

BIAL Fellowship Programme 68/04

The Emotional Stroop effect: Cognitive, emotional, and physiological aspects.

Dr. Isabelle Blanchette, University of Manchester

Dr. Anne Richards, Birkbeck College, University of London

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The Manchester Studies

In Manchester, the data collection for the second experiment was completed several months prior to the completion of the London studies due to the earlier commencement of this half of the project. All the data have been collected and the physiological data has been processed. The first study found that facial EMG movements of the corrugator supercillii were directly related to the amplitude of the interference of negative words on the Stroop task. The same interference was not predicted by the explicit affective ratings of the words by participants. Thus, implicit emotional reactions were a better predictor of Stroop interference than explicit affective evaluations. The second experiment uses the same paradigm, but with a subliminal presentation of the Stroop words. Thus, we are further exploring the implicit aspects of this effect. It appears that we have replicated the emotional Stroop effect with the subliminal presentation. Even if participants cannot read the words (the words are presented for 17 ms), participants take longer to name the colour of surroundings masks when the word is emotional than when it is neutral. Furthermore, activity of the corrugator supercillii (frown muscle) is again related to the extent of interference in the Stroop task. On trials with greater corrugator activity, participants display longer RTs to name the colour of negative words. The awareness checks built into the procedure at the end show that the presentation was truly subliminal and that participants were not aware of the nature of the stimuli presented between the masks. Thus, results largely confirmed our hypotheses.

Anastasia Lavda, the RA in Manchester, has now finished her contract. Her contract ended on the 27th of March. This was just enough time to complete all the tasks that she was responsible for. She has completed data collection and data processing for the two experiments that were planned for Manchester.

The London Studies

The project began in London in 2005, with Victoria Hamilton being appointed as an RA for 14 months. Ms Hamilton's was employed for two days per week, and her contract started on 17th October, 2005 and ended on 16th December, 2006. The research progressed very smoothly, and data collection went to plan. The first experiment was completed in April and the second experiment commenced at the end of April. Ms Hamilton concentrated her efforts on participant recruitment and data collection for the second experiment, and Dr Richards began the collation and integration of the electrophysiological and behavioural data. Data collection was completed in December 2006, and the full analysis of the electrophysiological and behavioural data is now complete. A total of 130 participants completed the experiments in London.

In the two London-based experiments, we successfully manipulated the emotional connotations of neutral non-words by using our simple associative conditioning paradigm. The first experiment found the predicted anxiety-related emotional Stroop interference, and the size of this interference was related to state anxiety. The difference in the SCR data for negatively and neutrally conditioned Stroop stimuli was also related to state anxiety, but neither the affective ratings nor SCR responses predicted the size of the Stroop interference effect. The second experiment failed to show an emotional Stroop effect, but the electrodermal activity and affective ratings showed sensitivity to the emotional connotations of the non-words.

When the mode of conditioning matches the mode of Stroop presentation, i.e., when they are both presented in unmasked format, the predicted pattern of RTs are evident. However, when there is a mismatch, i.e., when the non-words are presented in masked format during the conditioning phase, but presented in masked format for the Stroop phase, the predicted pattern of RTs is not observed. However, electrodermal activity appears to be sensitive to the emotional connotations created during conditioning, even when there is a mismatch between the conditioning task and the Stroop task, and therefore such an indirect measure may be useful for future research. It is interesting that there was only electrodermal sensitivity in low-trait participants when these individuals showed some awareness of the masked stimuli. However, the high-trait participants showed sensitivity to the emotional significance of the masked Stroop non-words irrespective of their awareness level, despite not showing any Stroop RT differences, and not giving lower affective ratings to the negatively conditioned stimuli. The finding that all participants gave the negatively conditioned non-words lower affective ratings compared to neutrally-conditioned non-words when they were rated in unmasked format, but

not masked format, suggests that the conditioning was successful. These ratings may be the result of some indirect access to a memory of the earlier picture/non-word pairing, although there was no evidence from the picture/non-word pairing task that individuals had conscious access to this information.

The data from these experiments suggest that there are complex dissociations between the various implicit and explicit components of emotional processing. The combination of electrophysiological and behavioural measures provides a fruitful way of disentangling these interactions between emotional and attentional processing.

Dissemination of Findings

Dr Richards attended the BIAL conference in Portugal in March 2006 with an Abstract summarising the project to date. Ms Lavda presented a poster at the British Psychological Society in September 2006. A paper has been accepted as a poster presentation to the Cognitive Science Conference in Delphi in 2007. This will result in a conference paper and a published paper in the Proceedings.

We are in the process of writing up two empirical papers from the project for submission to international journals. Dr Blanchette is currently on maternity leave, and this will result in a short delay in the submission of the papers.

Publications

Lavda, A., Blanchette, I., Richards, A. & Hamilton, V. Facial expressions are better predictors of the Stroop interference than explicit emotional ratings. Poster, BPS, September, 2006.

Richards, A., & Blanchette, I. The emotional Stroop effect: Cognitive, emotional and physiological aspects. Abstract, *BIAL Foundation, 6th Symposium*. 29th March - 1st April, 2006.

Richards, A., Blanchette, I., Hamilton, V., & Lavda, A. Cognitive, Emotional and Physiological Components of Emotional Stroop using Associative Conditioning. Paper accepted by the *European Cognitive Science Conference*, Delphi, Greece, May 23-27, 2007

Richards, A., Blanchette, I., Hamilton, V., & Lavda, A. Implicit and explicit aspects of conscious and nonconscious emotional processing. Manuscript in preparation.