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ARE IN-GROUP SOCIAL STIMULI MORE REWARDING THAN OUT-GROUP?

by

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A thesis submitted in partial fulfillment of the requirements
for graduation with Honors in the Health and Human Physiology

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All requirements for graduation with Honors in the
Health and Human Physiology have been completed.

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Annie Walsh
Honors Thesis

Are In-group Social Stimuli more Rewarding than Out-group?

Abstract

Stimuli associated with in-groups and out-groups might be cues that capture visual attention. We examined whether such value-driven attentional capture can be induced with in-groups and out-group images. Thirty-five participants were gathered, fifteen of which identified as Caucasian and twenty identified as Asian. Furthermore, we implemented images of Asian and Caucasian faces as reward feedback. I hypothesize that participants will have a stronger connection to their same ethic group, and therefore, their attention will be biased more for an in-group member than an out-group one. Following this hypothesis, I predict that participants will have the longest response time when an in-group distractor color is present, compared to the presence of an out-group distractor or a neutral distractor. MATLAB computer programing was used to display the study and counterbalanced the amount of images of in-group and out-groups, as well as the colors associated with each. An interesting attentional capture effect was observed for the Caucasian participants but no clear effect observed for the Asian participants. Differences seen with Asian and Caucasian participants may be due to differing amounts of exposure with each ethnic group. These findings can help in determining how social preferences and group affects in psychology are formed. Although not statistically significant, these results suggest patterns of attention associated with different ethnic groups. Collecting more participants in the future can further this study. These findings can then be used to determine reward across different age groups and the effects different types of reward may have on attention.

Introduction

Every second, humans decide what to focus their attention on. However, the decision of where to focus attention varies among each person. How does someone decide what to pay attention to? The visual field must differentiate between important and unimportant information. The visual system does so by adapting moment-by-moment to environmental changes by tracking stimulus salience, current objectives, and reward (Awh, Belopolsky, & Theeuwes, 2012). To do so, visual attention itself must be continuously updated to meet the processing demands of a given scene (e.g., Lien, Ruthruff, & Johnston, 2010). Specifically, social information has been shown to influence the direction of attention. For example, attention is biased in the direction that another person is looking (e.g. Frischen, Bayliss, & Tipper, 2007). From the standpoint of associative learning, stimuli associated with the self, such as one's own name, have high attentional priority (e.g. Harris, Pashler, &Coburn, 2004; Moray, 1959; Sui, Chechlacz, & Humphreys, 2012; Sui, He, & Humphreys, 2012).

Human attention can be influenced by several factors. Some factors known to influence attentional selection can be categorized as purely stimulus-driven and purely goal-driven, other factors such as priming reward history and target context have all been shown to affect selection but these effects do not necessarily rely on goals or particular stimulus attributes, (Roper & Vecera, 2016). Such attentional selection has been shown to exhibit characteristics of a teachable behavior and the ignoring of a stimulus can be facilitated when such ignoring is reinforced with positive outcomes (e.g. Anderson, 2016). Positive social feedback has been shown to bias attention towards the stimuli that predict it (e.g. Anderson, 2016). These findings support the idea that associative learning between an arbitrary stimulus and a valence outcome can give rise to changes in attentional priority, as suggested by studies dissociating value-driven attention from the motivational aspects of reward (e.g. Anderson, 2016). The current experiment being studied will extend this idea of learning by association to social rewarding outcomes. The positive social reward, in-group images, would be expected to encourage the direction of attention to lead to a specific outcome.

Stimuli previously associated with reward outcomes, such as money and food, and stimuli previously associated with aversive outcomes, such as monetary loss, automatically capture attention. From this information, it is know that social reward (happy expressions) can bias attention towards associated stimuli (e.g. Anderson, 2016). For this reason, the present study uses images with neutral facial expressions to avoid unintentional bias and determine directional attention from the affect of social reward only. Findings such as those noted earlier, support the existence of a mechanism by which attention is biased to select stimuli that have been learned to predict a biologically pertinent outcome (e.g. Anderson, 2016).

The importance and significant of the present study, is due to the effective deployment of attention and how critical it is to the success of performing of any cognitive task. Attention determines what aspects of the sensory input are selected for cognitive processing, memory storage, and awareness, (e.g. Anderson, 2011). To promote survival and well being, the brain is optimized to learn about perceptual stimuli that signal the potential for attaining reward. Voluntary attention to stimuli that predict reward is an effective mechanism for efficiently selecting valuable stimuli. Many studies have shown that reward facilitates voluntary attention to task-relevant stimuli, and that reward-based strategies and priorities strongly influence attentional performance, (e.g. Anderson,2011). Currently, social reward studies have been completed but not yet proven with significant results. Replicating the methods of a monetary reward study but with social rewards will create the opportunity to prove that a correlation exists.

This experiment will discover how people's attention is influenced by social rewards, specifically, with the presence of an in-group or out-group face. The objective is to determine if social rewards work the same way as monetary rewards and if social rewards can influence or bias the direction of a person's attention. An in-group is someone in society who the participant will identify with ethnically, whereas the out-group is an ethnicity that differs from the participant's. The two ethnic groups that will be tested are Asian and Caucasian. When presented with an image of an in-group, I hypothesize that participants will have a stronger connection to their same ethic group, and therefore, their attention will be biased more for an in-group member than an out-group one. Following this hypothesis, I predict that participants will have the longest response time during the testing phase when an in-group distractor color is present, compared to the presence of an out-group distractor or a neutral distractor.

If this hypothesis were to be supported, it would contribute to understanding why the preference for in-group faces over out-group faces, the reason being that in-group faces may have been associated with previous rewards or themselves be rewarding. This will help to understand how group affects and social preferences in social psychology come about. If the hypothesis is found to be accurate, these social preferences may be found to come from the reward experienced by an individual due to different social stimuli. For future research this could be useful for examining how social rewards can work across age groups.

Method

Participants

Approximately twenty-four participants who are undergraduates from the University of Iowa psychology research participant pool participated for partial course credit. All participants reported having normal or corrected-to-normal visual acuity and no color blindness. The University of Iowa Institutional Review Board approved the study and all participants provided informed consent.

Apparatus

An Apple Mac Mini computer displayed stimuli on a 17-in. CRT monitor and recorded keyboard responses and latencies. The experiment was controlled using MATLAB (The MathWorks, Natick, MA) and the Psychophysics Toolbox (Brainard, 1997). Participants were seated 60 cm from the monitor in a quiet, dimly lit room.

Distribution of trials

The experiment commenced with a 24-trial practice block in which performance feedback was given to help participants learn the stimulus–response mappings (described below). During practice, all stimuli were presented in white on a black background, and no rewards were presented. The following training phase consisted of 240 trials and was segmented into 60-trial blocks. Finally, the testing phase was composed of 288 trials and was segmented into 72-trial blocks.

Training phase

The stimulus display consisted of six colored rings arranged in a circular array (see Fig. 1a). Each ring was rendered in a different color, and the task was to report the orientation of a line segment within a red (RGB value: 255, 0, 0) or green (RGB value: 0, 255, 0) target ring, one of which was present on every trial. The target ring was equally likely to be red or green and equally likely to appear at any of the six locations along the circular stimulus array. Each ring subtended a visual angle of 2° with a line width of 5 pixels. The total stimulus array subtended a visual angle of 10° and was centered within the display. Distractor colors were randomly drawn without replacement from the following pool of values: blue (RGB value: 0, 0, 255), magenta (RGB value: 255, 0, 255), white (RGB value: 255, 255, 255), tan (RGB value: 237, 199, 114), yellow (RGB value: 255, 255, 0), and cyan (RGB value: 0, 255, 255). Each ring contained a white line segment (length = 1.2° visual angle; width = 0.2° visual angle) that was either horizontal or vertical. Importantly, the line inside the target ring was also either vertically (0°) or horizontally (90°) aligned. Participants were instructed to report the orientation of the line within the target ring by pressing either the left, vertical, or right, horizontal, shift key. The key–orientation mapping was counterbalanced. Every trial commenced with a centrally presented fixation point that remained on-screen for 1,000 ms. After fixation, the stimulus array was displayed for 2,000 ms or until participants responded (see Fig. 1b). After an incorrect response, the text, Wrong! was displayed at the center of the screen in 24-point Helvetica font for 1,000 ms. After a correct response, an image of an in-group or out-group, Asian or Caucasian face, was centrally presented on-screen for 1,000 ms (see Fig. 2). Specific feedback schedules were established such that one target color was an in-group image

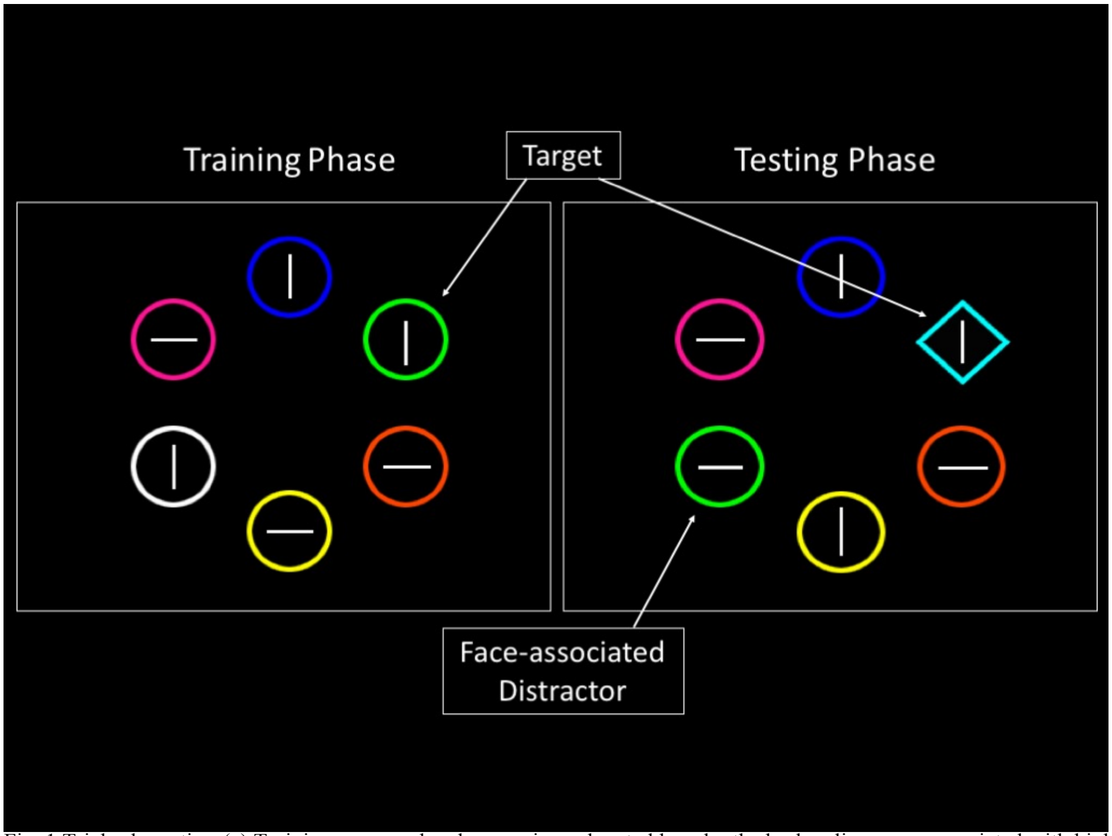

Fig. 1 Trial schematics. (a) Training array: red and green rings, denoted here by the broken line, were associated with high-value (in-group face) and low value (out-group face) stimuli during training. (b) Timing of training trials: Fix =fixation point, ITI = intertrial interval. (c) Testing array: Targets were blue diamonds, and previously rewarded distractors appeared on half of the trials. (d) Timing of testing trials: No faces were presented during the testing phase. Instead, feedback text (Correct! and Wrong!) was provided. These displays are for illustration only; in the experiment, white line segments appeared on black backgrounds (see Experiment 1, Method). (Color figure online.)

Fig. 2 Images seen during training phase after participant correctly responds to orientation of line within the circle.

and the other target color was an out-group image. For instance, for half of the participants, the in-group color was red and the out-group color was green. In this case, a correct response to a red target was followed by the presentation of an in-group image in 80% of trials and an out-group image in 20% of trials. In contrast, a green target was followed by an out-group image in 80% of trials and an in-group image in 20 % of trials. These color–reward associations were counterbalanced across participants.

Testing phase

To assess the impact of previously associated colors, participants completed testing trials immediately after the conclusion of training. The testing sessions were identical to the training sessions except that participants always searched for a diamond-shaped target among five colored distractor rings and reported the orientation of a line segment within the diamond.

Every trial, the color of the diamond target was randomly chosen from the following pool of colors: blue, magenta, white, tan, yellow, and cyan. After participants responded, accuracy feedback (i.e., Correct! or Wrong!) was displayed for 1,000 ms (see Fig. 1c, d). Importantly, however, no images of in-group or out-group faces were presented during the testing phase. The critical manipulation in the testing phase is the color of the distractor rings. For one half of testing trials, the distractors' colors were randomly drawn without replacement from the mentioned pool of colors (i.e., they were neutral with regard to reward). On the other half of testing trials, one of the distractors was presented either in red or in green (red in 25% and green in another 25% of testing trials), and thus in a color that was formerly rewarded during training. These previously rewarding colors were now poised to distract attention away from the diamond-shaped target.

Data Analysis

After the collection of data, participants with accuracy less than 90% were discarded. Accuracy is defined as the participant correctly pressing the right shift key upon a line presented horizontally or the left shift key upon a line that is presented vertically within the diamond. Participants more than 2.5 standard deviations from the mean response time will be discarded. The measurement will be taken for each condition the participant experienced in the experiment. For example, one condition is responding to the orientation, vertical or horizontal, of a line within a red circle as the rewarding color and Caucasian as the in-group image associated with the red circle. There are 6 different conditions. The difference in response time for each participant, and for each condition, will then be compared with other participants to determine if there is an effect of in-group and out-group faces on attention and reward.

Results

Testing phase

Response times (RTs) were first trimmed for each participant. All responses above or below 2.5 standard deviations for each condition were discarded from subsequent analyses. This trimming removed less than 8% of all trials in the experiment. We conducted a two-factor, mixed-model ANOVA with a within-subjects factor of distractor type (in-group distractor, out-group distractor, or distractor absent) and a between-subjects factor of group (Asian versus Caucasian).

Mean response time across all participants appears in Figure 3. There was no main effect of distractor type, with similar response times when the distractor was associated with the in-group face (942 ms) as it was when it was associated with the out-group face (933 ms) or when distractors were absent (943 ms), $F(2, 66)=0.77$, $p = 0.47$. Although there was a numeric difference between the two participant groups, with faster responses by the Caucasian participants (909 ms) than by the Asian participants (962 ms), this difference failed to reach statistical significance, $F(1, 33)=0.95$, $p = 0.34$. Finally, these two factors showed a trend towards an interaction, $F(2, 66)=1.49$, $p = 0.23$. This trend toward an interaction suggests that the distractor types differed between the two groups. As can be seen in Figure 3, Caucasian participants showed faster responses in the presence of a distractor associated with out-group faces (890 ms) than in the presence of a distractor associated with in-group faces (921 ms). This difference was marginally significant, $t(14)=2.06$, $p=.058$.

Accuracy was generally high, which is typical in this type of visual search task. On average, participants were 97% correct across all conditions and groups. There were no systematic differences across any of the conditions, indicating that both Asian and Caucasian participants were highly accurate for all of the distractor types. (Compare Table 1).

Table 1 Testing phase mean accuracy as the proportion of correct trials

Testing phase accuracy

	Neutral Distractor	Out-group distractor	In-group distractor
	M	M	M
Exp. 1	97%	96%	96%

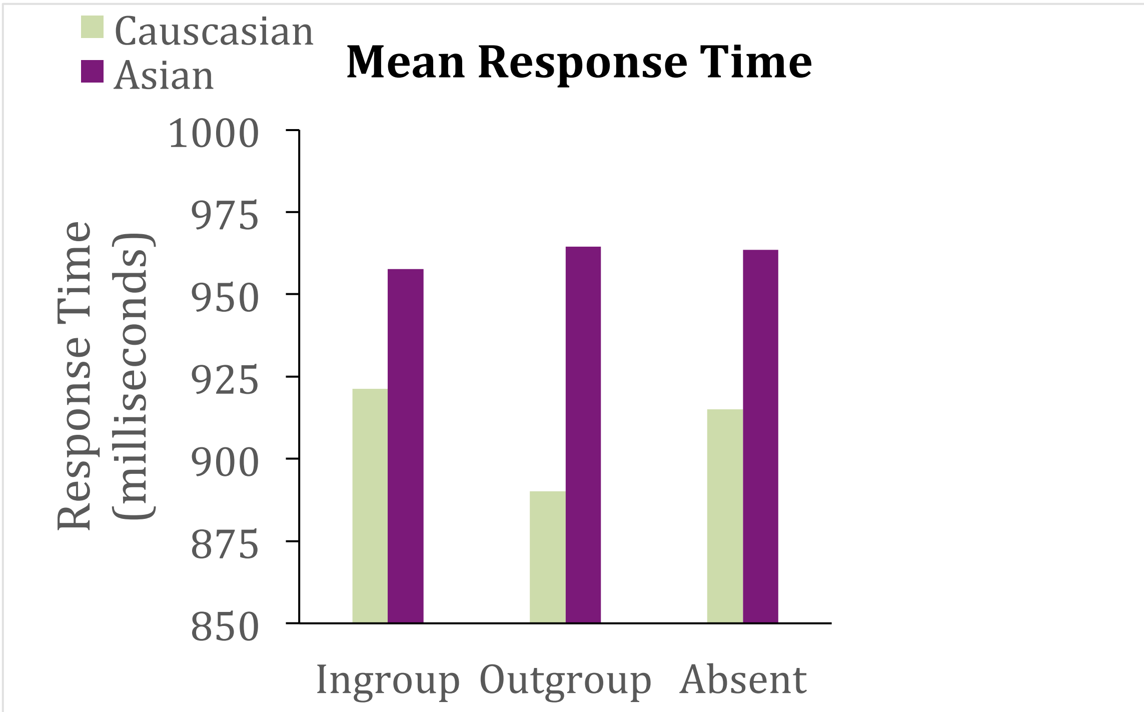

Fig. 3 Testing phase RT. When colored targets were implicitly associated with images of Asian and Caucasian Faces during training, the same previously rewarded targets became distractors during a transfer phase.

Discussion

When colored targets were implicitly associated with images of Asian and Caucasian faces during training, the same previously rewarded targets became distractors during a subsequent transfer phase. Specifically, if distractors were presented in a previously associated out-group color, Caucasian participants were faster in responding to the diamond shape as compared to when distractors were presented in a neutral or in-group color. It is possible that Caucasian participants learned to ignore or suppress items associated with their out-group and therefore had a faster response when it was present. Conversely, Asian participants did not show a clear difference in response time for the in-group distractor, out-group distractor, or no distractor. This may be because Asian participants living in America, the participants used in this study, have more exposure with both ethnic groups. Also, the difference in response times between the Asian and Caucasian participants was quite large, although not significant. These main findings disprove my hypothesis, suggesting there may not be a strong attentional focus directed toward in-groups.

Although these results disprove my hypothesis, they provide evidence of other possible patterns that may be present. The pattern seen with the response time from the Caucasian participants was much faster for an out-group distractor than for the in-group and neutral distractors. As written in the Anderson study, attentional selection has been shown to exhibit characteristics of a teachable behavior and the ignoring of a stimulus can be facilitated when such ignoring is reinforced with positive outcomes (e.g. Anderson, 2016). Positive social feedback has been shown to bias attention towards the stimuli that predict it (e.g. Anderson, 2016). The noticeable difference seen in Caucasian response time with out-group versus in-group distractors may suggest that this learned behavior occurred in the Caucasian participants. It is possible the Caucasian participants quickly ignored the items associate with their out-group because it was something that was not rewarding.

Continuing with this study, we can collect more participants to hopefully see a clearer difference in response times among the Asian and Caucasian participants.
Our frequent interactions with ethnicity may build upon each other to form robust reward associations with race. Based on a long history of these interactions, it is likely that the sight of certain ethnicities produces a strong reward signal in the brain (as inferred from

Schultz, 2006). This reward signal helps us to pursue our goals by allowing us to learn about the cues in our environment.

Overall, our results suggest possible patterns with attention tracking the reward value of particularly potent representations of ethnicity. These finding will be helpful in future research by gathering more participants to determine a more clear difference in response time's for the distractor types. To further the results of this experiment we can examine rewards across a range of age groups, as well as, determine if there are other reward types, excluding monetary rewards, that may influence or bias the direction of attention.

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