

## Original Article

## Eye images increase generosity, but not for long: the limited effect of a false cue

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## ABSTRACT

People are more cooperative when explicitly observed, and simply exposing people to images of eyes or faces has been shown to increase cooperation of various types and in various contexts, albeit with notable, if controversial, exceptions. This ‘eyes effect’ is important both for its potential real-world applications and for its implications regarding the role of reputation in the evolution and maintenance of human cooperation. Based on the general principle that organisms eventually cease responding to uninformative stimuli, we predicted that the eyes effect would be eliminated by prolonged exposure. A novel experiment confirmed that participants exposed briefly to an eye-like image gave more money in an economic game than those in a longer exposure condition and those in a control condition. There was no generosity difference between the long exposure and control conditions. Furthermore, a meta-analysis of 25 eyes effects experiments confirmed that the effect emerges reliably after short exposures to eye images, but not after long exposures. An understanding of the limits of false cues on behaviour helps resolve empirical discrepancies regarding the eyes effect and exonerates the importance of reputation even in anonymous, one-shot interactions.

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## 1. Introduction

Theoretical models suggest that reputational mechanisms can facilitate the evolution and maintenance of cooperation (Barclay, 2011a; Nowak & Sigmund, 2005; Ohtsuki & Iwasa, 2006; Pollock & Dugatkin, 1992; Roberts, 2008). Accordingly, people are more cooperative when others can observe or will be informed of their actions (Andreoni & Petrie, 2004; Barclay, 2004; Barclay & Willer, 2007; Bixenstine, Levitt, & Wilson, 1966; Kurzban, 2001; Milinski, Semmann, & Krambeck, 2002a, 2002b; Rege & Telle, 2004; Sylwester & Roberts, 2010; Wedekind & Milinski, 2000). We should expect even subtle cues of observation to affect cooperation, given that human decision-making is influenced not only by conscious, reasoned evaluation of explicit knowledge (e.g. the rules of a game), but also by non-conscious, intuitive judgments based on implicit cues (DeBruine, 2002; Hagen & Hammerstein, 2006; Haidt, 2001). Haley and Fessler (2005) investigated whether implicit cues of observation influence cooperative decision-making by exposing participants to eye-like images just before they completed a generosity task, finding that generosity was higher in the eyes condition relative to control conditions that did not contain a visual cue to observation (henceforth the ‘eyes effect’). A growing collection of laboratory experiments has since shown that the eyes effect can increase cooperation of various types, including generosity (Mifune, Hashimoto, & Yamagishi, 2010; Oda, Niwa, Honma, & Hiraishi, 2010; Rigdon et al., 2009; Nettle et al.,

2013), public goods contributions (Burnham & Hare, 2007), and condemnation of moral violations (Bourrat, Baumand, & McKay, 2011). Supplementing these findings are several exciting experiments showing real-world eyes effects: enhanced (i) contributions to a voluntary payment system in an office coffee room (Bateson, Nettle, & Roberts, 2006), (ii) clean-up of garbage in a university cafeteria (Ernest-Jones, Nettle, & Bateson, 2011) and at bus stop benches (Francey & Bergmuller, 2012), and (iii) charitable donations in supermarkets, especially when there were few potential observers (Ekström, 2011; Powell, Roberts, & Nettle, 2012).

Images of eyes are obviously not the same as eyes attached to real people who could spread reputational information. That said, false social cues in other domains can elicit similar responses as the real thing (e.g. sexual arousal caused by pornography), and brain regions that respond involuntarily to faces also respond to images of faces and eyes, and even to scrambled face images, schematic face designs, and cartoon faces (Bentin, Allison, Puce, Perez, & McCarthy, 1996; Emery, 2000; Haxby, Hoffman, & Gobbini, 2000; Tong, Nakayama, Moscovitch, Weinrib, & Kanwisher, 2000). Given the mounting evidence that people behave more cooperatively as their actions are more likely to be known to others (Andreoni & Petrie, 2004; Barclay, 2004; Barclay & Willer, 2007; Bixenstine et al., 1966; Kurzban, 2001; Milinski et al., 2002a, 2002b; Rege & Telle, 2004; Sylwester & Roberts, 2010; Wedekind & Milinski, 2000), increased cooperation in response to false cues to observation can be interpreted as a by-product of psychological systems evolved to calibrate behaviour as a function of predictable reputational consequences. Supporting this interpretation, the eyes effect is mediated by expectation of reward and seems to reflect an expectation for improved reputation in the eyes of a third party (Oda et al., 2011). Furthermore, it has been reported that eyes

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have no effect on giving to out-group members but a significant effect on giving to in-group members, among whom a cooperative reputation is more relevant because of the greater likelihood for future cooperative opportunities (Mifune et al., 2010).

Despite a growing number of experiments demonstrating eyes effects, this phenomenon – and in particular any interpretations that involve reputation – has been disputed, especially in light of several experiments in which no eyes effect was reported (Carbon & Hesslinger, 2011; Fehr & Schneider, 2010; Lamba & Mace, 2010; Raihani & Bshary, 2012).

Sorting out this controversy is important because of the significance of the eyes effect to both theory and real-world behaviour. Nettle et al. (2013) performed a meta-analysis of eye effect experiments using dictator games that helped resolve some discrepancies by finding that mean giving (the commonly-reported dependent variable) is less reliably affected by eyes than is the (less commonly-reported) probability of giving more than zero. The current paper focuses on another potential explanation for discrepancies in the literature on eyes effects: procedural differences in exposure to eye images.

As shown in Table 1, studies finding an effect of eyes tend to use methods that make the stimuli suddenly salient just before cooperation is measured. Such methods include abrupt presentation (Haley & Fessler, 2005 – method clarified in personal communication with K. Haley) or modification (Burnham & Hare, 2007; Sparks, 2010) of images, and placing images directly above instructions (Bourrat et al., 2011; Rigdon et al., 2009). In contrast, in experiments where eye images were highly visible and unchanging before and throughout the decision-making process, no eyes effect was observed (Fehr & Schneider, 2010 – method clarified in personal communication with F. Schneider; Sparks, 2010; Tane & Takezawa, 2011). This pattern (see Table 1) hints that the “involuntary neural activation” (Burnham & Hare, 2007) associated with seeing images of eyes or faces, or the effect of that activation on

behaviour, may diminish as exposure to the stimulus increases. No previous research has investigated the duration of the eyes effect, but reduced response to uninformative stimuli is a general pattern of learning (Domjan, 2005). Barclay (Barclay, 2011b) speculated that humans would be likely to habituate to false cues of social presence, much as predators habituate to defensive eyespots displayed by some prey species (Blest, 1957; Edmunds, 1974; Stevens, 2005). More generally, we should predict eventual reduced responses to any particular cue of reputation that is not occasionally associated with real reputational consequences.

In this paper, we report the results of an experiment designed to test whether a brief exposure to eye images has a different effect on generosity than an exposure of several minutes. We predict that participants exposed to eye images for a short time only will be more generous than those not exposed to eyes (replicating previous results) and that those exposed to eye images for several minutes will be less generous than those exposed for a short time. We also report the results of a meta-analysis of 25 eyes effect experiments that tested whether the eyes effect emerges less reliably when methods provide a prolonged exposure to the false cue. If a longer exposure to eyes has less pro-social effect than a short exposure, this would advise researchers and would-be social engineers about using social cues for eliciting cooperation, and help clarify discrepant findings regarding the effects of eyes on cooperation.

## 2. Materials and methods

### 2.1. Experiment

#### 2.1.1. Participants and procedure

188 (47 male and 141 female) Introductory Psychology undergraduate students (average age 18.34 years  $\pm$  SD 1.11 years) participated

**Table 1**  
Only Short Exposures Induce the Eyes Effect.

Study	Effect of eyes <sup>a</sup>	Exposure <sup>b</sup>	Location	Eyes Presentation Details
Haley and Fessler (2005)	yes	short	lab	experiment window resizes, revealing eye images just before game
Current Study: Sudden Eyespots	yes	short	lab	experiment window resizes, revealing eye images just before game
Burnham and Hare (2007)	yes	short	lab	eye images alternate frequently
Sparks (2010) Exp. 3	yes	short	lab	eye images alternate frequently
Mifune et al. (2010) Exp. 1 & 2	yes	short	lab	“call button” on computer screen draws attention to eye images just before game
Rigdon, Ishii, Watabe, and Kitayama (2009)	yes	short	lab	eye images displayed above decision prompt
Bourrat et al. (2011)	yes	short	lab	eye images displayed above decision prompt
Oda et al. (2011)	yes	short	lab	alone in room with eyes painting for 1 min before game
Keller & Pfattheicher (2011) Exp. 1 & 2	yes	short	lab	eye images adorn info sheet presented just before decision prompt
Francey and Bergmuller (2012)	yes	short	bus stop	images on clean-up prompt above bus bench, short exposure time
Ekström (2011)	yes	short	supermarket	images on charitable donation decision screen
Powell et al. (2012)	yes	short	supermarket	stickers on donation bucket
Raihani and Bshary (2012)	yes <sup>c</sup>	short	online	sudden appearance
Carbon and Hesslinger (2011)	no <sup>d</sup>	short	lab	eye images displayed above decision prompt
Bateson et al. (2005)	yes	ambiguous	coffee room	images (changed weekly) on instruction posters above honesty box
Ernest-Jones et al. (2010)	yes	ambiguous	cafeteria	posters (changed daily) on cafeteria walls
Nettle et al. (2013)	yes	ambiguous	lab	posters above desk - field of vision may shift upward during dictator game
Sparks (2010) Exp. 1	no	ambiguous	lab	posters above computer screen - partially in field of vision
Sparks (2010) Exp. 2	no	ambiguous	lab	posters above desk - not in field of vision
Fehr and Schneider (2010)	no	prolonged	lab	eye images visible on computer screen for several minutes prior to task
Tane and Takezawa (2011) Exp. 1 & 2	no	prolonged	lab	eye images visible on computer screen for several minutes prior to task
Lamba and Mace (2010)	no	prolonged	lecture hall	other participants constantly visible during several minutes of game decisions
Current Study: Constant Eyespots	no	prolonged	lab	eye images visible on computer screen for several minutes prior to task

<sup>a</sup> In dictator games experiments, effects of eyes may include different mean generosity and/or probability of giving. See Nettle et al. (2013). Significant effects of eyes were in the direction of increased generosity, with the sole exception of Sparks (2010) Exp 3.

<sup>b</sup> We classify a method as providing short exposure when eye stimuli are suddenly visible or attention is drawn to them shortly before the DV is measured. When eye stimuli are visible and in the participant's line of vision for several minutes, we classify the methods as a prolonged exposure. When stimuli are constantly visible but participant attention may be focused elsewhere, exposure length is ambiguous. We distinguish laboratory and real-world experiments because these environments differ in the presence and intensity of competing stimuli.

<sup>c</sup> Raihani and Bshary (2012) reported no effect of eyes on mean giving. Nettle et al. (2013) reanalyzed their data, finding an effect of eyes on probability of giving.

<sup>d</sup> Carbon and Hesslinger (2011) found no difference between pictures of eyes and pictures of eye-like flowers that were chosen for having “similar overall structure and complexity” to eyes (p. 206); this similarity in response to eyes and eye-like flowers is consistent with evidence that humans respond similarly to faces, face-like images, and vaguely face-like configurations of dots (Bentin et al., 1996; Emery, 2000; Haxby et al., 2000; Rigdon et al., 2009; Tong et al., 2000).

for course credit plus game earnings; the average session size was 3.95 people (SD = 1.26). Sessions began with all participants gathered in a common area, where the experimenter delivered verbal instructions that provided an overview of the tasks, emphasized the anonymity of participants' responses from each other and from the experimenter, and explained how any earnings would be distributed anonymously. Participants were told they would participate in "at least one economic game involving a decision about how to allocate money between yourself and another participant" but that payment would be based on the results of one randomly selected game. They were told, truthfully, that each game involved a different anonymous partner, none of whom would be a participant from the same session. Participants were asked to seat themselves in the adjacent computer room so that the experimenter would not know who used which computer. Participants then seated themselves at computer workstations separated by vertical dividers, read and signed a paper consent form, and began the self-guided computer program. After all participants finished the tasks and left the computer area, they were informed that they each were a part of two dictator games, one in the divider role and one as the recipient. The experimenter entered the computer area, flipped a coin to decide which of the two games the (effectively anonymous) user of each computer would be paid for, and left an envelope containing the appropriate payment in front of the computer. Participants then re-entered the computer area, claimed their envelopes and left. This procedure was approved by the University of Guelph Research Ethics Board and involved no experimental deception.

2.1.2. Experimental design

Participants were randomly assigned to one of three conditions: No eyes (n = 55), Constant Eyespots (n = 64), or Sudden Eyespots (n = 69). As depicted in Fig. 1, the computer's desktop background in the No Eyes condition featured a landscape image (Microsoft's "Bliss"); in both eyespot conditions the background included the stylized eyespots used in previous research (Fehr & Schneider, 2010; Haley & Fessler, 2005; Mifune et al., 2010; Oda et al., 2011). All participants first completed a demographic questionnaire and then a generosity measure known as a Dictator Game (e.g. Haley & Fessler, 2005): each participant was asked to divide \$10, in any whole-dollar increment, between him or herself and an anonymous other participant. In the Constant Eyespots condition, the program window was sized and positioned so that the eye images were visible at all times, whereas in the Sudden Eyespots condition the window covered the eye images during the demographic questionnaire phase. In all conditions, the program window closed after the demographic questionnaire was submitted, fully revealing the desktop images, while a message was displayed for three seconds indicating the next section was loading. When the dictator game screen appeared, the window in the Sudden Eyespots condition was slightly resized so that the eyes would be visible (see Fig. 1). Window size and position in other conditions were unchanged.

2.1.3. Analysis

We tested for effects on mean donation by conducting an ANOVA with condition, participant sex, and the interaction of sex and condition

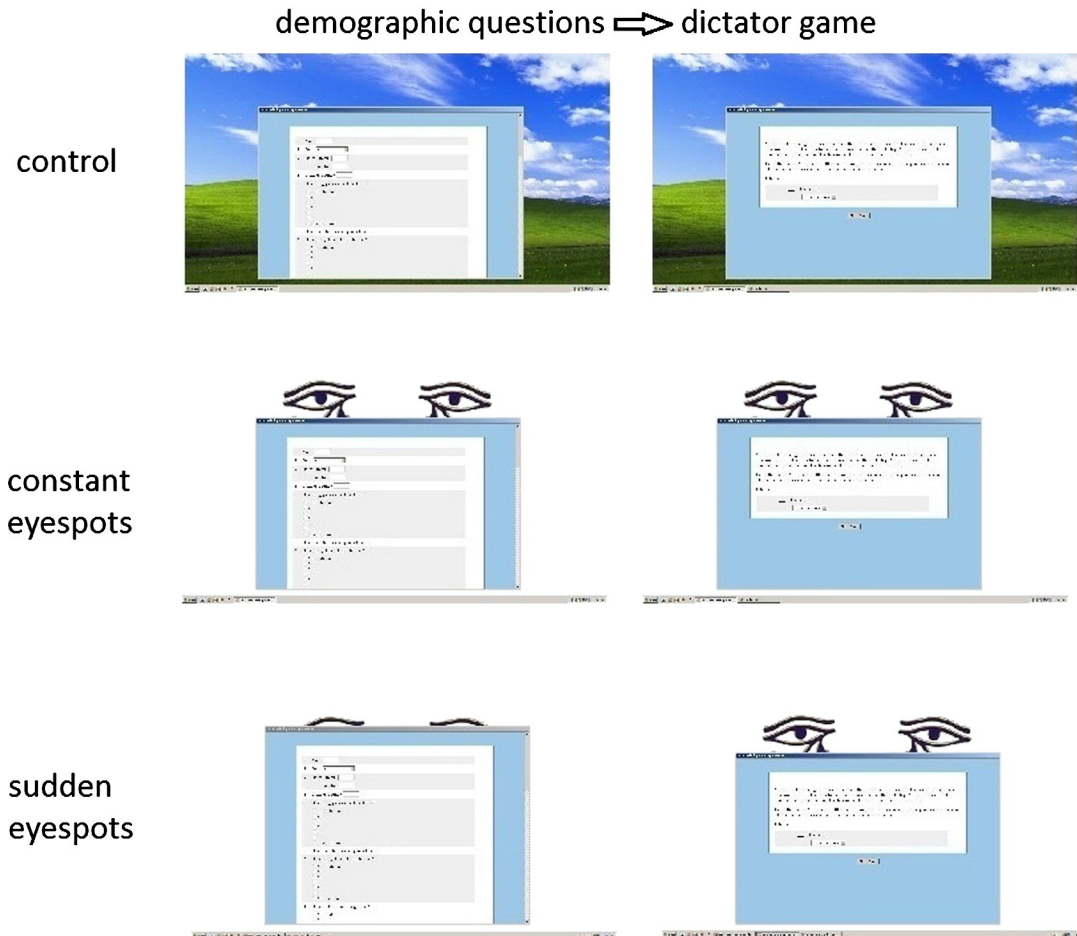


Fig. 1. Participant view during the first two phases of the experiment, by condition.



as predictors of mean donation amount. Participant sex and the interaction of sex and condition were not significant in any analyses, and so we do not discuss them further. We went on to test for differences in mean giving between the three conditions using paired *t* tests with equal variance not assumed. We used a one-tailed test for comparing No Eyes and Sudden Eyespots because previous results (see Table 1) allow a strong directional prediction of greater generosity in the latter condition. To address non-normal distribution of the data, we re-ran our analyses both with non-parametric tests and with a bootstrapped sample, and these alternate analyses produced similar results (see Supplementary Material, available on journal's website at [www.ehbonline.org](http://www.ehbonline.org)).

## 2.2. Meta-analysis

We conducted a simple meta-analysis of eyes effect studies, including 18 published papers containing 21 studies, an unpublished MSc thesis with 3 studies, and the current experiment. We classified these studies by whether any effect of eyes was observed (yes or no) and by length of exposure to eye stimuli (short, prolonged, ambiguous). Table 1 provides more information about these classifications. We used Fisher's exact tests to analyze two-by-two contingency tables in which the ambiguous methods were (1) omitted, (2) reclassified as "short", or (3) reclassified as "prolonged."

## 3. Results

### 3.1. Experiment

Across conditions, 174 of 188 (92.6%) participants gave \$1 or more, and mean giving was \$4.47 (SD = 1.84) out of \$10. This is an unusually high level of generosity for the dictator game, but despite the possibility of ceiling effects, mean giving differed significantly by condition (Fig. 2;  $F_{2,185} = 5.02$ ,  $p = 0.008$ ). Consistent with our predictions and previous results, mean giving was significantly higher in Sudden Eyespots than Constant Eyespots ( $t_{131} = 3.04$ ,  $p = 0.003$ ) and No Eyes ( $t_{122} = 1.67$ ,  $p = 0.049$ ). Mean giving was not significantly different in the No Eyes and Constant Eyespots conditions ( $t_{117} = 1.46$ ,  $p = 0.146$ ). Similar results were produced using non-parametric tests and by bootstrapping the sample (see Supplementary Analyses, available on journal's website at [www.ehbonline.org](http://www.ehbonline.org)), and controlling for session size does not change the pattern of results. The significantly higher average donation in the Sudden

Eyespots condition appears to be the result of trends toward greater likelihood of giving combined with higher average donation contingent on giving (see Supplementary Analyses, available on journal's website at [www.ehbonline.org](http://www.ehbonline.org)).

### 3.2. Meta-analysis

Of 16 studies reporting methods with short exposure to eye stimuli, 15 reported effects of eyes; this near-unanimity is broken only by Carbon and Hesslinger (2011), who found no difference between conditions involving exposures to images of eyes and images of flowers that were chosen for being eye-like. Of 5 studies employing methods allowing prolonged exposure, none found effects of eyes. This difference is highly significant ( $p < 0.005$ ), regardless of whether the studies with ambiguous opportunities for habituation are omitted, classified as "short", or classified as "prolonged".

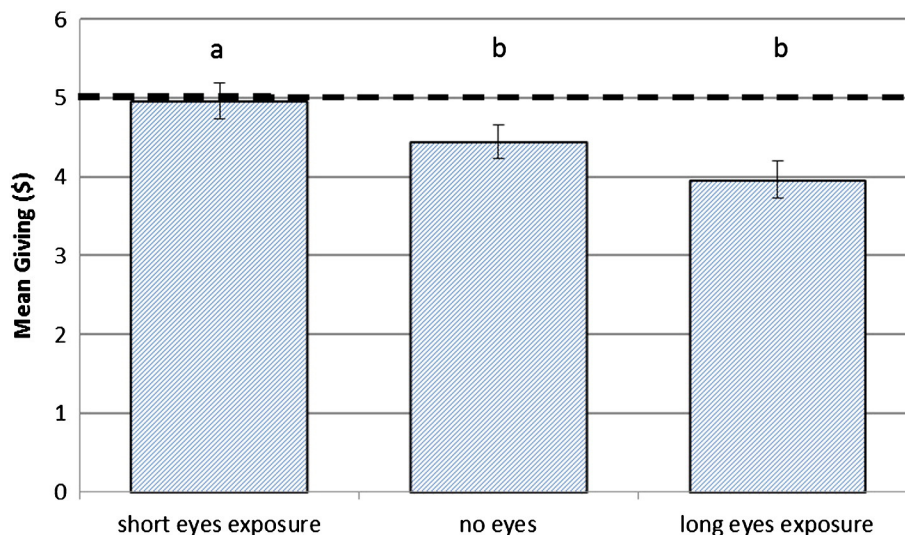
## 4. Discussion

### 4.1. Discussion of results

Our experiment replicates previous findings that people exposed to eyespots just before a giving decision tend to be more generous to anonymous partners than those exposed to a control image. Participants exposed to the same eye images for several minutes longer were no more generous than controls (and if anything were less generous), consistent with our hypothesis that people would disregard the false cue after a longer exposure. Our meta-analysis confirms that generosity differences reliably emerge after a short exposure to eye images, but not after a long exposure. These results are important for three reasons: (1) they demonstrate that experience with a false cue of observation may alter or eliminate the cue's effect on behaviour; (2) they help resolve discrepant findings about whether and when eyes will affect cooperation; and (3) they provide a necessary caution for those testing hypotheses about the effects of implicit reputational cues on cooperation.

### 4.2. The eyes effect as a fleeting, unconscious response to a false social cue

Previous literature on the eyes effect left open the possibility that increased cooperation in response to eye images could be a conscious



**Fig. 2.** Mean number of dollars ( $\pm$  s.e.m.) given in the Sudden Eyespots, No Eyes, and Constant Eyespots conditions. Different letters represent significantly different means: only the short exposure was significantly different from the other conditions. The dotted line represents a fair split, which is effectively the ceiling, and only the short exposure was not significantly different from this ceiling (Supplementary Analyses, available on journal's website at [www.ehbonline.org](http://www.ehbonline.org)).

choice. If this were the case, we would expect that increased exposure length would enhance the effect. Our experiment and meta-analysis show that the effect is eliminated, not enhanced, by increased exposure length. This strengthens the argument that the eyes effect is an involuntary, subconscious response (Burnham & Hare, 2007).

We suggest that people are almost constantly, and often subconsciously, evaluating their social environments for cues as to whether, and by whom, their words and deeds will be observed, and that the outcome of this process serves as an input into social decision-making. The process of evaluating one's environment (social or otherwise) involves detection of, interpretation of, and response to stimuli. Our data are consistent with at least two mechanistic causes. The first, habituation, can be defined as "a decrease in responsiveness to a stimulus when that stimulus is presented repeatedly or for a prolonged time" (McSweeney & Murphy, 2000, p. 348). Habituation is a phylogenetically-diffuse homeostatic process that evolved to filter out irrelevant stimuli (Eisenstein, Eisenstein, & Smith, 2001). Habituation may occur in response to stimuli continually present during an experimental session, even a single prolonged exposure, which may account for within-session changes in behaviour (McSweeney, Hinson, & Cannon, 1996; McSweeney & Murphy, 2000). Thus, we suggest that the vast literature on habituation and related learning phenomena may provide a useful guide for further investigation of the eyes effect or other situations where people eventually ignore false fitness-relevant cues. For example, more research is needed to determine if other characteristics of habituation are present (e.g. spontaneous recovery, dishabituation, and variety effects; reviewed by McSweeney & Murphy, 2000). A second (and possibly non-mutually-exclusive) mechanistic interpretation is that the appearance of eyes triggers unconscious eye-detection mechanisms which in turn activate an appraisal of social scrutiny, but the appraisal is deactivated as further inspection of the cues reveals them to be false (e.g. they are two-dimensional and haven't moved or changed). This interpretation is consistent with the modularist cognitive models invoked by Haley and Fessler (2005), and more generally is consistent with dual- or multi-route decision making models in which emotionally-relevant stimuli exert rapid, unconscious effects on behaviour, but slower-acting conscious pathways can eventually override the initial response (e.g. Bechara, Damasio, Tranel, & Damasio, 1997). We are agnostic about the mechanistic interpretation of the current results, and we look forward to future investigations of this. The important point is that both processes predict that people will eventually come to ignore false cues of fitness-relevant stimuli.

Reinterpreting the eyes effect as a fleeting, unconscious response to a false social cue helps resolve controversy generated by several anomalous findings.

#### 4.3. Reinterpreting previous research on the eyes effect

Tane and Takezawa (2011) found no effect of eye images on dictator game decisions made in darkness; however, their experiments involved exposures of greater than 3 min, so their null effect may be due to exposure length rather than darkness.

Fehr and Schneider (2010) reported a null effect of eyes on reciprocation of trust and argued that their results undermine claims that uncontrolled implicit reputational cues have much influence over cooperative decision-making in economic games, which in turn cast doubt on the hypothesis that reputational concerns contribute to non-zero levels of cooperation in anonymous situations (Kurzban, 2001; Haley & Fessler, 2005; Mifune et al., 2010; Oda et al., 2011; Bateson et al., 2006; Ernest-Jones et al., 2011). We offer a different interpretation of their results. Given the strong effect of their explicit reputation condition, reputational concerns do seem to be relevant to their task. The question then becomes: Why doesn't the particular cue to reputation used by Fehr and Schneider influence behaviour in their experiment? A possible answer is that prolonged exposure to eye

stimuli in the implicit reputation condition (personal communication with F. Schneider) afforded participants the opportunity to learn to disregard the false reputational cue, and/or for slow-acting pathways to override the fast-track emotional response to the false cue.

More speculatively, other reported null effects of observational cues may be explained by participants' previous experience evaluating their anonymity in the experimental context. University students, whom we suspect have ample experience evaluating their privacy while making sensitive decisions in public lecture halls, showed no difference between anonymous bargaining offers made in a private versus in a lecture hall with roughly 15 others (i.e. no eyes vs. real eyes), again in contrast to a strong effect of an explicit reputation condition (Lamba & Mace, 2010). Before Nettle et al. (2013) reanalyzed their data and found an effect of eyes on likelihood of donating, Raihani and Bshary (2012) speculated that average donations were unaffected by eye images because their participants were experienced completing anonymous surveys from their homes. We'd further suggest that frequent Internet users' chronic exposure to advertisements provides them ample experience at ignoring task irrelevant stimuli specifically designed to attract attention and change their behaviour. Future research could test whether less familiar observational cues have (stronger) effects on cooperative behaviour in these contexts. Such tests would help resolve the dispute over the extent to which reputational concerns influence anonymous, one-shot cooperation (Haley & Fessler, 2005; Fehr & Schneider, 2010; Raihani & Bshary, 2012; Tane & Takezawa, 2011; Nettle et al., 2013). Overall, it appears that most, if not all, of the known failures to find an effect of eyes can be attributed to either long exposures (present study) or to an analysis of mean donations without also analyzing the probability of donating at all (Nettle et al., 2013).

#### 4.4. Applications

Researchers attempting to create eyes effects in the laboratory should carefully consider the duration of the effect. In our Constant Eyespots condition, where no eyes effect was observed, eyes were visible for a mean time of 207.6 (SD = 53.8) s before participants were confronted with a cooperative task, significantly longer than the 60 s exposure for which an eyes effect has been reported ( $t_{63} = 21.9$ ,  $p < .001$ ) (Oda et al., 2011). Real-world experiments have shown effects of eye images on posters visible for longer than several minutes, though images were changed on a daily (Ernest-Jones et al., 2011) or weekly (Bateson et al., 2006) basis. Nettle et al. (2013) report eyes effects using posters in the lab, but Sparks (2010) found no effect of eye posters in laboratory experiments. Procedural differences may account for the discrepancy. Future research could investigate whether laboratory environments promote more rapid habituation to false reputational cues than real-world settings, perhaps because labs are often devoid of competing stimuli. Future research could also examine whether some cues of reputation are more quickly disregarded than others, possibly because of the realism of the cues (e.g. Magurran & Girling, 1986) or because the cues are associated with rare but important life events. Individual differences in susceptibility to the eyes effect also deserve further investigation.

For those attempting to use eye posters to promote real-world cooperation, previous research suggests they'll be most effective if few real observers will be present (Ernest-Jones et al., 2011; Ekström, 2011; Nettle et al., 2013). A habituation interpretation of our results suggests that eye images could be less effective if the same individuals will see them repeatedly, and that frequently changing the images may preserve their effectiveness.

#### Supplementary Materials

Supplementary data to this article can be found online at <http://dx.doi.org/10.1016/j.evolhumbehav.2013.05.001>.

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