The Role of Awareness in Approach and Avoidance Training Effects:  
Evaluative Change is influenced by Awareness of Stimulus-Action Contingencies

Introduction

Actions of approach and avoidance (AA) are closely linked to the evaluation of a stimulus as good or bad. In AA training research, the spontaneous tendency to either approach or avoid a specific stimulus is re-trained by repeatedly performing incompatible AA behavior in response to this stimulus (see Kawakami et al., 2007). *Explain.* Typically, AA training causes changes in the spontaneous evaluation of well-known stimuli (e.g., well-known social groups, alcohol-related stimuli, spiders, …).

Recently, researchers have considered whether AA training procedures can also be used to establish evaluations of novel stimuli (e.g., Woud et al., 2008). A growing number of studies have provided evidence that AA training impacts implicit (e.g., Woud et al., 2013) and explicit evaluations (e.g., Huijding et al., 2011; Laham et al., 2013) of novel stimuli. However, not all attempts to find effects of AA training have been successful, suggesting that these effects depend on subtle boundary conditions (Vandenbosch & De Houwer, 2011).

The aim of the present study was to investigate the role of contingency awareness in AA training effects. *Explain.* The importance of contingency awareness in studies examining the acquisition of preferences via conditioning procedures has attracted much attention (e.g., EC research). *Explain.* Though there is still debate about the necessity of the awareness of CS-US contingencies in EC effects, there is general consensus that contingency awareness is the most significant moderator of EC effects (Hofmann, De Houwer, Perugini, Baeyens, & Crombez, 2010). *Explain.*

In congruence with EC research, in AA training studies an evaluative transfer results from repeatedly pairing a valenced factor (i.e., a valenced action) with a stimulus. However, in AA training the evaluative learning encompasses an action-stimulus link and thus involves the actual execution of the approach or avoidance action. Traditional accounts of AA training effects have typically stressed the importance of action execution and attributed these effects to automatic processing in an impulsive, associative system (e.g., Phills et al., 2011). *Explain.*   
Consequently, factors that indicate the involvement of different processes (e.g., propositional processes), have received little or no attention in AA training research. *Explain.*

We propose that contingency awareness is a key factor in establishing AA training effects. Several recent findings have provided (indirect) evidence for this:  
(1) AA training procedures that allow participants to become aware of the action-stimulus contingencies produce more robust AA training effects (e.g., action framing: Laham et al., 2013; symbolic exemplar-based AA training: Woud et al., 2014). *Explain.*(2) Typical AA training effects occur even when participants do not perform these actions but are merely instructed about the stimulus–action contingencies (Van Dessel et al., in press). *Explain.*

In the present study we investigated effects of AA training on evaluations of novel faces. We adapted the exemplar-based AA training paradigm used by Woud and colleagues (2008) and Vandenbosch and De Houwer (2011) in such a way that the acquisition of knowledge about stimulus-action contingencies would be facilitated. *Explain.* To examine the importance of contingency awareness in AA training effects we (1) measured participants’ memory for the face-action contingencies and (2) manipulated participants’ knowledge of the contingencies by providing one group of participants with contingency information, whereas the other group received no information about the face-action contingencies.

**Experiment 1**

*Method*

*Results:*

* Explicit ratings: (1) AA training caused changes in explicit evaluations of novel faces.   
  (2) This AA training effect was not moderated by the contingency information factor (i.e., whether or not participants received information about the stimulus-action contingencies). (3) Contingency memory had a significant influence on effects of AA training. AA training effects were only observed for stimuli that participants had indicated the correct action for. The AA effect was reversed if participants had indicated an incorrect action.
* Evaluative priming: (1) AA training caused changes in implicit evaluations of novel faces. (2) This AA training effect was not moderated by the contingency instruction factor.   
  (3) Contingency memory had a significant influence on effects of AA training. AA training effects were only observed for stimuli that participants had indicated the correct action for. The AA effect was reversed if participants had indicated an incorrect action (only for participants who had received contingency information).

*Intermediate Discussion:*

* Experiment 1 revealed that AA training causes changes in both implicit and explicit evaluations of novel faces. Results suggested that contingency awareness is an important moderator of AA training effects. *Explain.*
* We found no evidence that our manipulation of contingency awareness, which involved providing participants with information about the contingencies, influenced AA training effects. However, participants who did not receive contingency information were already good at identifying face-action contingencies. Though contingency memory was (slightly) better for participants who received the contingency information, the power for detecting an added effect on evaluation in a between-groups comparison may have been insufficient. *Explain.*
* To further examine the importance of contingency awareness in AA training we performed Experiment 2. We addressed three important limitations of Experiment 1.   
  (1) In Experiment 1, contingency memory questions asked participants to indicate for each stimulus whether they most often performed approach or avoid actions in response to the stimulus or both actions an equal number of times. Because participants could not indicate that they did not remember contingencies, participants who had no knowledge of the contingency may have been encouraged to search for other information about the stimulus (e.g., their liking of the stimulus) and use this information for answering these questions.   
  (2) In Experiment 1, half of the participants received information about the stimulus-action contingencies. We could not exclude the possibility that the effect of contingency memory on AA training was fuelled by participants who received this information.   
  (3) All participants performed the evaluative priming task before they could indicate their explicit liking of the stimuli. Performing this task may have influenced effects of AA training on explicit evaluation.

**Experiment 2**

### Method: 3 changes: No ‘contingency information’ condition, 4 options in the contingency memory questions, order of implicit and explicit evaluation measurement counterbalanced.

### Results:

* In line with Experiment 1, AA training allowed for a significant influence on implicit and explicit evaluations of novel faces. Contingency memory moderated effects of AA training. We only observed AA training effects for contingency correct stimuli.

General Discussion

In two experiments, we compared evaluations of novel faces that were either approached or avoided and observed a preference for the approached stimuli. We consistently found that contingency awareness, assessed by participants’ memory for action-stimulus associations, moderated effects of AA training on explicit and implicit evaluations.

*Contingency awareness and AA training effects*

Our results may be interpreted as indicative that contingency awareness causes AA training effects. Alternatively, one could argue that a third factor causes both contingency awareness and AA training effects (e.g., attention). One aspect of our data provides support for the former interpretation: When participants incorrectly remembered face-action contingencies the AA training effect was reversed. *Explain.*

In contrast to recent findings of AA training effects when AA actions were performed in response to subliminally presented stimuli, our studies did not provide any evidence that AA training effects can arise when participants are unaware of stimulus-action contingencies. These findings, however, do not allow us to draw strong conclusions about the necessity of contingency awareness for AA training effects. (1) AA training may cause smaller effects in the absence of contingency awareness and our experiments may have lacked the power to detect small effects. *Explain.* (2) The specific procedure and stimuli that we used in this study may have impeded the detection of AA training effects for stimuli that participants did not know the correct action for (e.g., exemplar-based study, novel faces, …). *Explain*. We hope that future research will investigate if and under what circumstances AA training may allow for effects that do not involve conscious knowledge of the stimulus-action contingencies.

*Mental process theories of AA training*

The finding that contingency awareness moderates AA training effects does not fit well with current accounts of these effects. Both motivational and common-coding accounts assume that the execution of AA actions in response to a stimulus allows for *automatic* changes in stimulus representations (e.g. Woud et al., 2008: Eder & Klauer, 2009). *Explain.*

In line with propositional accounts of EC (Gast & De Houwer, 2013), the current results may be more easily explained by a propositional account of AA training effects. When participants detect that they repeatedly approach a certain stimulus, this may allow participants to infer that this stimulus is positive. Once this proposition is formed it may influence both implicit and explicit measures of evaluation. *Explain.*

*Limitations of the current research*

An important limitation of our investigation is that it included only item-based awareness measures probing for participants’ memory of stimulus-action contingencies. In EC research there is discussion about the usefulness of such awareness measures (Gawronski & Walther, 2012; Dedonder, Corneille, Bertinchamps, & Yzerbyt, 2014). *Explain.* Future studies on the importance of contingency awareness in AA training should involve the experimental manipulation of contingency awareness.

*Summary*