Being Observed Does Not Boost Rule Retrieval

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OPEN DATA

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ABSTRACT

Previous research, mainly focusing on the situational preconditions of rule violations, indicates that feelings of being watched by other agents promote rule compliance. However, the cognitive underpinnings of this effect and of rule violations in general have only attracted little scientific attention yet. In this study, we investigated whether cues of being observed not only reduce the likelihood of violating rules but also affect the underlying cognitive processes of such behavior when still putting a rule violation into action. Therefore, we applied a motion-tracking paradigm in which participants could violate a simple stimulus-response mapping rule while being faced with pictures of either open or closed eyes. In line with prior research, temporal and spatial measures of the participants' movements indicated that violating this rule induced substantial cognitive conflict. However, conflict during rule-breaking was not moderated by the eye stimuli. This outcome suggests that rule retrieval constitutes an automatic process which is not or is only barely influenced by situational parameters. Moreover, our results imply that the effect of perceived observation on rule conformity is driven by normative influences on decision-making instead of social facilitation of dominant action tendencies.

INTRODUCTION

Crossing a red light, littering, or stealing a bike. There are numerous kinds of rule violations with different consequences for the rule-breaking agent and society. In this study, we investigated how cues of being observed affect cognitive processes underlying rule-violating behavior. Previous research in this field mainly adopted a third-person perspective, focusing on how contextual and personal factors influence the occurrence of rule-violating behavior (e.g., Hilbig & Zettler, 2009). One important finding is that the mere presence of other agents, or rather perceived observation, increases conformity to rules and social norms (Dommes et al., 2015; Pedersen et al., 1986). Even subtle social cues such as simple pictures of open eyes created such an effect in economical decision-making games (Haley & Fessler, 2005) as well as in several naturalistic settings regarding littering (Bateson et al., 2013; Ernest-Jones et al., 2011), bike theft (Nettle et al., 2012), donations for charity (Fathi et al., 2014), and paying for drinks via an honesty box (Bateson et al., 2006). Even though it can be questioned whether such subtle social cues lead to feelings of observation comparable to the presence of real agents (Carbon & Hesslinger, 2011; Nettle et al., 2013), the effect of perceived observation on rule conformity seems to be robust.

Whereas the impact of observation on rule violation has been discussed at length in the literature, the underlying cognitive mechanisms of this phenomenon have received only little attention so far. Focusing on the outcome of decision-making processes suggests a major role of normative social influence, as documented in classic studies on conformity (Asch, 1956; Cialdini & Goldstein, 2004; Deutsch & Gerard, 1955; Sherif, 1936). In contrast, theories of social facilitation (Zajonc, 1965) suggest that perceived observation increases the influence of dominant action tendencies (Bond & Titus, 1983; Zajonc, 1966).

Recent findings on rule violation have suggested that rule abidance is a dominant action tendency even when agents intend to violate a rule or norm (Pfister, Wirth, Schwarz, Steinhauser et al., 2016). In contrast to earlier research in this field, the current study adopted a first-person perspective on rule violations, focusing on the cognitive processes occurring at the very moment a rule is violated. Therefore, it did not target the question of whether an agent breaks a rule under certain conditions, but rather the cognition and performance when actually enacting a rule-breaking intention. A key question in this line of research is whether a rule continues to affect cognition and behavior even after an agent has decided to go against this rule. This is indeed the case. Converging evidence for this claim comes from studies using a range of different empirical approaches including movement-trajectory analysis (Pfister, Wirth, Schwarz, Steinhauser et al., 2016; Wirth et al., 2016), mental chronometry (Wirth et al., 2018), and electroencephalography (Imhof & Rüsseler, 2019; Pfister, Wirth, Schwarz, Foerster et al., 2016). The available findings consistently indicate that rule-violating actions are accompanied by direct and immedi-

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ate retrieval of rule-abiding action tendencies. This effect holds true in abstract setups that neither impose motivational temptations for rule-breaking nor punish this kind of behavior, but it occurs similarly when rule violations are rewarded financially (Pfister et al., 2019). However, it is an open question whether the available evidence for rule retrieval indicates full or partial retrieval of rule-abiding action tendencies.

In the experiment presented here, we examined whether cues of being watched affect the cognitive underpinnings of rule-breaking actions by fostering retrieval of rule-abiding action tendencies. We applied a state-of-the-art motion-tracking paradigm (Pfister, Wirth, Schwarz, Steinhauser et al., 2016; Wirth et al., 2016) in which participants indicated before each trial whether they will follow or break an arbitrary stimulus-response mapping rule. At the same time, we either presented cues of observation (open eyes as used in Bateson et al., 2006) or control images (closed eyes). We expected cognitive conflict for rule violations as quantified in four temporal and spatial measures derived from trajectory analysis. Importantly, if cues of being watched were to moderate immediate retrieval of rule-abiding behavior, this conflict should be magnified for open as compared to closed eye cues. Contrary to this speculation, we did not find evidence for such a moderating effect, suggesting that previous reports are mainly due to normative social influence rather than (social) facilitation.

METHOD

Participants

We collected data of 28 participants. Previous research on the effect of observation cues in tasks that assess choice behavior has often yielded medium to large effects (e.g., $d = 0.63$ in Bateson et al., 2006; $d = 0.80$ in Nettle et al., 2012). Testing for a generic large effect size of $d = 0.80$ would have required 14 participants for a power of $1\text{-}\beta = 80\%$ ($\alpha = .05$, two-sided testing; calculated with the power.t.test function in the statistics package *R*, version 4.0.3). We tested twice as many participants to ensure sufficient power also in the face of dropouts. We did not observe enough observations per design cell for five participants (who did not commit more than 10 violations across the entire experiment; see Wirth et al., 2020, for corresponding recommendations), and one participant indicated in the post-questionnaire that they did not directly move the mouse cursor to one of the two target destinations but moved straight upwards first and then to the right or left target area. Therefore, the movement trajectory could not be used as an indicator for potential cognitive conflict (see the Materials and Procedure section for details). Therefore, our final sample consisted of 22 participants (21 females, 21 right handers; $M_{age} = 20.2$ years, $SD = 2.2$ years) who earned course credit for their participation. This effective sample size still provided a power of $1\text{-}\beta > 80\%$ for the smaller of the two effect sizes indicated above. Our experimental design was declared as ethically unobjectionable by the ethics committee of the Institute of Psychology of the University of Würzburg (GZEK 2016-02).

Materials and Procedure

The experiment was conducted at a laboratory of the University of Wuerzburg. Participants gave written informed consent and received detailed instructions regarding the task. At the beginning of the study, we introduced a stimulus-response mapping rule. Participants were informed that there are two target stimuli (square and triangle) which are mapped to two target areas in the upper left and upper right side of the screen (e.g., if the target stimulus is a triangle, participants should move the cursor to the right target area). The exact mapping was balanced over participants but constant for each participant across the experiment. Before each trial, participants indicated whether they wanted to follow or break this stimulus-response mapping rule. Querying this action intention allowed us to differentiate between deliberate rule violations and unintentional action slips. The corresponding display showed two boxes containing the statements “Follow rule” and “Break rule” (German originals: “Regel befolgen” vs. “Regel brechen”). Participants indicated their choice by pressing either “F” or “V” on the computer keyboard with their left hand (middle vs. index finger), while the location of the two options was counterbalanced across participants. Afterwards, a new screen displaying a home area (1.4 cm in diameter) in the bottom centre as well as two target areas (1.4 cm in diameter) in the upper left and upper right side of the screen appeared. The inter-center distance between home area and each target area measured 11.9 cm and the inter-center distance between both target areas was 12.6 cm. There were two target stimuli (square and triangle; bounding box: 1.2 cm × 1.2 cm), each mapped to one of the two target areas. The mouse cursor was represented by a small circle (0.5 cm in diameter). To start each trial, participants had to move the mouse cursor to the home area and keep it there for at least 500 ms. After this time, the target stimuli appeared, indicating to which target area the participant should move the mouse cursor as fast as possible (depending on the preceding response to follow or break the rule). Figure 1 shows the procedure of a typical trial.

To measure movement trajectories, we sampled x and y coordinates of the mouse cursor at approximately 140 Hz. Moreover, we measured the time from onset of the target stimulus until the cursor had left the home area (initiation time, IT) as well as the time from leaving the home area until reaching one of the target areas (movement time, MT). After this, the cursor disappeared and the screen was blanked 500 ms later. The next trial started 1000 ms later and we did not display any written feedback besides of encouraging participants to respond more quickly when they had not started a movement within 500 ms after target onset. To manipulate feelings of being watched, we presented pictures of eyes (30.6 cm × 11.5 cm), which were either open (observation trials) or closed (control trials). These images were presented on two separate screens located directly behind the laptop on which the experiment was conducted (see Figure 2). In total, there were 8 blocks with 48 trials each, 12 trials for each combination of eye state (open vs. closed) and target location (left vs. right).

At the end of the experiment, participants indicated on a scale from 1 to 7 (1 = *not at all*, 7 = *absolutely*) whether they tried to ignore the

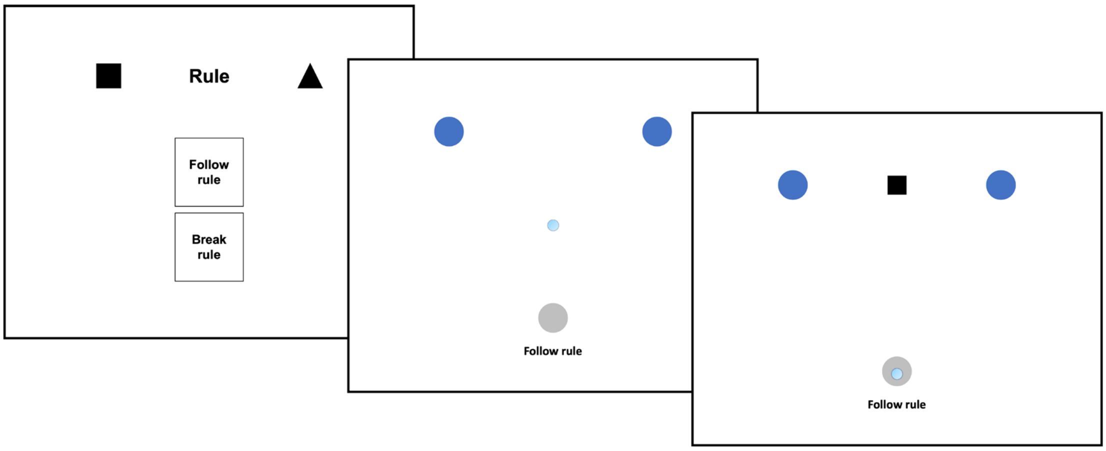

FIGURE 1.
Trial procedure. First, participants indicated whether they intended to follow or break the stimulus-response mapping rule displayed above. Afterwards, they had to move the mouse cursor to the home area to make the target stimulus appear.

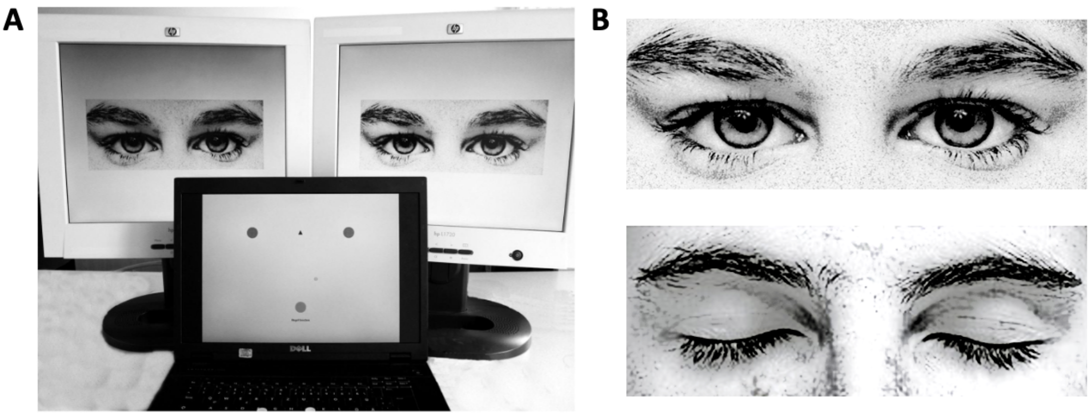

FIGURE 2.
Panel A: Illustration of the experimental setup. Participants conducted the experiment on the laptop in the foreground while the eye stimuli were presented on two additional screens in the background. Panel B: The eye stimuli used in the study.

depicted eyes and whether they felt especially watched in trials containing pictures of open eyes.

RESULTS

Data Treatment and Analyses

We preprocessed trajectory data using custom MATLAB scripts (The MathWorks, Inc.) to determine the maximum absolute distance (MAD) and area under the curve (AUC) between each actual trajectory and a straight line from the movement's start- to endpoint. Movements to the left were mirrored at the vertical midline to allow plots of averaged trajectories. We stripped off all data before the cursor had left the target area (i.e., until IT), and time-normalized the remaining data to 100 points by linear interpolation. We computed MAD as the (signed) maximum Euclidean distance from these points to the reference line (in px), with positive values indicating deviation in direction of the opposite target. Similarly, AUC was computed as the signed area between the interpolated points and reference line (in px^2). We did not analyze the first block as well as the first trial per block for each participant. Furthermore, we excluded trials in which participants did not behave according to their prior compliance response (i.e., rule-breaking action but intended rule-abidance and vice versa) and trials in which IT, MT, MAD, or AUC deviated more than 2.5 *SD*s from their corresponding cell mean, excluding 10.5% of the trials in total.

For all dependent variables, we calculated a repeated-measures analysis of variance (rmANOVA) with the factors of observation (eyes open vs. eyes closed) and rule compliance (correct vs. violation).

Manipulation Check

Participants followed the rule in *M* = 58.7% (*SD* = 9.8%) of all trials. In our observation condition, we observed *M* = 59.2% (*SD* = 9.8%) valid rule-abiding trials for analysis compared to *M* = 58.2% (*SD* = 10.5%) in the eyes closed condition (note that participants indicated their choice before seeing the eye stimuli). On a scale from 1 to 7 (1 = *not at all*, 7 = *absolutely*) participants on average reported a 3.36 (*SD* = 1.87) regarding the question how much they tried to ignore the eye stimuli and a 2.68 (*SD* = 1.46) regarding the question how much they felt watched by the open eyes.

Temporal Measures

IT and MT were significantly higher for rule-violating trials (see Figure 3), IT: $F(1, 21) = 33.27$, $p < .001$, $\eta_p^2 = .61$; MT: $F(1, 21) = 15.66$, $p = .001$, $\eta_p^2 = .43$. None of the measures was affected by the observation cue, *Fs* < 1, and there was no interaction, IT: $F < 1$; MT: $F(1, 21) = 1.53$, $p = .229$, $\eta_p^2 = .07$.

Movement Trajectories

MAD and AUC were significantly higher for rule violating trials (see Figure 4), MAD: $F(1, 21) = 24.89$, $p < .001$, $\eta_p^2 = .54$; AUC: $F(1, 21) = 21.27$, $p < .001$, $\eta_p^2 = .50$, but they were not affected by the observation cue, and there was no interaction, *Fs* < 1.

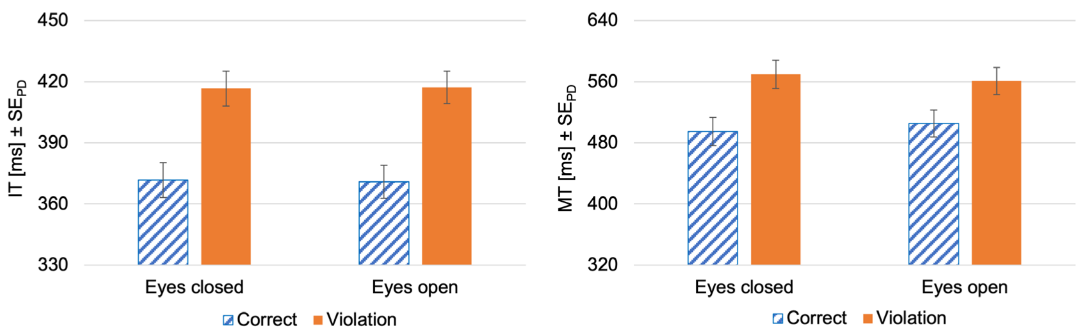

FIGURE 3.

Initiation times (IT, left plot) and movement times (MT, right plot) for each combination of rule compliance (correct vs. violation) and observation condition (eyes closed vs. eyes open). Error bars represent standard errors of paired differences (SEPD, Pfister & Janczyk, 2013) calculated separately for each observation condition.

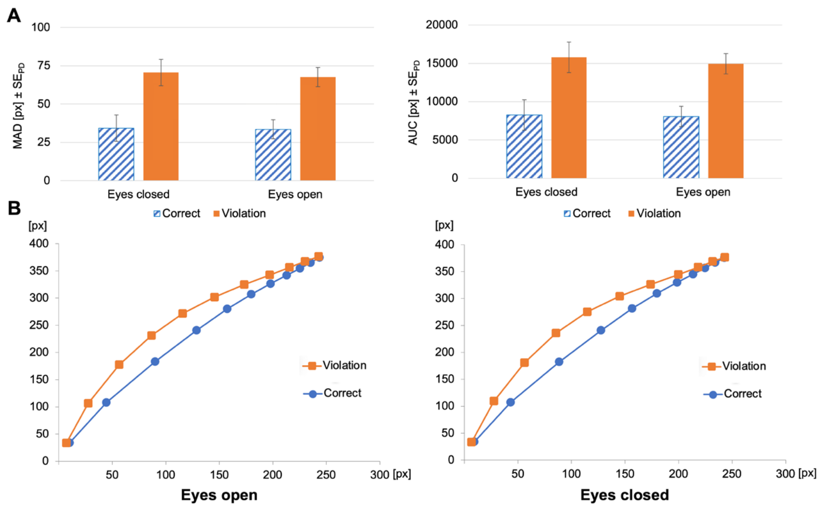

FIGURE 4.

A) Maximum absolute distance (MAD, left plot) and area under the curve (AUC, right plot) for each combination of rule compliance (correct vs. violation) and observation condition (eyes closed vs. eyes open). Error bars represent standard errors of paired differences (SEPD, Pfister & Janczyk, 2013), calculated separately for each observation condition. B) Mean time-normalized movement trajectories for the observation condition (eyes open, left plot) and the control condition (eyes closed, right plot). Dots represent cursor coordinates in 10%-steps of normalized movement time.

DISCUSSION

In the current study, we investigated the influence of perceived observation on the cognitive underpinnings of rule violating behavior. Therefore, we applied a motion-tracking paradigm in which participants could violate an arbitrary stimulus-response mapping rule. To manipulate feelings of being watched, we presented pictures of eyes which were either open or closed. Movements in rule-violating trials were significantly slower and their trajectory was characterized by a stronger deviation towards the alternative response option compared to rule-abiding trials. Even though we applied a completely arbitrary rule, rule violations induced substantial cognitive conflict as suggested in previous work (Pfister, Wirth, Schwarz, Steinhauser et al., 2016; Wirth et al., 2016). Importantly, the extent of cognitive conflict during rule-violating behavior was not affected by our observation cue.

As participants indicated in the post-questionnaire that they only felt slightly observed by the open eyes, it is possible that our manipulation was not strong enough to create a sufficiently strong feeling of being watched. Consequently, future research should try to present the observation cues in a more salient fashion (e.g., using dynamic stimulation) or could also use real persons to induce feelings of being watched (for determinants of the feeling of being watched, see Muth et al., 2017). Moreover, as rightly pointed out by an observant reviewer, the setup of our rule violation task itself might have reminded some participants of a face (target areas as eyes and home area as mouth). Construing the setup in this way might have created feelings of being watched independent of the experimental manipulation. This influence could have potentially overshadowed an observation-effect induced by the open eyes. Finally, in contrast to most real-word scenarios, participants in our experiment did not have to fear any punishment for rule-violating behavior. The strong effect of social presence on rule compliance, as suggested by field studies (e.g., Dommes et al., 2015), might be closely linked to the possibility of being punished.

The present null result supports the assumption that rule retrieval constitutes a surprisingly automatic process (Pfister, Wirth, Schwarz, Steinhauser et al., 2016; 2019; Wirth et al., 2016). This notion is further supported by post-hoc analyses suggesting that the rating of how much participants tried to ignore the eyes did not correlate with the AUC difference of rule violations with open and closed eyes, $r(21) = .05$, $p = .815$. Such correlational results require a cautious interpretation due to our limited sample size for these analyses. However, assuming an absent correlation in the population implies that prior findings which showed a significant effect of perceived observation on rule violation (e.g., Bateson et al., 2006) can be traced back to normative influences on decision-making (Cialdini & Goldstein, 2004) instead of increased rule retrieval in the presence of others (Zajonc, 1965).

Summarized, our results suggest that rules and social norms are activated automatically, leading to immediate retrieval of rule-abiding action tendencies, and therefore the cognitive foundations of rule violations are not affected by cues of observation. Follow-up studies should determine whether this is also true for a less subtle or more naturalistic manipulation of perceived observation.

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Both authors contributed equally to this work.

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DATA AVAILABILITY

Raw data, pre-processing and analysis syntax, as well as the program file are available on the Open Science Framework: https://osf.io/yb94m/

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