

Original Article

# Fear is readily associated with an out-group face in a minimal group context<sup>☆</sup>

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Initial receipt 28 August 2011; final revision received 27 February 2012

## Abstract

Research on prepared learning demonstrates that fear-conditioning biases may exist to natural hazards (e.g., snakes) compared to nonnatural hazards (e.g., electrical cords) and that fear is more readily learned toward exemplars of a racial out-group than toward exemplars of one's own race. Here we push the limits of the generalizability of the mechanisms underlying race biases in a fear-conditioning paradigm by using arbitrary group categories not distinguished by race. Groups were distinguishable solely by t-shirt color, with assignment based on performance in a perceptual task. In this "minimal group paradigm," we found that out-group exemplars were more readily associated with an aversive stimulus than exemplars of one's in-group. Our findings suggest that prepared learning in an intergroup context is not limited to contexts involving racial categories involving histories rife with cultural stereotypes and that previous findings of learning biases along racial lines may be interpreted as a by-product of a broader psychological system for prepared fear learning toward categories of agents that may have posed persistent threats over human evolutionary history.

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**Keywords:** Intergroup bias; Coalitional psychology; Fear; Fight–flight; Minimal groups; Prepared learning

## 1. Introduction

Learning is an adaptation that evolved to cope with environmental changes occurring within the life span, allowing individuals to tailor behavior to their specific environmental contexts (Öhman & Dimberg, 1978). Yet learning is costly in terms of the complex neural circuitry required, and in the time and energetic resources needed to

acquire and maintain the adaptive response. If costly trial-and-error learning were the only learning mechanism available, most animals would be dead before they understood which predators and circumstances to avoid (Bolles, 1970; Öhman & Mineka, 2001). To offset such costs, many animals more readily learn adaptive responses to danger-relevant stimuli, such as has been demonstrated for primates' reactions to snakes (Öhman et al., 1985).

Using this reasoning, Olsson, Ebert, Banaji, and Phelps (2005) demonstrated that exemplars of a race other than one's own were more strongly associated with anxious arousal than exemplars of one's own race, mimicking patterns of bias for conditioned fear toward natural hazards. The authors interpreted their findings as indicative of a general propensity to readily acquire fear reactions toward humans categorized as not belonging to one's own social in-group (the *out-group*). The present research investigates whether the mechanisms of prepared learning in fear-conditioning experiments apply within intergroup contexts

<sup>☆</sup> Author note: This material is based on work supported by the National Science Foundation under Grant BCS-0847237. We thank the research assistants in the Morality and Intergroup Relations Lab for their help conducting this study. We also thank Dan Ilgen and Rebecca Gore for their feedback. Inquiries should be sent to: Carlos David Navarrete, Department of Psychology, Michigan State University, East Lansing, MI, 48824, E-mail: [cdn@msu.edu](mailto:cdn@msu.edu).

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not circumscribed by race. Specifically, we examined to what extent a fear response is more readily acquired, or less readily extinguished, when paired with unfamiliar faces categorized as belonging to a contrived out-group in a variant of the classic “minimal group paradigm” (Tajfel, Billig, Bundy, & Flament, 1971).

## 2. Methods

### 2.1. Participants

Research participants were student volunteers from the psychology department’s research subject pool at Michigan State University. Using the exclusionary criteria described in Olsson et al. (2005), participants were excluded from the analysis because of a lack of a skin conductance response ( $n=14$ ), failure to acquire a conditioned response to at least one of the two reinforced conditioned stimuli during acquisition ( $n=16$ ), technical problems ( $n=12$ ), or voluntarily ending their participation after beginning the procedure ( $n=6$ ). Data were analyzed for 124 White and 44 non-White participants (71% female).

### 2.2. Procedure

A variant of the minimal-group paradigm (Tajfel et al., 1971) was employed in which group color assignment was based on three trials of a color perception task. Participants viewed a monitor presenting an image of a 56-block grid of two primary colors randomly dispersed in equal numbers for 2 s (red/blue, red/yellow, or blue/yellow), after which they indicated their choice of what they believed to be the more prevalent color. Color assignment was determined by which color participants perceived as more prevalent on at least two of the three trials. Participants wore t-shirts of the color they judged as more prevalent for the remainder of the experiment (see Online Supplemental Material, Figures S1 and S2, available on the journal’s website at [www.ehbonline.org](http://www.ehbonline.org)).

After group color assignment, participants underwent a delayed fear-conditioning protocol (Olsson et al., 2005), with in-group and out-group stimuli presented *within-subjects* on a computer monitor. Stimuli were composed of images of White men with neutral expressions taken from the NimStim Face Database (Tottenham et al., 2009), and were digitally manipulated to appear as if wearing either the same colored t-shirt as the participant (in-group) or a different colored t-shirt (out-group). For each subject, two images from each group category were randomly selected from the pool of available images and were kept as intergroup stimuli for all fear-conditioning trials for the duration of their experiment session.

Conditioning trials were blocked into three phases: *habituation* (trials 1–4), *acquisition* (trials 5–9), and *extinction* (trials 10–14). In each trial block, participants viewed two in-group and two out-group images while skin conductance responses (SCRs) were simultaneously recorded. Each

image was presented for 6 s followed by a blank screen lasting between 12 and 15 s (duration random).

During habituation, participants viewed the images with no aversive stimulus. However, during the acquisition phase (beginning at the end of trial 4), one image from each group category (the reinforced conditioned stimulus, CS+) co-terminated with a 1-ms electrical shock and 10-ms burst of white noise (90 dB), together constituting the aversive, unconditioned stimulus (US). The intensity of shock was calibrated by each subject in a work-up procedure to be “uncomfortable, but not painful” (Olsson et al., 2005). The other image from each category (the unreinforced conditioned stimulus, CS–) was presented without the US, as a control. During the extinction phase (beginning at the end of trial 9), all images were presented without the US, allowing the conditioned fear responses to extinguish.

### 2.3. Fear response

Conditioned fear responses were assessed by taking the largest SCR that occurred in the 5 s of image duration leading up to the administration of the US. SCRs were measured in microsiemens and were scaled to control for extreme observations by square-rooting, dividing each by the mean SCR following the US, and then standardizing values within subjects by z-scores. Conditioned fear responses were thus measured as the differential SCR in scaled microsiemens between the CS+ versus the CS– from the same category.

## 3. Results

### 3.1. Acquisition

Fear responses to each target group category were averaged across trials during the acquisition phase. Mean comparison against the baseline control (zero) affirmed that participants successfully acquired fear responses toward in-group targets,  $\text{mean} \pm \text{S.D.} = 0.09 \pm 0.57$ ,  $t_{167} = 2.11$ ,  $p = .036$ , as well as toward out-group targets,  $\text{mean} \pm \text{S.D.} = 0.27 \pm 0.64$ ,  $t_{167} = 5.46$ ,  $p < .0001$ .

In evaluating whether fear responses were more readily acquired toward out-group targets relative to in-group targets, a mean comparison test revealed that the response was greater when learned toward out-group targets relative to in-group targets (difference = 0.18, S.E. = .07,  $t_{167} = 2.52$ ,  $p = .013$ ).

### 3.2. Extinction

To test whether fear responses conditioned toward in-group or out-group targets were resistant to extinction, mean fear responses were calculated for each target group category using all trials in the extinction phase and then compared against zero (the baseline control). As expected, our analyses revealed that the mean fear response to in-group targets during extinction,  $\text{mean} \pm \text{S.D.} = 0.02 \pm 0.54$ , was not significantly different from baseline,  $t_{167} < 1$ . However, contrary to expectations, the mean response to the out-group targets,

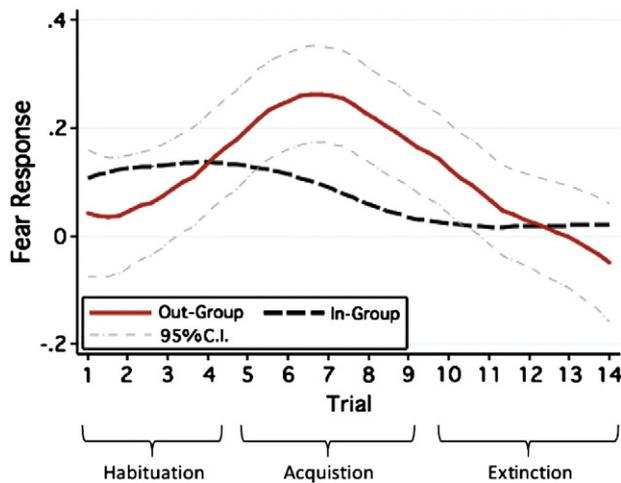


Fig. 1. Fear response by target group and trial. Smoothed means include a 95% confidence interval around the out-group target group.

mean±S.D.=0.01±0.53, also did not significantly differ from baseline,  $t_{167}<1$ . A comparison of means revealed no differences between target categories in extinction (difference=−0.02,  $t_{167}<1$ ).

Exploratory regression analyses revealed no significant effects for participant race or gender on the acquisition or extinction of a conditioned response.

A graphical depiction for fear responses across trials is depicted in Fig. 1. Conditioned responses by trial, including scaled values for each CS+ and CS−, are detailed in the Online Supplemental Material, Tables S1–S2 (available on the journal's website at [www.ehbonline.org](http://www.ehbonline.org)).

#### 4. Discussion

In this study, we tested whether fear-conditioning biases in interracial contexts documented by previous researchers also apply to minimally defined, nonracial group contexts devoid of cultural or historical meaning. We found that participants presented with largely arbitrary intergroup stimuli more readily learned a fear response when the aversive stimuli were paired with out-group faces distinguished from the in-group solely by t-shirt color. Although we document a superior conditioning effect against the out-group in fear acquisition, we did not find evidence for the enhanced resistance to extinction of the conditioned response, as has been found when groups are defined by race (Olsson et al., 2005; Navarrete et al., 2009). In the learning literature, prepared associations are indicated by either superior acquisition or the enhanced resistance to extinction of a conditioned response (reviewed in Öhman & Mineka, 2001). Both kinds of learning biases have intuitively adaptive implications, but it has been argued that there is no a priori reason to regard either index as inherently more valid than the other (Kimble, 1961; Rescorla, 1980).

Yet, perhaps there are design differences in the mental processing of categories of persons characterized by historically deep social identities (e.g., race or ethnicity) versus those characterized as ephemeral coalitions. Natural selection operating on the fear learning system may have evolved different decision rules for acquisition and extinction of the fight–flight response regarding groups with which individuals may have had experience versus those to which one has not. For example, if an individual has an informational basis for mistrusting or fearing an out-group (such as ethnic group stereotypes about danger) and that information is reinforced via aversive experiences with an individual from that out-group, the system may activate the neural processes for resistance to extinction of a fear response toward members of that group. But when there is no such prior basis for mistrust/fear (as in temporally shifting groups or coalitions), the extinction of negative conditioned responses may be more likely since it would be more instrumental for people to “let things go” toward out-group individuals in more fluid and strategic intergroup contexts, even if fear toward individuals newly categorized as out-group members may be readily learned. More research is needed to empirically evaluate such possibilities and to more fully uncover the workings of the psychological systems underlying the learning and “unlearning” of our nervous system responses underlying the expression of prejudice, ethnic enmity, and xenophobia.

Our findings suggest that prepared learning in an intergroup context is not limited to situations involving racial categories with long histories of strife or negative cultural stereotypes. Perhaps some elements of group-based prejudice may be interpreted as a by-product of ancient psychological processes of fear learning toward stimuli categorized as persistent threats. Although not definitive, our findings are consistent with the notion that our fear learning systems may be prepared to readily activate fight-or-flight responses toward individuals categorized as belonging to a social out-group after an aversive experience. Such responses may ready the body to flee, attack, or counterattack during times of intergroup aggression. Such learning biases could have developed because of persistent intergroup conflict throughout our evolutionary history (Keeley, 1996; Choi & Bowles, 2007; Wrangham & Peterson, 1996).

#### Supplementary Materials

Supplementary data to this article can be found online at doi:10.1016/j.evolhumbehav.2012.02.007.

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