy on comprehension questions following ambiguous sentences that probe for the lingering garden path effect.
4. These findings extend research integrating emotion and cognitive control: real-time sentence processing is influenced by affect under selective conditions, namely when control must be initiated to recover from misinterpretation.

References

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3. Gray, Braver, & Raichle. (2002). Integration of emotion and cognition in the lateral prefrontal cortex. *PNAS.*
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5. Christianson, Hollingworth, Halliwell, & Ferreira. (2001). Thematic roles assigned along the garden path linger. *Cog Psych.*

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