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Working mechanisms of a general positivity approach-avoidance training: Effects on action tendencies as well as on subjective and physiological stress responses

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ABSTRACT

Background and Objectives: The general positivity training, a Cognitive Bias Modification procedure modifying individuals' approach-avoidance tendencies to positively and negatively valenced pictures by means of a joystick task, has been proven effective in attenuating stress reactivity in dysphoric students. The present study explored which training component (pull positive pictures, push negative pictures, or both) is the active one in changing action tendencies and stress responses.

Methods: Two-hundred-and-thirteen students completed one of four approach-avoidance trainings before being exposed to a stressful speech-task: The general positivity training (pull positive and push negative pictures), a training to approach positive pictures and avoid empty pictures (ApP), a training to avoid negative pictures and approach empty pictures (AvN), or a sham-training.

Results: The pattern of results suggests that the groups trained to avoid negative pictures showed a stronger increase in positive approach-avoidance tendencies than the other two groups. However, only the positivity training induced significant within-group changes in positive bias. The groups further did not differ in self-report or cardiovascular measures of anxiety in response to the stress-task. Instead, the training affected mood directly: Exposure to negative pictures during the training increased state anxiety.

Limitations: Generalizability of the findings is limited by using an unselected student sample. Also, the use of empty pictures as neutral stimuli in the ApP and AvN could have weakened training effects in these groups.

Conclusions: Although our results hint at the importance of avoiding negative pictures for modifying an approach-avoidance bias, only the positivity training with both components may effectively induce a positive bias. Remarkably, we failed to replicate and extend previously reported effects of the training on stress-responses. Hence, it remains questionable whether the changes in bias reflect changes in underlying cognitive processing tendencies or task-specific learning effects.

In emotional disorders, Cognitive Bias Modification trainings (CBM; MacLeod & Mathews, 2012) have mainly targeted negative attentional biases (Attentional Bias Modification) and interpretation biases (CBM-I; for reviews see, Cristea, Kok, & Cuijpers, 2015; Hallion & Ruscio, 2011). A CBM paradigm which has received less attention so far, is the Approach-Avoidance Task (AAT; Rinck & Becker, 2007). The AAT has been developed based on the assumption that positively evaluated stimuli automatically elicit approach motivation and behavior, whereas negative stimuli trigger motivational and behavioral avoidance (Rinck & Becker, 2007). With the AAT, such automatic behavioral tendencies can be assessed: During the task, participants push and pull positive and negative pictures with a joystick. Depending on the joystick movement, the pictures increase or decrease in size, creating the impression that they are actually being approached or avoided. In line with approach-avoidance models (e.g., Elliot, 2006; Lang, Bradley, & Cuthbert, 1990) and early studies using comparable paradigms (Chen & Bargh, 1999; Solarz, 1960), research shows that participants respond faster when the stimulus-response assignment is compatible (e.g., positive pull/approach), than when it is incompatible (e.g., positive push/avoid). Interestingly, the AAT can also be used for training purposes, by establishing a contingency between stimulus valence and required responses. So far, the AAT has mostly been used for reducing approach tendencies towards drug-related stimuli, by training individuals to always push these stimuli away (e.g., Machulska, Zlomuzica, Rinck, Assion, &

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Margraf, 2016; Wiers, Eberl, Rinck, Becker, & Lindenmeyer, 2011). Several studies provide evidence that such an alcohol-avoidance training successfully reduces relapse rates in patients (Eberl et al., 2014, 2013; Wiers et al., 2011), which is why the AAT has been considered one of the most promising CBM techniques so far (Cristea et al., 2015). Favorable effects were, however, also found when the approach of smiling faces was trained in socially anxious samples (Rinck et al., 2013; Taylor & Amir, 2012).

Training automatic behavioral tendencies could also be relevant for depression, where the natural desire to approach positive and avoid negative outcomes is disturbed (Trew, 2011). Depressed individuals show difficulties in the disengagement from negative information, which in turn has been associated with a prolonged processing of negative information and negative mood maintenance (Sanchez, Vazquez, Marker, LeMoult, & Joormann, 2013). At the same time, depression is characterized by cognitive and behavioral avoidance and by lower reward sensitivity, associated with less approach of rewarding cues (Trew, 2011). Indeed, a first study showed that in an AAT, sad individuals with heightened depressive symptomatology tend to avoid happy faces more than angry and sad ones (Vrijsen, Van Oostrom, Speckens, Becker, & Rinck, 2013). Both approach deficit and avoidance motivation are assumed to be associated with limiting positive experiences and reinforcement of non-depressed behavior, contributing to the development and maintenance of depression (Trew, 2011). Consequently, it has been argued that depressed individuals should benefit from a training that is specifically designed to promote the approach of positive and the avoidance of negative information (Becker et al., 2016; Trew, 2011).

Based on these considerations, Becker et al. (2016) developed the so-called *General Positivity AAT-Training*, where participants repeatedly have to pull a broad range of positive pictures closer and to push a broad range of negative pictures away. In a first proof-of-principle study, the authors compared this positivity training to the opposite negative training (pull negative, push positive). Results showed that the negative training could reverse an initial positive bias (faster approach of positive pictures, faster avoidance of negative ones) into a negative bias in healthy individuals, and that training effects transferred to an attentional bias. A second experiment showed that a pre-existing positive bias could also be increased by the positivity training in both healthy and dysphoric students. Although the training did not have immediate effects on mood, it reduced stress responses in the dysphoric group, suggesting that such a general form of positive AAT-training may be of therapeutic value.

Despite these promising findings, little is known about how and why this training procedure actually works. Participants both approach positive pictures and avoid negative pictures, therefore it remains to be established which training component (i.e., pull positive pictures or push negative pictures) is the effective one when it comes to increasing a positive bias and attenuating stress. This is especially important when considering the goal of using such a training in clinical settings. After all, it is unclear whether the use of negative stimuli has favorable effects by inducing habituation to the repeatedly encountered negative pictures, or if it might even have adverse effects on participants by increasing responsiveness to negatively valenced cues. If both components are effective independently of each other, one could consider the application of a single-component training (pull positive pictures only) in clinical practice. Hence, our primary aim was to investigate whether a single component (pull positive pictures *or* push negative pictures), or rather the combination of both components (pull positive *and* push negative pictures), is responsible for the observed training effects.

To answer this question, participants of the current study completed one of four AAT training versions. One group received the original positivity training (Positive-Negative group; PN) in which positive pictures were approached and negative ones avoided. A second group received a sham-training in which positive and negative pictures were approached and avoided equally often (control group; CT). A third group never saw any negative pictures; they were trained to approach positive pictures and avoid empty (monochrome) pictures (Approach-Positive group; ApP). The fourth group never saw any positive pictures; they were trained to avoid negative pictures and approach empty ones (Avoid-Negative group; AvN).

Becker et al. (2016) assumed that the training increases a positive bias and reduces emotional vulnerability to stress because *both* the approach deficit of positive information and the heightened processing of negative information are targeted. Indeed, one may argue that a training with both components should be more effective than a single-component training, assuming an additive effect of the two training components. However, the existing literature provides no evidence for such additive effects, neither is there any evidence pointing to an equal or potentially stronger effect of a training with only one of the two components. Hence, the nature of this study was explorative, and we systematically investigated all possible predictions that could be derived from the findings of Becker et al. More precisely, the following alternative hypotheses regarding the induction of a positive bias were tested:

(1) Training with the positive and the negative component (PN) is more effective than all other trainings (ApP, AvN, CT).
(2) Both trainings with the positive component (PN and ApP) are more effective than training with the negative component only (AvN) and CT training.
(3) Both trainings with the negative component (PN and AvN) are more effective than training with the positive component only (ApP) and CT training.
(4) Finally, training with at least one of the components (PN, ApP and AvN) is more effective than the CT.

Our second aim was to investigate which of the components was responsible for the stress-reducing training effects found by Becker et al. (2016). In the previous study, the attenuating effects on stress responses only appeared in dysphoric students, but not in non-dysphoric students. Therefore, it was suggested that the used stressor (an anagram-task) might have been too weak to elicit varying stress responses in non-dysphoric students, which is why, we made use of a potentially more stress-inducing task, consisting of an adapted version of an impromptu speech task (Amir, Weber, Beard, Bomyea, & Taylor, 2008). Participants' self-reported anxiety was assessed in anticipation of and in response to this stressor. Additionally, as a more objective measure of stress reactivity, cardiovascular indices including heart rate, heart rate variability, and systolic and diastolic blood pressure were recorded during the entire stress-task. In line with Becker et al. (2016) and earlier research showing that training-induced changes in bias mediate stress responses (See, MacLeod, & Bridle, 2009; Taylor, Bomyea, & Amir, 2011), we expected that the group(s) showing a stronger increase in positive bias would also report less anxiety in anticipation of and in response to the stressor. The same pattern of results was expected for the physiological measurements.

1. Methods

1.1. Participants

We randomly assigned 213 male (n = 41) and female (n = 172) students of Radboud University Nijmegen (the Netherlands), to one of the four training groups. One participant was excluded from the analyses due to 50% error rates on the AAT pre-assessment. The remaining sample showed a mean error rate of 7.3%. The four groups did not differ on demographic variables or baseline questionnaires (see Table 1). In the analyses described below, the critical effects involve either the interaction of a 4-level between-subjects factor (4 groups) with a 2-level within-subjects factor (pre-post), or the main effect of the 4-level between-subjects factor. For medium-sized effects of these kinds