

No evidence of attentional bias in statistics anxiety

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Introduction

- Statistics anxiety is defined as the feelings of anxiety encountered when taking a statistics course or doing statistical analyses (Cruise et al., 1985).

Introduction

- Statistics anxiety is often conceptualized as a multidimensional construct consisting of three factors.

Factor	Description
Interpretation anxiety	The feelings of anxiety encountered when interpreting statistical data
Test and class anxiety	The anxiety involved when enrolled in a statistics class or when taking a statistics test
Fear of asking for help	The anxiety experienced when seeking help

Introduction

- The antecedents, effects, and interventions of statistics anxiety have been well documented.
- Antecedents include
 - Probabilistic nature of statistics (Williams, 2013)
 - Procrastination (Onwuegbuzie, 2004)
 - Age and Gender (Baloğlu, 2003)

Baloğlu, M. (2003). Individual differences in statistics anxiety among college students. *Personality and Individual Differences*, 34(5), 855–865. doi:10.1016/S0191-8869(02)00076-4

Onwuegbuzie, A. J. (2004). Academic procrastination and statistics anxiety. *Assessment & Evaluation in Higher Education*, 29(1), 1–19. doi:10.1080/0260293042000160384

Williams, A. S. (2013). Worry, intolerance of uncertainty, and statistics anxiety. *Statistics Education Research Journal*, 12(1), 48–59.

Introduction

- A consistent negative relationship has been found between statistics anxiety and statistics achievement in a variety of studies.

Galli, S., Ciancaleoni, M., Chiesi, F., & Primi, C. (2008, July). *Who failed the introductory statistics examination? A study on a sample of psychology students*. Paper presented at the 11th International Congress on Mathematical Education, Monterrey, Mexico.

Hanna, D., & Dempster, M. (2009). The effect of statistics anxiety on students' predicted and actual test scores. *The Irish Journal of Psychology*, 30(3-4), 201–209. doi:10.1080/03033910.2009.10446310

Onwuegbuzie, A. J., & Seaman, M. A. (1995). The effect of time constraints and statistics test anxiety on test performance in a statistics course. *Journal of Experimental Education*, 63(2), 115–124.

Introduction

- Interventions include
 - Innovative instructional methods (Pan & Tang, 2004)
 - Use of immediacy behaviors (Williams, 2010)
- Despite the large number of investigations on statistics anxiety, the mechanisms by which statistics anxiety operate are unclear.

Pan, W., & Tang, M. (2004). Examining the effectiveness of innovative instructional methods on reducing statistics anxiety for graduate students in the social sciences. *Journal of Instructional Psychology*, 31(2), 149–159.

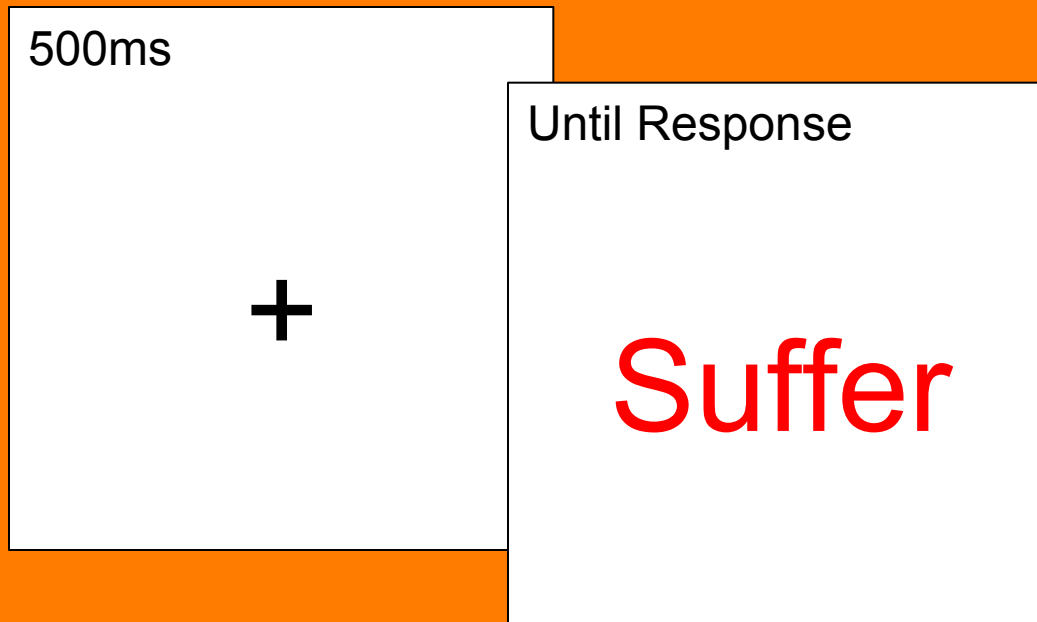
Williams, A. S. (2010). Statistics anxiety and instructor immediacy. *Journal of Statistics Education*, 18(2). Retrieved from <http://www.amstat.org/publications/jse/v18n2/williams.pdf>

Introduction

- According to cognitive theories such as schema theory (Beck, 1976) and network theory (Bower, 1981), individuals with anxiety have a cognitive bias to process information that is congruent with their anxiety.
- Researchers have used the emotional Stroop task and the dot probe task to study this bias.

Introduction

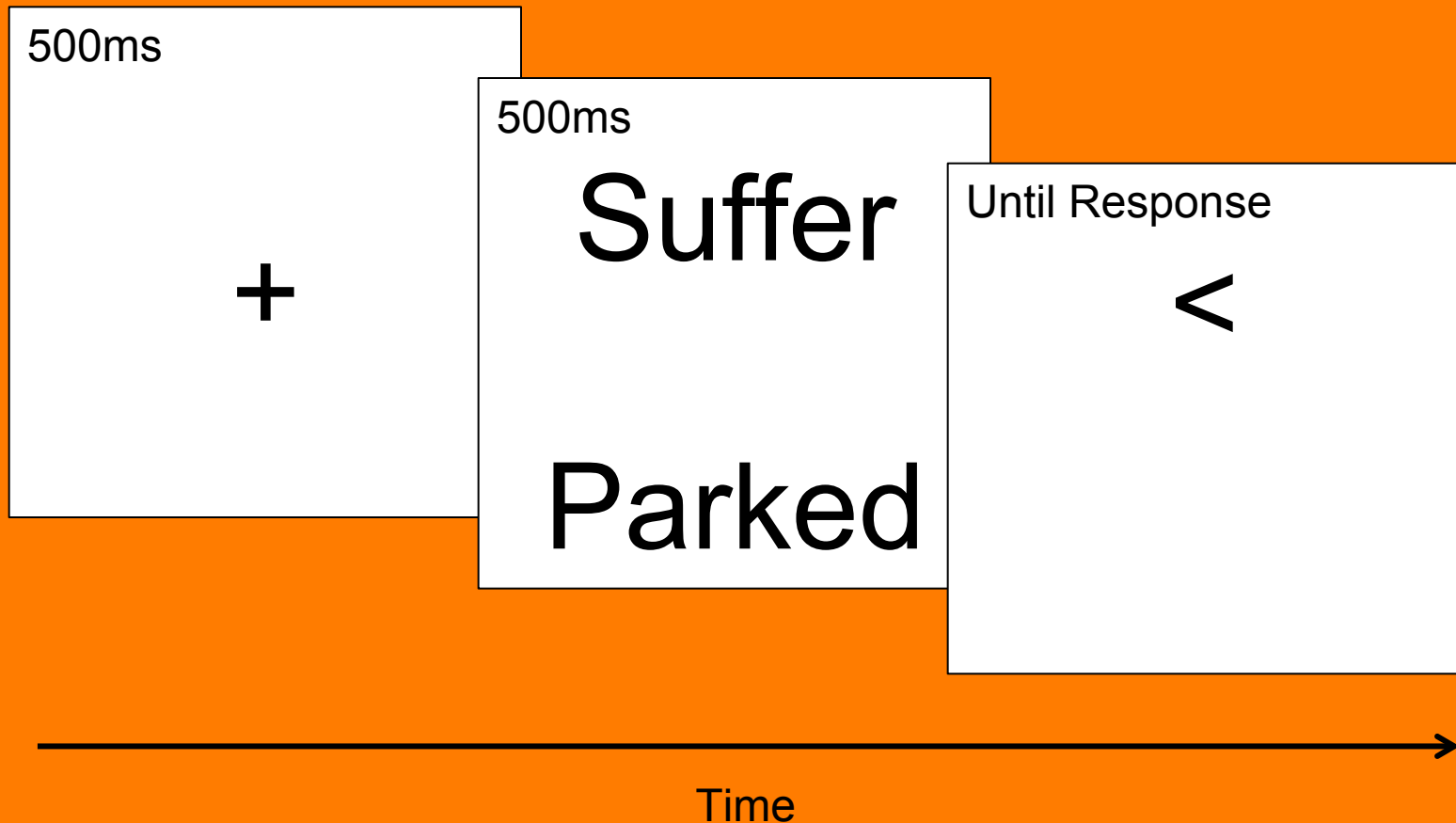
- Emotional Stroop task



Time →

Introduction

- Dot probe task (MacLeod et al., 1986)



Introduction

- Evidence of attentional bias has been documented among clinical (Buckley et al., 2000) and non-clinical populations (Mogg et al., 2000).
- The emotional Stroop task and the dot probe task could be applied to statistics anxiety to further understanding of this construct.

Buckley, T. C., Blanchard, E. B., & Neill, W. T. (2000). Information processing and PTSD: A review of the empirical literature. *Clinical Psychology Review, 20*(8), 1041–1065. doi:10.1016/S0272-7358(99)00030-6

Mogg, K., Bradley, B. P., Dixon, C., Fisher, S., Twelftree, H., & McWilliams, A. (2000). Trait anxiety, defensiveness and selective processing of threat: An investigation using two measures of attentional bias. *Personality and Individual Differences, 28*(6), 1063–1077. doi:10.1016/S0191-8869(99)00157-9

Introduction

- Participants with higher statistics anxiety will be slower to name the color of a threatening item on the emotional Stroop task than their low-anxious counterparts (Hypothesis 1).
- Participants with higher statistics anxiety will be faster in responding to a probe stimulus that replaces a threatening item on the dot probe task than their low-anxious counterparts (Hypothesis 2).

Methodology

- Participants consisted of 76 (73.7% females) students in the James Cook University Psychology programs at the Australia (35.5%) and Singapore campuses (64.5%). Their ages ranged from 18 to 50 years ($M = 24.05$, $SD = 7.65$).

Methodology

- 36 pairs of words and 12 pairs of symbols were used as stimuli
- Examples:

Threat	Neutral
Statistics	Furniture
Error	Brief
\bar{y}	%
σ	*

Methodology

- Tasks
 - Emotional Stroop task
 - Dot probe task
- Instruments
 - Statistical Anxiety Rating Scale (Cruise et al., 1985)
 - Marlowe-Crowne Social Desirability Scale (Crowne & Marlowe, 1960)
- All instruments and tasks were counterbalanced to control for order effects.

Results

- A median split was used to classify participants into the Low Anxiety group and the High Anxiety group for the three factors of statistics anxiety (Cruise et al., 1985).

Results

- Threat bias index (TBI) scores were also calculated.
 - Emotional Stroop task = mean RT for threatening stimuli – mean RT for neutral stimuli.
 - Dot probe task = mean RT for incongruent trials (probe replaces neutral) - mean RT for congruent trials (probe replaces threat).

Results

- A series of ANOVAs indicated no significant effects for all three factors of statistics anxiety on the TBI for words and symbols on both tasks.

Discussion

- The results provided no support for both hypotheses. No evidence of attentional bias in statistics anxiety was found for the emotional Stroop task and the dot probe task.

Discussion

- The absence of attentional bias is likely due to three methodological reasons.

Discussion

- First, statistics words and symbols might not be relevant to statistics anxiety. More relevant stimuli should be used by considering each factor of statistics anxiety individually. For instance, examination-related threat words (e.g., stupidity, disgraced) (MacLeod & Rutherford, 1992) might be more relevant for Test and Class Anxiety

Discussion

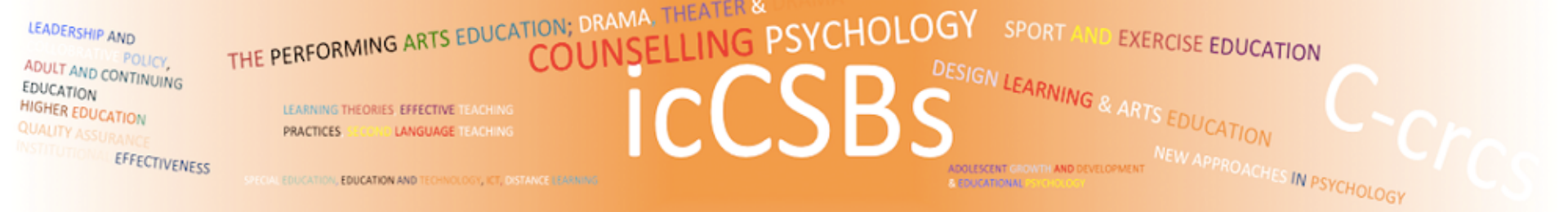
- Second, attentional bias might be suppressed if participants expect a threatening event (Helfinstein et al., 2008). Since most of the participants in the current study were enrolled in a statistics course (86.8%), attentional bias might be suppressed because they expect to encounter statistics (e.g., lectures, homework, or test) in the near future.

Discussion

- Third, conducting the study online might have affected the results. Anecdotal evidence suggests that participants are less motivated and focused in online studies. Indeed, the current study had a high percentage of errors and outliers (8.1%), and large standard deviations (up to 195.92 SD) compared to other studies (e.g., only 3% errors/outliers, and up to 110 SD in Egloff & Hock, 2003).

Discussion

- Future research could
 - Use more relevant stimuli
 - Recruit as participants, students who have completed at least one statistics course but were not currently enrolled in a statistics course, to avoid the suppression effect
 - Conduct the study in a laboratory



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