J. Behav. Ther. & Exp. Psychiat. xxx (2014) 1–8

Contents lists available at ScienceDirect

Journal of Behavior Therapy and Experimental Psychiatry

journal homepage: www.elsevier.com/locate/jbtep

Attention bias modification via single-session dot-probe training: Failures to replicate

Jonas Everaert [a,*], Cristina Mogoaşe [b,c], Daniel David [b,d], Ernst H.W. Koster [a]

[a] Ghent University, Department of Experimental Clinical and Health Psychology, Henri Dunantlaan 2, 9000 Ghent, Belgium
[b] Babeş-Bolyai University, Department of Clinical Psychology and Psychotherapy, Republicii Street 37, 400015 Cluj-Napoca, Cluj, Romania
[c] Iuliu Haţieganu University of Medicine and Pharmacy, Cluj-Napoca, Romania
[d] Mount Sinai School of Medicine, NY, USA

ARTICLE INFO

Article history:
Received 24 April 2014
Received in revised form
28 October 2014
Accepted 28 October 2014
Available online xxx

Keywords:
Dot-probe
Attention training
Transfer
Affective task-switching
Interpretation

ABSTRACT

Background and objectives: Across three experiments we investigated transfer effects of single-session attention bias modification via dot-probe training.
Methods: In experiment 1, participants received training either toward or away from negative images or no-training, and transfer to an affective task-switching task was examined. In two other experiments, participants were trained to orient attention toward either positive or negative words (experiment 2a) or facial expressions (experiment 2b), and transfer to an interpretation bias task was examined.
Results: In all experiments, the dot-probe training procedure did not effectively modify biases in attention allocation at the training condition level, but produced a large variability in individual attention bias acquisition within and across conditions. Individual differences in pre-training attention bias and attention bias acquisition were not related to performance on the affective task-switching task or the interpretation tasks.
Limitations: The present investigations are limited by the lack of effectiveness of ABM at the condition level, the order in which transfer tasks were administered, and the restricted range of affective symptoms that could moderate training and transfer effects.
Conclusions: The findings from three experiments provided no evidence for single-session dot-probe ABM procedures to effectively manipulate attention bias toward negative, away from negative, or toward positive stimuli at a training condition level. At the individual differences level of analysis, again no evidence was found for transfer of attention training. The observations invite further empirical scrutiny into factors that moderate attentional plasticity in response to dot-probe ABM procedures to optimize the conditions for effective implementation and transfer of training.

1. Introduction

Emotional biases in attention are related to psychological well-being: Healthy individuals pay more attention to positive material, whereas anxious and depressed individuals predominantly attend to threatening or sad material (Peckham, McHugh, & Otto, 2010; Van Bockstaele et al., 2014). These attention biases operate at several stages in the pathogenesis of affective disorders (e.g., at subclinical or remission stages), affect an individual's response to emotionally distressing situations, and predict the course of affective symptoms over time (Cisler, Bacon, & Williams, 2009; De Raedt & Koster, 2010). Hence, attention biases seem causally involved in one's emotional state. To address its causal status, experimental procedures have been developed to manipulate emotional biases in attention allocation (Koster, Fox, & MacLeod, 2009).

A commonly-used procedure to manipulate attention bias is based on the emotional dot-probe task, originally designed to measure selective attention toward disorder-related material (MacLeod, Mathews, & Tata, 1986). A standard task design simultaneously presents two stimuli (e.g., one disorder-related, one

* Corresponding author. Tel.: +32 09 264 94 42; fax: +32 09 264 64 89.
E-mail addresses: jonas.everaert@ugent.be (J. Everaert), cristina.mogoase@ubbcluj.ro (C. Mogoaşe), daniel.david@ubbcluj.ro (D. David), ernst.koster@UGent.be (E.H.W. Koster).

http://dx.doi.org/10.1016/j.jbtep.2014.10.011

neutral) for a brief duration (e.g., 500 ms) at either side of fixation. After offset, a probe (e.g., an E or F) appears with equal probability at the location of one of the stimuli. Participants are instructed to identify the probe as quickly and accurately as possible by pressing the corresponding button. Negative biases in attention are inferred from faster RTs on trials with probes replacing disorder-related stimuli (i.e., congruent trials) compared to trials with probes replacing neutral stimuli (i.e. incongruent trials). By varying the contingency between the disorder-related stimuli and the probe's location, the standard design can be adapted to induce or reduce emotional biases in attention. Using such an adapted version of the task, MacLeod and colleagues were able to induce a negative bias by consistently presenting the probe at the location of the disorder-related stimulus and, analogously, to reduce a negative bias by presenting the probe at the opposite location (MacLeod, Rutherford, Campbell, Ebsworthy, & Holker, 2002; Mathews & MacLeod, 2005). Interestingly, they found that induction compared to reduction of a negative attention bias increased stress reactivity.

Building on these initial observations, numerous studies investigated the causal relation between attention bias and symptoms of emotional disorders, including studies examining whether ABM reduces symptoms of anxiety and depression. Effect sizes of attention training on affective symptoms vary strongly across meta-analyses. An early report estimated the effect size of ABM on anxiety in the medium range in nonclinical or subclinical samples, and in the medium-to-large range in clinical samples (Hakamata et al., 2010). Later reports, including a larger number of studies, found only small effect sizes of ABM training in modifying anxiety and emotional reactivity (Beard, Sawyer, & Hofmann, 2012; Hallion & Ruscio, 2011; Mogoase, David, & Koster, 2014). For depression, meta-analytic evidence suggests no effects of ABM on depressive symptomatology, but note that there is little research testing ABM in depressed samples (see Mogoase et al., 2014). While several recent ABM studies did not produce clinically significant changes (Boettcher, Andersson, Carlbring, & Group, 2013; Carlbring et al., 2012; Julian, Beard, Schmidt, Powers, & Smits, 2012; Neubauer et al., 2013; Rapee et al., 2013), such failures might be due to failures of ABM to change attentional bias at the *training condition* (group) level (Clarke, Notebaert, & MacLeod, 2014). Yet, there is large variability among trainees in attention bias acquisition following ABM delivery and such *individual differences* may predict anxiety levels (e.g., Clarke, Chen, & Guastella, 2012; Clarke, MacLeod, & Shirazee, 2008). These observations prompt researchers to consider both the training condition and individual differences level of analysis when evaluating dot-probe ABM effects.

Although ABM seems effective in reducing affective symptoms, the processes through which ABM alters these symptoms need clarification. Decreases in attention bias through training are related to reductions in affective symptoms (Mogoase et al., 2014), but this does not explain how changes in attention result in a congruent symptomatic improvement. One process that could account for this is generalization or transfer from the stimuli presented in a controlled experimental training context to non-trained disorder-relevant stimuli and mechanisms closely related to attention that are important to emotional well-being. Transfer effects of dot-probe ABM were investigated by Van Bockstaele, Koster, Verschuere, Crombez, and De Houwer (2012). In their study, participants were trained to attend either toward or away from threatening pictures, but training effects did not generalize to an emotional interference task measuring processes related to attention. These findings contradict earlier observations suggesting that dot-probe training effects generalize to a spatial cueing task, that is, conditions resembling the initial training task (Amir et al., 2009; Amir, Weber, Beard, Bomyea, & Taylor, 2008; Heeren, Lievens, & Philippot, 2011). Moreover, there is some evidence for transfer of ABM to memory. A study reported that participants with elevated depressive symptom severity levels trained to orient away from negative words did not show a negative recollection bias which was observed in control individuals (Blaut, Paulewicz, Szastok, Prochwicz, & Koster, 2013). In sum, research indicates that dot-probe training effects transfer to new, non-trained stimuli under similar conditions, but provides mixed evidence regarding transfer to other critical processes. The limited insight into the stimuli and processes to which ABM effects transfer warrant further empirical scrutiny.

This paper presents three experiments to investigate transfer of single-session dot-probe training. In experiment 1, we studied transfer of attention training toward and away from negative material to non-trained stimuli in an affective task-switching task. This task measures the ability to flexibly switch between affective and non-affective processing task-sets, which is a process predictive of trait resilience (Genet & Siemer, 2011). In experiment 2a and 2b, we examined transfer of training toward positive and negative material to trained and non-trained stimuli in an interpretation task requiring individuals to evaluate positive and negative self-relevant meanings. Interpretation bias, a risk factor to various emotional disorders (Mathews & MacLeod, 2005), depends on emotional biases in attention and regulates emotional memory (Everaert, Duyck, & Koster, 2014; Everaert, Tierens, Uzieblo, & Koster, 2013). In keeping with recent ABM research, we investigated effects of training on attention bias and transfer tasks at the condition as well as at the individual differences level. We expected that trained attention biases modulate the flexibility of switching between emotional and non-emotional features of non-trained stimuli and alter interpretation of emotional information.

2. Experiment 1

2.1. Methods

2.1.1. Design overview

After the pre-training attention bias assessment, participants were randomly assigned to either a condition in which attention was trained away from negative stimuli (i.e., 'neutral training'), toward negative stimuli (i.e., 'negative training'), or the no-training control. Then, participants completed a post-training bias assessment and the affective switching task. The experiment ended with the questionnaires. The study protocol was approved by the ethical committee at Ghent University.

2.1.2. Participants

Undergraduate students completed either the neutral ($n = 26$), negative ($n = 23$), or no-training ($n = 25$) condition. All participants provided informed consent and were compensated a course credit or 8 euro.

2.1.3. Tasks and measures

2.1.3.1. Attention training. ABM consisted of a dot-probe procedure modeled after Amir et al. (2008) and Van Bockstaele et al. (2011). On each trial, a 500 ms fixation was followed by of the presentation of two pictures (3.82° height by 5.06 width) above and below fixation for 500 ms. There was a 3.8° angle between fixation and the picture's center. After offset, a probe (E or F) replaced one picture and participants identified the probe as fast and accurately as possible by pressing the corresponding button. The next trial started 500 ms after a response was registered. Participants were seated approximately 60 cm from the monitor.

Please cite this article in press as: Everaert, J., et al., Attention bias modification via single-session dot-probe training: Failures to replicate, *Journal of Behavior Therapy and Experimental Psychiatry* (2014), http://dx.doi.org/10.1016/j.jbtep.2014.10.011