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Affective stimuli capture attention regardless of categorical distinctiveness: An emotion-induced blindness study

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Affective stimuli capture attention, whether their affective value stems from emotional content or a history of reward. The uniqueness of such stimuli within their experimental contexts might imbue them with an enhanced categorical distinctiveness that accounts for their impact on attention. Indeed, in emotion-induced blindness, categorically distinctive neutral pictures disrupt target perception, albeit to a lesser degree than do emotional pictures. Here, we manipulated the categorical distinctiveness of distractors in an emotion-induced blindness task. Participants searched within RSVP streams for a target that followed an emotional or a neutral distractor picture. In a categorically homogenous condition, all non-distractor items were exemplars from a uniform category, thus enhancing the distractor’s categorical distinctiveness. In a categorically heterogeneous condition, each non-distractor item represented a distinct category. Neutral distractors disrupted target perception only in the homogenous condition, but emotional distractors did so regardless of their categorical distinctiveness.

Keywords: Emotion-induced blindness; Reward-driven capture; Attentional capture; Categorization.

Although we are often able to control the focus of our attention, some properties of the environment seem to be particularly adept at grabbing our attention without...
our volition (i.e., “attentional capture”). Within the traditional visual cognition literature, research has tended to focus on physical properties that capture attention, such as motion (e.g., Franconeri & Simons, 2003; Hillstrom & Yantis, 1994), salient colours (e.g., Theeuwes, 1994), and sudden onsets (e.g., Jonides & Yantis, 1988; Yantis & Jonides, 1984). Attentional capture has also been of interest within the clinical literature, where the focus has typically been on the attention-capturing power of emotional stimuli and how their impact is moderated by individual differences (e.g., Fox, 1993; MacLeod, Mathews, & Tata, 1986; Mogg & Bradley, 1999). Increasingly, these two traditions of research have found common ground as investigators have shown that affectively tinged stimuli—whether their affective value stems from emotional content or reward (or punishment) history—capture attention in well-established visual cognitive paradigms (see Bar-Haim, Lamy, Pergamin, Bakermans-Kranenburg, & van IJzendoorn, 2007 and Dolan, 2002 for reviews).

The evidence for attentional capture by affectively rich stimuli—that is, stimuli with negative or positive emotional significance—takes different forms across different tasks. Visual search tasks (Öhman, Flykt, & Esteves, 2001) and cueing studies (Fox, Russo, Bowles, & Dutton, 2001; Mogg & Bradley, 1999) typically use response time as the critical variable, as typically does the widely used “dot probe”, in which people respond faster to a target that appears in a location previously occupied by an emotional stimulus than by a neutral stimulus (e.g., MacLeod et al., 1986; Mogg & Bradley, 1999). In contrast, accuracy is used as the measure of interest when participants search for targets in rapid serial visual presentations (e.g., Anderson & Phelps, 2001; Most, Chun, Widders, & Zald, 2005). Across the different tasks, data consistently suggest that affectively powerful stimuli capture attention faster and better than neutral stimuli do, sometimes with beneficial—and sometimes with detrimental—consequences for performance on a primary task. As an example of a detrimental impact on task performance, when people search for a single target picture embedded within rapid serial visual presentations of items (e.g., presented at a rate of 100 ms/item), their accuracy is robustly impaired when the target follows a task-irrelevant emotionally evocative distractor picture—an effect that reflects attentional capture by the emotional distractors and which has been called emotion-induced blindness (Arnell, Killman, & Fijavz, 2007; Kennedy & Most, 2012; Most et al., 2005; Most, Smith, Cooter, Levy, & Zald, 2007; Wang, Kennedy, & Most, 2012).

Like stimuli with intrinsically emotional content, stimuli that have been associated with reward and/or punishment also capture attention. Stimuli that participants train to associate with reward capture attention in subsequent visual search tasks (Anderson, Laurent & Yantis, 2011a, 2011b; Chelazzi, Perlato, Santandrea, & Libera, 2013; Failing & Theeuwes, 2014) and appear to be perceptually enhanced (Hickey, Chelazzi, & Theeuwes, 2010). Stimuli linked with punishment also grab attention (Schmidt, Belopolsky, & Theeuwes, 2015; Smith, Most, Newsome, & Zald, 2006). For example, Smith and colleagues (2006)
conditioned participants to associate otherwise neutral images with aversive bursts of white noise, finding that these stimuli subsequently induced emotion-induced blindness. It may be that reward-linked and punishment-linked stimuli engage similar mechanisms as stimuli with intrinsic emotional content (Murray, 2007; but see Sakaki & Mather, 2012).

A reasonable interpretation of such findings is that attention is captured by stimuli directly on the basis of their affective value. Alternatively, however, such stimuli might capture attention because participants categorize them differently than other items in the visual display. For example, in some experiments, the attention grabbing emotional item belongs to a different object category from the other stimuli, such as a snake among mushrooms (e.g., Öhman et al., 2001). This is largely the case in previous emotion-induced blindness studies, where the emotional distractor has often been a picture of people or animals among pictures of landscapes (e.g., Kennedy, Rawding, Most, & Hoffman, 2014; Most et al., 2005). Thus, it is important to understand whether such apparent “emotion” effects are modulated by distractors’ categorical novelty. Even in cases where the perceptual properties of a distractor are controlled with more rigor—such as studies in which a colour that has been linked with reward captures attention more than a colour that has not (Anderson et al., 2011a)—the possibility remains that the affective stimulus is categorized differently from other stimuli. Such stimuli may, for example, be deemed as belonging to a “high value” category and the other stimuli to a “low value” category, with the high value stimuli capturing attention only once their categorical distinctiveness within the display is registered. Evidence suggests that the behavioural impact and neural processing of emotional—and categorical—oddballs can be hard to disentangle (e.g., Fichtenholtz et al., 2004; Strange & Dolan, 2001, 2007), raising the question as to whether what appears to be direct effects of affective value on attentional capture may instead be indirect and driven by an intermediate categorization process. Consistent with this possibility, previous work has demonstrated that categorical “oddballs” can grab attention even when perceptual properties are largely controlled (Strange & Dolan, 2001, 2007; see also Barnard, Scott, Taylor, May, & Knightley, 2004; Goodhew, Kendall, Ferber, & Pratt, 2014; Stein, Zwickel, Kitzmantel, Ritter, & Schneider, 2010).

Within emotion-induced blindness experiments, there is some evidence that categorical distinctiveness might contribute to the effect: in a number of instances, the rapid streams are composed of landscape/architectural photos, and both the emotional and non-emotional distractors depict people or animals—making both categorically distinctive within the stream (e.g., Kennedy & Most, 2012; Most et al., 2005). Although emotional distractors impair target perception more than non-emotional distractors do, the non-emotional distractors consistently impair performance relative to baseline. And although one possibility could be that this reflects attentional capture by the perceptual distinctiveness of the distractors, scrambled versions of the distractors—which contain the same
colour and luminance as negative distractors—barely affect performance at all, suggesting that categorical (as opposed to perceptual) distinctiveness does indeed play a role. Although the difference in the impact of emotional vs. non-emotional distractors could in itself indicate capture by affective stimuli over and beyond the contribution of categorical distinctiveness, an alternative interpretation is that the cues that indicate categorical distinctiveness are additive, with affective uniqueness being an additional contributor to the sum.  

In the present study, we sought to understand the degree to which attentional capture by affective stimuli might be modulated by their categorical novelty within a task; we examined attentional capture by emotional and non-emotional stimuli when their relative affective values were constant but their uniqueness in terms of object category was enhanced or diminished. Specifically, the distractors appeared in streams composed of object exemplars from a homogenous category (enhancing distractors’ categorical distinctiveness) or from a heterogeneous collection of object categories (diminishing distractors’ categorical distinctiveness). Because evidence suggests that capture by non-emotional distractors in an emotion-induced blindness task is driven by their categorical distinctiveness, we predicted that this manipulation should modulate the target processing impairments these non-emotional distractors elicit. Our critical question was what the outcome of this manipulation would be on the impact of emotional distractors. If affective stimuli grab attention due, either in whole or in part, to their categorical distinctiveness, then they should elicit less target processing impairment in the heterogeneous condition than in the homogeneous condition. If, however, their power to grab attention derives primarily from their affective nature, then this manipulation should have no observable impact.

METHOD

Participants

A total of 69 University of Delaware undergraduates (mean age 19.25 years; 35 female) participated for course credit. Thirty-seven participants were part of the heterogeneous condition and 32 were part of the homogeneous condition. All participants provided informed consent and the experiment was approved by the University of Delaware Human Subjects Review Board.

Materials and procedure

The experiment was divided into four blocks, each containing 84 trials. Every trial consisted of a rapid serial visual presentation (RSVP) stream of 21 images, with each image appearing for 150 ms and being immediately replaced by the next. Images in the stream were coloured, 320 × 240 pixel photographs, and every trial included one critical distractor, one target, and 19 filler images.
The target and filler images were drawn from a set of 21 different categories of everyday objects, wherein each category contained 21 exemplars (e.g., teapots, shoes, keys, etc.).

Every stream had a single image that served as the critical distractor. The critical distractor in any given stream could be emotionally negative, neutral, or simply another filler image (as a “baseline” condition). A total of 56 negative and 56 neutral pictures were selected as distractors and depicted people or animals. These images were mostly gathered from the International Affective Picture System (IAPS; Lang, Bradley, & Cuthbert, 2001) based on ratings of emotional valence and arousal, and were supplemented by images taken from publicly available sources. The negative and neutral distractors were rated on 9-point scales of valence and arousal by a separate group of participants and have been used in several previous emotion-induced blindness experiments (e.g., Kennedy et al., 2014). The negative emotional distractors, which included emotionally powerful scenes such as medical trauma, threatening animals, and violence, were rated as both more unpleasant and more arousing than the neutral distractors, which depicted people with neutral expressions and non-threatening animals (ps < .001).

The category images included 21 different object categories that represented common, everyday objects. Each of the 21 object categories contained 21 photographic exemplars collected from publicly available sources, totalling 441 category images in all. In every stream, a blue border (10 pixels wide) surrounded one of the category images, which served to identify it as the target. The emotionally negative, neutral, or baseline distractor was presented randomly at a serial position between 3 and 8, and it preceded the target picture by 3, 5, 7, or 9 images in the rapid serial stream.

Participants were randomly assigned to one of two conditions. In the heterogeneous condition, participants searched for the blue-bordered target in streams that contained exemplars from different categories of common objects (e.g., teapot, shoe, house, key, etc.). In this condition, the heterogeneity of items in each stream minimized the categorical “oddball” nature of the distractor, as each item represented a different category. Determination of which object served as the target was pseudorandom: the target object type was cycled so as not to repeat until all other object types had been targets. Order of the objects and exemplars of each target type were random. In baseline streams, participants saw exemplars of all 21 object types. In streams with negative or neutral distractors, the distractor replaced one of the objects in the stream.

In the homogeneous condition, streams were composed of exemplars all of the same type of common object (e.g., all teapots, all shoes, all houses, etc.). Order of the exemplars was random, and the assignment of the object stream type was pseudorandom: it cycled so as not to repeat until all other object types had been stream types. In baseline streams, subjects saw all 21 exemplars of the same object type. In streams with negative or neutral distractors, the distractor replaced a random exemplar in the stream.
At the end of each stream, all images from the stream except for the critical distractor appeared in an array on the computer screen (160 × 120 pixels per image) and participants were instructed to identify, via mouse click, the one target image that had been surrounded by the blue border. Note that this aspect of the task—the search for an otherwise non-distinctive blue bordered item and the forced-choice selection of it from an array—marked a departure from most previous emotion-induced blindness experiments, where participants reported the orientation of the one rotated target in each stream. However, because participants needed to identify an item based on its unique identity instead of via a binary orientation decision, the search array was optimal for this experiment. The positions of images in the array were random (see Figure 1). Correct responses were followed by a bell sound via headphones; no sound accompanied incorrect answers. The next trial began immediately after participants made their target selection.

Throughout the experiment, stimuli appeared against a grey background on a 19-inch CRT monitor with a refresh rate of 100 Hz, via the Psychophysics Toolbox for Matlab (Brainard, 1997; Pelli, 1997). Screen resolution was set to

Figure 1. Example of part of an experimental trial, where items were presented at a rate of 150 ms/item in (a) heterogeneous or (b) homogeneous streams. The target is defined by the surrounding blue border, and participants identified the target at the end of the stream with a mouse press on the array of images. Sometime before the target, an emotionally negative, neutral, or baseline (no) distractor appeared some before it. See text for details.
800 × 600 pixels, making the 320 × 240 pixel photographs 5.4” × 4” stimuli. Participants sat at a comfortable distance from the computer screen and head position was not fixed. Before starting the experiment, participants were shown examples of emotional and neutral images and engaged in a short 16-trial practice session, with RSVP rates starting at 300 ms/item and increasing to the experiment presentation rate of 150 ms/item. The practice session did not include negative or neutral distractors. Participants were debriefed at the end of the experiment.

RESULTS

Percentage accuracy in reporting the target served as the primary measure of interest. An overall 3 (Distractor Type: negative, neutral, none) × 4 (Lag-3 vs. Lag-5 vs. Lag-7 vs. Lag-9) × 2 (Categorical Context: Heterogeneous vs. Homogeneous) mixed ANOVA revealed a significant main effect of Distractor Type, $F(2, 134) = 7.721, p < .001, \eta^2_p = .103$, Lag, $F(3, 201) = 56.577, p < .001, \eta^2_p = .458$, and Categorical Context, $F(1, 67) = 96.944, p < .001, \eta^2_p = .591$, as well as a significant interaction between the three, $F(6, 402) = 3.435, p = .003, \eta^2_p = .049$ (see Figure 2). There was a significant interaction between Distractor Type and Lag, $F(6, 402) = 6.614, p < .001, \eta^2_p = .090$, but no significant interaction between Distractor Type and Categorical Context, $F(2, 134) = 1.304, p = .275, \eta^2_p = .019$, or between Lag and Categorical Context, $F(3, 201) = 1.005, p = .392, \eta^2_p = .015$.

Participants in the Heterogeneous condition performed better overall on the task ($M = 83.3\%, SD = 10.8\%$) than participants in the Homogeneous condition ($M = 48.6\%, SD = 18.1\%$). This makes sense, as targets in the homogenous condition looked similar to non-targets in the same stream. In the heterogeneous condition, each stream item not only looked relatively distinctive, but participants could attach a categorically broad semantic label (e.g., “teapot”) to the target item;

![Figure 2](image-url)
in contrast, in the homogeneous condition, semantic labels would be relatively useless for demarcating the target and participants would have had to maintain detailed visual memories of targets’ features.

Because the Lag × Categorical Context interaction was qualified by a further interaction with Distractor Type, we examined this two-way interaction for each Distractor Type separately. In streams with Negative Distractors, there was no interaction between Lag and Categorical Context, $F(3, 201) = 0.679, p = .544, \eta_p^2 = .010$. Similarly, in streams with Baseline distractors, there was no significant interaction between Lag and Category Type, $F(3, 201) = 0.468, p = .705, \eta_p^2 = .007$. However, there was a significant interaction between Lag and Category Type in the Neutral streams, $F(3, 201) = 7.329, p < .001, \eta_p^2 = .099$.

This effect within the neutral condition was primarily driven by performance at Lag-3 (the earliest lag tested), where performance following neutral distractors resembled performance following negative distractors in the homogeneous condition but resembled baseline in the heterogeneous condition. At Lag-3 in the homogeneous condition, there was a significant difference in accuracy between the neutral and baseline streams (Neutral: $M = 38.6\%$, $SD = 19.2\%$; Baseline: $M = 48.1\%, SD = 18.4\%; t(31) = 4.974, p < .001$) but not between neutral and negative streams (Negative: $M = 38.4\%, SD = 18.9\%; t(31) = .087, p = .932$). In contrast, in the heterogeneous condition at this lag, there was a significant difference between neutral and negative streams (Negative: $M = 71.9\%, SD = 15.5\%$; Neutral: $M = 81.4\%, SD = 11.8\%; t(36) = 5.834, p < .001$), but not between the neutral and baseline streams (Baseline: $M = 81.0\%, SD = 13.8\%; t(36) = 0.248, p = .806$). To hone in on the role of categorical distinctiveness in streams with negative distractors at Lag-3, we ran a 2 (negative vs. baseline) × 2 (homogeneous vs. heterogeneous) ANOVA, which revealed no significant interaction, $F(1, 67) = 0.040, p = .843, \eta_p^2 = .001$, further suggesting that categorical distinctiveness does not modulate capture by negative stimuli. And this was unlike the pattern observed for neutral compared to baseline distractors at Lag-3, in which the 2 (neutral vs. baseline) × 2 (homogeneous vs. heterogeneous) ANOVA revealed a significant interaction, $F(1, 67) = 16.561, p < .001, \eta_p^2 = .198$.

**DISCUSSION**

Across numerous tasks and studies, affectively laden stimuli appear to capture attention, whether their affective quality stems from their intrinsic emotional content or their history of association with rewarding or aversive outcomes (e.g., Anderson & Phelps, 2001; Anderson et al., 2011a; Hickey et al., 2010; Öhman et al., 2001). Such findings have deeply influenced theories of emotional information processing, its role in clinically relevant individual differences (e.g., Bar-Haim et al., 2007; Fox, 1993; MacLeod, 1991; MacLeod et al., 1986; Mogg & Bradley, 1999), and neurobiological accounts of communication between
classically emotion- and attention-linked regions (e.g., Dolcos & McCarthy, 2006; Hickey et al., 2010; Vuilleumier, 2005). Yet, one possibility is that rather than affective value directly capturing attention, such stimuli capture attention because they are categorized differently than the non-affective stimuli in the display—with the affective stimuli capturing attention because of their categorical uniqueness (Ferrari, Bradley, Codispoti, & Lang, 2010; Weinberg, Hilgard, Bartholow, & Hajcak, 2012).

In the present emotion-induced blindness study, we manipulated the context within which emotional and non-emotional distractors appeared in order to increase or decrease the degree to which they represented a unique object category while holding their relative affective values constant. Specifically, emotional and neutral distractors appeared in rapid streams composed either of categorically homogeneous filler items (thereby enhancing the categorical oddball nature of the distractors) or of categorically heterogeneous filler items (thereby diminishing their categorical oddball nature). As predicted, this manipulation modulated the target perception impairments elicited by non-emotional distractors: in the heterogeneous streams, performance following non-emotional distractors did not differ from when there was no distractor, but in homogeneous streams non-emotional distractors caused as much impairment as emotional ones did. Critical to the primary motivation of this experiment, the manipulation of categorical context did not modulate performance following emotional distractors relative to baseline. (A main effect of categorical context, where performance following all distractor types was worse in the homogeneous condition, likely reflected the greater difficulty of selecting a target based on specific features than by semantic category.)

It is worth noting that it is unclear if emotional stimuli would have continued to impact subsequent stimuli if they were no longer the only affectively powerful stimulus in the stream. It may be that the affective stimuli in this study assumed categorical novelty not only on the basis of their object identity, but also on the basis of their affective significance (i.e., belonging to a “high value” category while all other items in the stream belonged to a “low value” category), and that this in itself represented an intermediate categorization stage that drove their

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1 We attempted to replicate these findings in a within-subjects design, with participants receiving two blocks each of heterogeneous and homogeneous conditions (interleaved to minimize differences in practice across conditions). However, this design did not elicit differences in performance between the homogeneous and heterogeneous conditions; instead, in both conditions, negative distractors impaired target accuracy more than neutral distractors, and neutral distractors impaired target accuracy more than baseline distractors. We then reran the between-subjects version described in the main text, which successfully replicated our initial results. It seems likely that carryover effects stemming from the within-subjects, interleaved manipulation of condition interfered with differences in strategy that participants would otherwise employ when faced with the homogeneous and heterogeneous streams. See Appendix for more details regarding the methods and results of this replication experiment (which also served to verify the effect across universities in the USA and Australia).
ability to capture attention. Future studies could possibly address the issue of affective novelty by manipulating the number of affective stimuli in a stream.

Intriguingly, the impacts of categorical—and affective—uniqueness were not additive: whereas increasing distractors’ object category uniqueness modulated attentional capture by non-emotional items, it did not similarly modulate capture by emotional items. Further, when the categorical uniqueness of non-emotional distractors was enhanced, they appeared to capture attention as much as the emotional distractors did. This raises the question as to whether the consequences of affective uniqueness are different from those of object category uniqueness. It is hard to draw firm conclusions about this from the current data, as the main effect of categorical context (i.e., better performance in the heterogeneous than homogenous condition) raises the spectre of ceiling or floor effects that might obscure additive effects of categorical and affective uniqueness. It may also be that the emotional intensity of the distractor images we used impaired performance to such an extent as to obscure a possible additional contribution of categorical uniqueness. That is, if affective uniqueness is one cue that contributes to a stimulus’s overall categorical distinctiveness, it may be that there is little else needed to set a stimulus apart when its emotional resonance is very high. Less emotionally powerful distractors might have induced a lesser effect, allowing observation of such additive effects. In this light, it is noteworthy that some previous research has found additive effects of emotional quality and categorical uniqueness (Weinberg et al., 2012).

A further limitation of the current work is that the earliest lag that we tested was Lag-3, which involved a lapse of 450 ms between the onsets of the distractor and target. Thus, it is impossible to rule out a stronger role of categorical distinctiveness (or an additive effect of categorical and affective uniqueness) at earlier stages of attentional engagement. However, previous work suggests that emotional stimuli tend to impair performance more than neutral stimuli at Lag-1 (and at only 100 ms between the distractor and target; Kennedy & Most, under review; Most & Jungé, 2008), which suggests that affective properties can capture attention over and beyond the role of object category at earlier stages of processing as well. It also bears mentioning that whereas emotion-induced blindness studies typically index perceptual processing (e.g., Kennedy & Most, 2012), the present study employed a memory test instead. Although this raises questions as to whether the impairments in this study reflected the same mechanisms as in previous emotion-induced blindness studies, in both cases the impairments stem from attentional capture by affective stimuli.

Overall, these findings demonstrate that while categorically distinct items can capture attention, the impact of affective stimuli is robust regardless of whether the categorical distinctiveness of such stimuli is minimized or enhanced. Future work should continue to investigate how the affective qualities of a stimulus
can grab attention in different contexts, if different sources of oddball status (e.g., object category vs. affective) work in parallel or are additive, and if all types of affective value (e.g., intrinsic emotional content vs. associations with reward or punishment) operate in the same way.

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**APPENDIX: METHODS AND RESULTS OF REPLICA TION AT THE UNIVERSITY OF NEW SOUTH WALES, AUSTRALIA**

**Method**

**Participants.** A total of 43 participants were recruited from the community using the University of New South Wales SONA system and were compensated AU$12 for their time (mean age 24.63 years; 30 female). Twenty-one were assigned to the heterogeneous condition and 22 to the homogeneous condition. All participants gave informed consent and the experiment was approved by the University of New South Wales Human Research Ethics Approval Panel.

**Materials and procedure.** The materials and procedure were identical to those reported in the original experiment, with a few minor changes: Stimuli appeared against a black background on a 24-inch Benq LED monitor with a refresh rate of 120 Hz. Screen resolution was 1920 × 1080 pixels, with the 320 × 240 pixel photographs appearing as 3.46" × 2.64" stimuli. The practice session was shortened to eight trials, still starting at 300 ms/item and increasing to the experiment presentation rate of 150 ms/item.

**Results**

The overall 3 (Distractor Type) × 4 (Lag) × 2 (Categorical Context) mixed ANOVA revealed a significant main effect of Distractor Type, F(2, 82) = 3.243, p = .044, η² = .073, Lag, F(3, 123) = 25.382, p < .001, η² = .382, and Categorical Context, F(1, 41) = 26.162, p < .001, η² = .390 (but no significant interaction between the three, F(6, 246) = 1.083, p = .373, η² = .026). There was a significant interaction between Distractor Type and Categorical Context, F(2, 82) = 3.273, p = .043, η² = .074, but no significant interaction between Distractor Type and Lag, F(6, 246) = 1.001, p = .425, η² = .024, or between Lag and Categorical Context, F(3, 123) = 0.293, p = .830, η² = .007.

As in the original experiment, participants in the Heterogeneous condition performed better overall on the task (M = 75.9%, SD = 22.8%) than participants in the Homogeneous condition (M = 44.1%, SD = 20.2%). There were no interactions between Lag and Categorical Context in either the Negative Distractor condition, F(3, 123) = 0.835, p = .477, η² = .020, the Baseline condition, F(3, 123) = 0.614, p = .607, η² = .015, or (in contrast to the original experiment) the Neutral Distractor condition, F(3, 123) = 1.013, p = .389, η² = .024.

Critical to this replication, at Lag-3 in the Homogeneous condition, there was a significant difference in accuracy between the neutral and baseline streams (Neutral: M = 70.6%, SD = 21.1%; Baseline: M = 70.6%, SD = 21.1%; t(20) = 1.563, p = .134). As in the original experiment, the 2 (negative vs. baseline) × 2 (homogeneous vs. heterogeneous) ANOVA for Lag-3 data did reveal a significant interaction, F(1, 41) = 9.939, p = .003, η² = .195. But not between the neutral and baseline streams (Baseline: M = 68.2%, SD = 24.6%; Neutral: M = 73.3%, SD = 23.2%; t(20) = 2.140, p = .045),

As in the original experiment, the 2 (negative vs. baseline) × 2 (homogeneous vs. heterogeneous) ANOVA for Lag-3 data again revealed no significant interaction, F(1, 41) = 0.569, p = .455, η² = .014 and the 2 (neutral vs. baseline) × 2 (homogeneous vs. heterogeneous) ANOVA for Lag-3 data did reveal a significant interaction, F(1, 41) = 9.939, p = .003, η² = .195.