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Adjustment during Reintegration following Deployment**

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14. ABSTRACT The overarching goal of the grant is to develop valid and reliable computerized tools to measure and modify anger-related cognitive biases and ultimately to examine their efficiency in reducing anger and adjustment difficulties among soldiers. The first aim of the research, addressed in Study 1, was to measure the associations between state and trait anger and biases in anger-related attention and interpretation. This aim was addressed in study 1 (reported in the previous annual report). During the past year analysis of data from study 1 has been expanded by applying a theoretically-driven indirect analysis, which revealed evidence for a sequential indirect effect of attention bias on anger-related measures, via anger-related interpretation and response biases. A scientific paper based on these findings has been submitted for publication and is currently under review. In the past year study 6 of the grant has been performed - 80 participants with high trait anger scores have participated in the study at TAU. A mirror study via collaboration with Bristol University is running the same protocol as the one we ran at TAU, thus could fortify, enhance, and increase generalization of the findings. The Bristol study is not related to the current funding. During the next academic year we plan to conduct study 5 of the grant focusing on attention bias modification trial designed to reduce attention bias toward threat/anger faces.					
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INTRODUCTION

To enhance military performance in combat, soldiers learn to selectively attend to potential threats and to weigh any ambiguous information in the context of potential life-threatening danger. The development of such cognitive biases is expected to enhance soldiers' life preserving actions that among others include the use of combat-related aggressive action. Although the tendency to promptly and aggressively respond to potential threats in combat is crucial for survival, it may prove maladaptive in non-combat environments. Since deployed soldiers confront dramatic changes in environmental threat conditions, ranging from safety to acute danger, considerable plasticity in threat-related attention and threat interpretation is required. Insufficient plasticity in threat processing may confer risk for military performance and psychological adjustment both in theatre and upon reintegration back to civilian environments. The overarching goal of the current grant is to develop valid and reliable computerized tools to measure and modify anger-related cognitive biases and ultimately to examine their efficiency in reducing anger and adjustment difficulties among soldiers. This goal is perused through unique research collaboration between WRAIR and Tel Aviv University offering a combination of experts in advanced psychological research in military context and in translational cognitive-neuroscience research.

BODY

Study materials preparation

We completed development of all the relevant materials for study 6 which was run during the past year, as well as for study 5 which is planned to be run during this academic year.

Preparations included programming computerized tasks, adjusting the tasks and stimuli to the specific requirements of the current study, installing the tasks on lab computers, and quality-control for all the computerized elements of the study. We also prepared all the necessary written materials, such as consent forms and self-report questionnaires and obtained IRB approval.

Staff recruitment and training

We recruited research assistances for the study and trained them on all the aspects of running the experiment and recoding the data from the self-report questionnaires. We also trained the RAs on all aspects related to contact with potential participants and scheduling the experimental sessions.

Recruitment of participants and data collection

In the past year we conducted Study 6, which was also run at the same time by our collaborators in the University of Bristol, who used similar methods to modify interpretation biases (Penton-Voak et al., 2013). As proposed, we hope to determine: a) whether this cognitive bias modification is effective in reducing interpretation biases and anger levels; and b) which of the two quite similar protocols (TAU vs. Bristol) is more effective in reducing anger and anger susceptibility. Data collection at TAU has been completed (80 participants have completed the study as expected). Data collection in Bristol University is still ongoing (39 participants have participated with the goal set to 80).

Data recording and preparation:

All the data obtained from study 6 was coded and has been prepared for analysis.

Data analysis:

During the past year we have expanded the analyses of data from study 1, adding a sequential indirect effects model analysis (Hayes, 2013), based on a theoretical framework of the classic modal model of emotion regulation (Gross & Barrett, 2011; Gross & Thompson, 2007). The new analysis added to the findings regarding simple correlations between cognitive biases and anger-related measures (described in the previous annual report), and revealed evidence for an indirect effect of attention bias on anger-related measures, via anger-related interpretation, and response

biases. A scientific paper reporting these findings was written and submitted for publication, and it is currently under review (the manuscript's abstract is attached in appendix 1). Partial results from Study 5 (the TAU data only) were reported in the last MOMRP Resilience IPR (August 2014), suggesting high efficiency of both the TAU and Bristol interpretation bias modification programs in changing the cognitive bias and some evidence that the TAU program was efficient in reducing aggressive retaliation. Full analysis must await completion of data collection in Bristol.

Preparation for the next study:

The next study being prepared for running during the current academic year relies on the significant results concerning attention bias emanating from Study 1. This is study number 5 of the original grant. As proposed, this study includes an attention-bias modification procedure for participants with high levels of self-reported trait anger. We have added a few additional measurement tasks to the pre-training and post-training sessions, to improve our ability to detect effects of training on behavioral, cognitive, and physiological measures related to anger (in addition to self-reported measures). The new measures were all approved for use in this study by TAU's ethics committee. Materials were prepared and data collection is expected to start shortly. We will request that some of the extant funding will be used to purchase the psychophysiology equipment (Skin Conductance Response, Heart Rate).

Problem areas

No real problems were encountered in conducting the study.

Future plans

We plan to complete study 5 during this academic year, targeting anger-related attention biases.

KEY RESEARCH ACCOMPLISHMENTS

- Materials preparation for study 5.
- Staff recruitment and training for study 5.
- Data collection from 80 undergraduate students from Tel-Aviv University who participated in study 6 (+35 participants from Bristol University).
- All TAU data from study 6 has been coded.
- Additional indirect effects analysis on data from study 1.
- Completing the writing of a scientific paper based on the findings from Study 1.

REPORTABLE OUTCOME

The key findings from study 1 suggest significant associations between attention bias toward angry faces in the dot probe task and self-reported anger and aggression measures, as well as between attention bias toward angry faces and the tendency to judge more faces as angry rather than happy in the emotion detection task (interpretation bias). In addition, a significant positive correlation was found between self-reported anger and aggression measures and the tendency to judge faces as angry faster than as happy faces in the emotion detection task (response bias). Additional analyses revealed a sequential indirect effect of attention bias on anger-related indices via interpretation and, in turn, response biases. These findings are in line with models of social information processing and emotion generation and regulation, and with the view of anger as related to approach motivation.

These results indicate that the main thrust of the grant is now grounded in evidence of significant associations between low-level cognition measured via implicit performance on computerized tasks and self-reported anger and aggression. Additionally, it suggests evidence to the interplay between attention, interpretation, and response mechanisms in promoting anger and aggression.

CONCLUSION

The findings of the Study1 indicate that faster attention orientation and faster responses to threatening stimuli, as compared to non-threatening stimuli, are associated with greater self-reported anger.

The indirect effect analysis revealed a sequential indirect effect of attention bias on anger that was attributable to variance shared in common with interpretation bias and, in turn, response bias. This finding suggests that threat-related attention bias affects anger indirectly through an attention → interpretation → response bias sequence. Such a sequential array is consistent with theoretical models of social information processing (Crick & Dodge, 1994) and emotion generation and regulation (Gross & Barrett, 2011; Gross & Thompson, 2007). According to these theoretical models, attention (or encoding) is the initial phase in the processing of social or emotional information, followed by interpretation (or appraisal) processes, which are in turn followed by a response.

In conclusion, this study revealed both direct and indirect associations between distinct cognitive processes and anger. The elucidation of a potential sequential effect suggesting that attention, interpretation, and response processes may work in concert to promote anger and aggression provides a novel framework for the development of intervention protocols.

REFERENCES

- Crick, N. R., & Dodge, K. A. (1994). A review and reformulation of social information-processing mechanisms in children's social-adjustment. *Psychological Bulletin*, *115*(1), 74-101. doi: 10.1037/0033-2909.115.1.74
- Gross, J. J., & Barrett, L. F. (2011). Emotion generation and emotion regulation: One or two depends on your point of view. *Emotion review*, *3*(1), 8-16.
- Gross, J. J., & Thompson, R. A. (2007). Emotion regulation: Conceptual foundations. *Handbook of emotion regulation*, *3*, 24.
- Hayes, A. (2013). Introduction to mediation, moderation, and conditional process analysis: a regression-based approach (Guilford, New York).
- Penton-Voak, I. S., Thomas, J., Gage, S. H., McMurrin, M., McDonald, S., & Munafò, M. R. (2013). Increasing recognition of happiness in ambiguous facial expressions reduces anger and aggressive behavior. *Psychological Science*, 0956797612459657.

Appendix 1

Anger-related cognitive processes underlying trait anger: A modal model framework

Abstract

Previous empirical findings suggest that attention, interpretation and response biases are related to anger, yet the potential interplay between these cognitive mechanisms in relation to anger has been scarcely explored. The current study followed an integrative approach looking at each cognitive process as part of a cognition-emotion chain, based on models of social information processing and emotion generation and regulation. Accordingly, we examined both simple associations between trait-anger and biases in attention, interpretation, and response to facial stimuli, as well as an indirect pathway by which these different biases sequentially contribute to trait-anger. One hundred and one undergraduate students completed an emotion-perception task, a dot-probe task, and questionnaires measuring anger and aggression tendencies. Attention bias toward angry faces in the dot-probe task and response bias in the emotion-perception task (faster responses to faces judged as angry compared to faces judged as happy) were both positively correlated with anger scores. No correlation was found between anger scores and anger interpretation bias. Interpretation bias was however positively correlated with attention and response biases. Analysis of the sequential model revealed an indirect effect of attention bias on anger-related indices via interpretation and, in turn, response biases. These findings are in line with models of social information processing and emotion generation and regulation, and with the view of anger as related to approach motivation. In addition, these findings may have implications for an optimal point of intervention in future cognitive bias modification treatments for anger and aggression.