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Pupil to pupil: The effect of a partner's pupil size on (dis)honest behavior

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ABSTRACT

Being observed by others fosters honest behavior. In this study, we examine a very subtle eye signal that may affect participants' tendency to behave honestly: observed pupil size. For this, we use an experimental task that is known to evoke dishonest behavior. Specifically, participants made private predictions for a coin toss and earned a bonus by reporting correct predictions. Before reporting the (in)correctness of their predictions, participants viewed videos of partners with dilating or constricting pupils. As dilating pupils are generally perceived positively, we expected that dishonesty would be reduced when participants look into the eyes of a partner with dilating pupils, especially when their own pupil size mimics the observed pupil size. In line with this prediction, Experiments 1 and 2 showed that, when earning a bonus meant harming the interaction partner, dishonesty occurred less frequently when the partner's pupils dilated rather than constricted. That is, when the interests of the self and the other conflict, participants use the pupil of the partner as a social cue to inform their behavior. However, pupil mimicry was not observed. In Experiment 3, we examined pupil mimicry and dishonesty in a context where there was no temptation to hurt the partner. Here, pupil mimicry between partners was observed, but there were no effects of the partner's pupil on dishonesty. Thus, when dishonesty harms the interaction partner, participants use pupillary cues from their partner to inform their behavior. Pupil mimicry, however, is bound to non-competitive contexts only.

Throughout their daily lives, people are often tempted to bend ethical rules and normative standards. People cheat when filing their tax report, fail to mention defects in the car they sell, buy a second class train ticket but travel first class, download illegal software and music, and deliberately overestimate the price of their stolen camera on insurance forms (Mazar, Amir, & Ariely, 2008). Combined, these transgressions create substantial societal costs - it is estimated that in the UK, the national treasury loses £ 25 billion annually due to people underpaying their taxes (Levi, 2010). Similarly, 35% of global software is estimated to the pirated, amounting to 40 billion USD per year in foregone income (Miyazaki, Rodriguez & Langenderfer, 2009). When a person prepares to engage in such dishonest behavior, this involves a trade-off between the personal gain that can be obtained, and the ethical and moral implications of dishonesty. That is, when people act dishonestly they must justify the violation of morality (Fischbacher & Föllmi-Heusi, 2013; Haidt, 2007; Shalvi, Handgraaf, & De Dreu, 2011). Accordingly, people rarely "lie all the way" and more often strike some middle ground between outright lying and strict honesty (Shalvi et al., 2011).

Apart from justifying violations of morality as an abstract concept ("thou shalt not lie"), dishonesty also requires justifying possible negative effects it has on others. Indeed, previous research has shown that the occurrence of dishonesty is shaped by social concerns. Dishonest behavior is substantially reduced when people feel they are observed rather than anonymous (Bateson, Nettle, & Roberts, 2006; Zhong, Bohns, & Gino, 2010). Even the presence of eye-like stimuli can trigger increases in pro-social behavior (Bateson et al., 2006; Haley & Fessler, 2005; Nettle et al., 2013). These findings support a functionalist approach to morality (Haidt, 2007), which suggests that being moral and honest enables people to maintain the positive social reputation required for being part of a group (Izuma, 2012). Beyond these functionalist elements, the incidence of dishonesty is also determined by more pro-social concerns, like the effect it has on other people. The incidence of dishonesty is reduced when it has negative effects on specific others, instead of, for instance, large, abstract institutions such as tax authorities or multinational companies (Gneezy, 2005). Dishonest behavior also depends on *who* is affected by it: dishonesty is less likely when it has negative effects on those seen as part of one's in-group

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(Mealy, Stephan, & Urrutia, 2007; Mifune, Hashimoto, & Yamagishi, 2010), when it harms people who are perceived as cooperative rather than competitive (Steinel & de Dreu, 2004), or individuals with whom one shares a common fate (Shalvi & De Dreu, 2014; Weisel & Shalvi, 2015). These factors that trigger concern for those who might be harmed by dishonesty need not be observed directly, but can also be inferred from very subtle social cues (Kret, 2015).

One such subtle social cue that can influence (dis)honesty is an interaction partner's pupil size. The eyes are an important source of social information. Both infants and adults use information from their partner's eyes to identify social and emotional signals, and follow gaze (Farroni, Csibra, Simion, & Johnson, 2002). The social and communicative functions of the human eyes are supported by their unique morphology. The contrast between the exposed sclera (eye-white) and the darker iris is a feature unique to human eyes (Kobayashi & Kohshima, 1997), which draws attention to the middle of the eye, to the pupil and to changes in its size (Kret, Tomonaga, & Matsuzawa, 2014). The pupil dilates in response to changes in ambient light, but also reflects on-going cognitive effort, interest, surprise, or uncertainty, as well as other emotions (Bradshaw, 1967; Hess & Polt, 1960; Hess, 1975; Lavín, San Martín, & Jubal, 2013). Moreover, pupil size is autonomic, that is, it cannot be controlled (Prochazkova & Kret, 2017). As such changes in pupil size provide an honest reflection of the person's inner state and thus may be a particularly relevant source of information for observers when making social decisions (Kret et al., 2014; Kret & De Dreu, 2017; Kret, Fischer, & de Dreu, 2015). In the current study, we are interested in how pupil size is *interpreted* by those who observe it.

A number of studies have examined how pupil dilation is interpreted, showing that those with large pupils are generally perceived positively by their interaction partners (Kret, 2017). They are judged to be attractive, sociable, and trustworthy, and those with small or constricting pupils cold, distant and untrustworthy (Amemiya & Ohtomo, 2012; Harrison, Singer, Rothstein, Dolan, & Critchley, 2006; Hess, 1975; Kret et al., 2015; Tombs & Silverman, 2004; Weibel, Stricker, Wissmath, & Mast, 2010). In a line of studies using the Trust Game, Kret et al. (2015) showed that people are more trusting of partners with dilating pupils than those with constricting pupils. That is, people use the pupil dilation of a partner as a source of social information, to inform their behavior towards that partner. In the trust game participants rely on the partner to return a proportion of the money they have invested. That is, their concern for social cues from their interaction partner may stem ultimately from self-interested concern for their own pay-offs. Will this person exploit me or can I trust them? In the current study, participants' outcomes do not depend on the behavior of the interaction partner, and we are interested in whether in such a case their behavior will be affected by pupillary cues from the interaction partner. Specifically, we examine whether pupil cues from a partner reduce participants' tendencies to engage in dishonest behavior.

There is some evidence that the mechanism behind the effects of pupil dilation on behavior is the mimicry of pupil sizes between interaction partners (Kang & Wheatley, 2017; Kret et al., 2015). Generally, interpersonal mimicry is known to increase affiliation and liking (Hove & Risen, 2009; Lakin, Jefferis, Cheng, & Chartrand, 2003), and reduce prejudice (Inzlicht, Gutsell, & Legault, 2012). In an experiment where participants played trust-games with different partners, it was observed that participants were more likely to base their trust on changes in the pupil size of the partner when they mimicked the pupil size of that partner (Kret et al., 2015; Kret & De Dreu, 2017). Thus, when an interpersonal cue like pupil dilation is mimicked, this has positive consequences and fosters trust and shared consciousness between partners (Kang & Wheatley, 2017). However, findings from the literature on both facial and pupil mimicry have shown that mimicry occurs preferentially between people from the same group, and that mimicry is less common, and may even be reversed when interacting with out-group members (e.g. Hess & Fischer, 2013; Kret et al., 2015; Kret & de Dreu, 2017). Likewise, competition has been shown to reduce affiliative tendencies and mimicry (Chartrand & Bargh, 1999; Lakin & Chartrand, 2003). In other words, pupil mimicry is modulated by the relationship between self and other: it occurs mostly in "benevolent" interpersonal contexts. Crucially for the current study, in contexts where one is tempted to harm the interaction partner, affiliative behaviors like mimicry are undesirable (Bourgeois & Hess, 2008). These findings suggest that perhaps in competitive contexts like dishonesty, where the participant is tempted to exploit an interaction partner, pupil mimicry may not occur. Here we assess whether this is the case, and whether observed pupil dilation may affect behavior through other routes.

In the current set of studies, then, we examine whether i) interacting with a partner with dilating rather than constricting pupils reduces dishonest behavior, and ii) whether this effect is mediated by pupil mimicry. Across three independent studies, we predict that dishonest behavior is reduced when the pupils of the interaction partner dilate. Moreover, we examine whether this effect can be explained through the mimicry of pupil sizes: we predict that when dilating pupils of the interaction partner are mimicked this leads to more positive perceptions of the interaction partner, which facilitates a decrease in dishonesty. To evaluate these hypotheses, participants were asked to predict the outcomes of a series of private coin tosses. Participants could win money through dishonesty, by overstating the number of correct predictions they made (Greene & Paxton, 2009; Shalvi et al., 2011). Before reporting the correctness of their prediction, participants saw a short video of an interaction partner with either dilating or constricting pupils (Bateson et al., 2006; van der Schalk, Hawk, Fischer, & Doosje, 2011). During the task, participants' own pupil size was recorded. In this way, we examine whether the pupil size of the partner affects the tendency to win money by dishonesty, and the role played by pupil mimicry.

1. Experiment 1

The hypotheses for Experiment 1 are as follows. First, we predict that participants will be less dishonest when interacting with a partner with dilating pupils, compared to a partner with constricting pupils. With regards to pupil mimicry, we predict that the participant's pupil size will mimic the pupil size of their partners, and that this will mediate the effect of partner's pupil size on dishonesty. We also include a direct gaze and an averted gaze condition. Direct gaze facilitates eye-contact (Emery, 2000), and provides the optimal situation to observe other features of the interaction partner's eyes. Thus, direct gaze might strengthen the effects of observed pupil dilation on dishonesty.

1.1. Method

We report all measures, manipulations, and exclusions in these studies, either in this section or the supplementary materials.

1.1.1. Participants

Forty-two participants (10 males, 23.8%) were recruited from amongst University of Amsterdam students. Exclusion criteria were trauma or surgery to the eyes, neurological or psychiatric conditions, and use of substances that may affect the pupil response, such as medication, drugs and coffee, less than 3 h before the experiment. The mean age was 21.4 years (min = 18 years old, max = 27 years old). Participants had (corrected to) normal vision. The experimental procedures were in accordance with the Helsinki Declaration and approved by the ethical board of the University of Amsterdam.

For this first Experiment, we based our expectations regarding effect size on those reported in Kret et al. (2015), which showed small effect sizes for pupil mimicry. Power analyses indicated that for a repeated measures within-participants design in which participants complete 72 trials each, a minimum of 40 participants was required to detect small effects at a power of $1 - \beta > 0.8$, and a p-threshold of $p = 0.05$. Once