Being Observed Magnifies Action

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We test the hypothesis that people, when observed, perceive their actions as more substantial because they add the audience's perspective to their own perspective. We find that participants who were observed while eating (Study 1) or learned they were observed after eating (Study 2) recalled eating a larger portion than unobserved participants. The presence of others magnified both desirable and undesirable actions. Thus, observed (vs. unobserved) participants believed they gave both more correct and incorrect answers in a lab task (Study 3) and, moving to a field study, the larger the audience, the larger the contribution badminton players claimed toward their teams' successes as well as failures (Study 4). In contrast to actions, inactions are not magnified, because they are unobservable; indeed, observed (vs. unobserved) participants believed they solved more task problems but did not skip more problems (Study 5). Taken together, these studies show that being observed fundamentally alters the subjective magnitude of one's actions.

Keywords: motivation, observers, social influence, shared reality

How the presence of others affects people's self-regulation and performance is one of the oldest questions of social psychology (Triplett, 1898; Zajonc, 1965). From this research, some fundamental findings have emerged: the presence of observers increases peoples' speed and performance in simple, well-practiced tasks, whereas it decreases performance in complex tasks (Bond & Titus, 1983; Guerin, 2010; Latané, 1981; Uziel, 2007). In other words, if an individual is observed during an action, the mere observation typically affects the *performance* of the action (e.g., Klehe, Anderson, & Hoefnagels, 2007; Zajonc & Sales, 1966).

Over and above altering overt behavior, the presence of others can also affect people's *perceptions* of their own actions. The presence of observers motivates people to establish a shared reality with these observers: to tune their understanding of their own action with the observers' understanding of those actions (Hardin & Higgins, 1996). As a result, people experience their actions from their own perspective and from the perspective of the observer simultaneously. We explore whether this additional perspective of one's actions amplifies the perceived magnitude of the action. Thus, we set out to examine the hypothesis that being observed magnifies peoples' perception of their own behavior such that their actions appear more substantial.

Being Observed

Being observed has manifold consequences on peoples' behavior. The presence of observers can influence how well people perform at various tasks, ranging from gymnastic performance (Paulus & Cornelius, 1974) to more complex tasks such as verbal learning (Higgs & Joseph, 1971). These effects emerge because the presence of observers increases the psychological and even physiological arousal the actor experiences (Mullen, Bryant, & Driskell, 1997; Zajonc, 1965), which enhances performance on easy, dominant tasks, and hinders performance on more complex, nondominant tasks (Henchy & Glass, 1968). Arousal in this case often stems from apprehending the evaluation of others (Blascovich, Mendes, Hunter, & Salomon, 1999; Cottrell, Wack, Sekerak, & Rittle, 1968). Specifically, people make inferences about the evaluations of others, and during easy tasks, the evaluations are positive and reinforce mastery of these easy tasks. However, performance on difficult tasks is more error-prone, and the fear of

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embarrassment from mistakes reinforces further negative performance (Bond, 1982; Sanna & Shotland, 1990).

More recent research has shown that merely feeling observed or being reminded of potential observers can also influence peoples' behaviors: the presence of pictures of watching eyes alone can increase cooperation, honesty, and generosity (Bateson, Nettle, & Roberts, 2006; Ernest-Jones, Nettle, & Bateson, 2011; Haley & Fessler, 2005; Rigdon, Ishii, Watabe, & Kitayama, 2009). These effects, too, result from the activation of reputational concerns and of self-awareness through the presence of observers (or merely their watching eyes; Haley & Fessler, 2005; Pfattheicher & Keller, 2015; Rigdon et al., 2009). People are prompted to manage the impression they give when someone is watching. Thus, people become more self-aware, align their behavior with social norms and social desirability, and show more honest and generous behavior (Sproull, Subramani, Kiesler, Walker, & Waters, 1996). Interestingly, the mere presence of others (even when they are not active spectators) seems to be enough to threaten people, thus producing effects of social facilitation and inhibition (Markus, 1978; Platania & Moran, 2001), even if the other person present is blindfolded and wears earplugs (Schmitt, Gilovich, Goore, & Joseph, 1986).

However, the presence of others is not always threatening for people. By contrast, the presence of others (even strangers) can at times provide social support (Schachter, 1959), so that people are, for instance, less anxious when waiting for a painful procedure (Coan, Schaefer, & Davidson, 2006) and perceive upcoming challenges as smaller (Schnall, Harber, Stefanucci, & Proffitt, 2008). When observers offer support and alleviate stress by their mere presence, actors' behavior is modified to express fewer stress responses and appear calmer.

Shared Reality

Over and above activating reputational concerns and providing social support, the presence of others also has deeper psychological consequences for people's perception of reality. People are motivated to experience a shared reality with others around them, by which they tune their attitudes to others' actual or perceived expectations (Echterhoff, Higgins, & Groll, 2005; Higgins, 1999). Indeed, people prefer to communicate similar thoughts and feelings about an object or a situation (Hardin & Higgins, 1996), to establish a shared understanding of the world (Echterhoff, 2010; Echterhoff, Higgins, & Levine, 2009). To reach such a shared understanding of reality, people take others' perspective and adapt their attitudes and perceptions to align them with those of others.

Sharing a reality with others fulfills several important purposes: First, one's feelings and thoughts are validated when others experience them too (Asch, 1951). Sharing a reality with others thus means that one's own inner states feel more true, valid, or real. Second, a shared reality creates a bond between individuals that allows them to experience commonality (Abrams & Hogg, 1990; Clark & Kashima, 2007; Levine & Higgins, 2001). Importantly, this shared reality could very well be illusory, whereby people falsely believe that others share their emotions and thoughts (Keysar & Barr, 2002). The mere illusion of shared reality, however, might still lead people to feel validated in their emotions and to feel more connected to the other person.

Simultaneous experiences foster the experience of a shared reality, even without directly communicating one's reality (Shteynberg, 2010). Therefore, simultaneous actions are better encoded in memory (Eskenazi, Doerrfeld, Logan, Knoblich, & Sebanz, 2013), and people like objects better when others have previously directed their eye gaze at these objects (Bayliss, Paul, Cannon, & Tipper, 2006). Thus, coexperiencing an experience with others can affect people's thoughts and attitudes about reality. Importantly, the belief in a simultaneous coexperience with someone else can be enough to alter people's perception of the experience. For example, in Boothby, Clark, and Bargh's (2014) studies, when participants ate pleasant or unpleasant chocolate simultaneously with another person, participants liked the pleasant chocolate better and the unpleasant chocolate worse than if the other person was doing something else, even though they did not communicate their liking. Thus, tasting the chocolate simultaneously intensified the taste. Possibly, people merely inferred that the other person shares the same thoughts and feelings, which in turn intensified their own thoughts and feelings.

Taken together, past research has shown that the presence of others can affect how people perform actions (Zajonc, 1965) and how they evaluate objects and situations (Boothby et al., 2014; Coan et al., 2006; Schnall et al., 2008; Shteynberg, 2015). Building on this research and the notion that people share their reality with others, we set out to test whether the presence of observers influences the magnitude of one's own actions. Do people believe they do more when others witness their actions?

Observers Magnify Perception of Actions

The perception of an action's magnitude is central for self-regulation because it provides input for whether and when to take further action (Carver & Scheier, 1998). Specifically, perceived magnitude of an action leads people to make inferences about their level of commitment to and the degree of progress they are making on a goal (Fishbach & Dhar, 2005; Fishbach, Henderson, & Koo, 2011). If people feel that an action is more substantial, they will afterward relax their efforts if they infer the action brought progress on a goal (an inference committed individuals make) or, alternatively, they will increase their effort if they infer the action signals strong commitment (an inference less committed individuals make; Fishbach & Dhar, 2005; Khan & Dhar, 2006; Kivetz, Urminsky, & Zheng, 2006; Koo & Fishbach, 2008). Regardless of the direction of the impact, perceiving an action as having greater magnitude will increase the action's influence on subsequent self-regulation. For example, an athlete who is observed during a successful practice might perceive her success as larger than she usually would have, and might decide to either relax her subsequent efforts because she feels she has made enough progress during the practice, or she might increase her efforts because she feels more committed as a result of the successful performance.

Whereas magnitude inferences matter, we explore whether they are influenced by being observed. When others are observing, people simultaneously perceive their actions through their own lens and through the lenses of the observer. Thus, instead of one pair of eyes, they see the action from multiple (e.g., two) pairs of eyes. This additional perspective is added to one's own perspective in a way that could augment people's perception of the magnitude of their action. In this way, the mere presence of others could affect human psychology more fundamentally than previously thought.

Specifically, we predict that an actor will magnify actions performed in the presence of an observer. Depending on the specific action, this magnification effect can carry different meanings. For example, we expect that people would perceive food portions they eat in the presence of an observer as larger than food portions eaten alone. When evaluating the size of a consumed food portion, one will presumably first use one's own perception as a reference point. In the presence of an observer, however, one might also try to infer the observer's thoughts and use them to augment one's own perception. Importantly, actors would only use the observer's inferred perception for aspects of the action that the observer actually witnessed. Thus, we expect that people will use the observer's perspective to evaluate those aspects of the action that the observer actually has witnessed (e.g., the portion size), but not those aspects that are unknown or invisible to the observer (e.g., the taste of the food).

We further predict that the magnifying effect of an observer on one's own perception is independent of self-presentational concerns. Although being observed fosters socially desirable behavior (Rigdon et al., 2009; Sproull et al., 1996), we expect that being observed has psychological consequences over and above social desirability concerns. If, indeed, adopting simultaneous perspectives alters one's subjective perception of one's actions, our model predicts people should magnify also undesirable actions in the presence of an observer. For example, the more people have observed a game, the more a sport's team player who scores a point might feel this point is critical for the overall outcome of the game, because the player sees the action through the eyes of the observers. However, we expect the same magnifying mechanism when the team player misses a point and sees the failure through the eyes of the observers and thereby deems it more critical. Thus, we expect that the presence of an observer magnifies one's own perception of desirable actions, undesirable actions, and also mundane and neutral actions (e.g., eating a neutral food) to the same extent and irrespective of self-presentational concerns.

Our analysis further assumes that being observed has psychological consequences beyond increasing self-awareness. Although being observed could foster self-awareness (Pfattheicher & Keller, 2015), people who are more self-aware should magnify all aspects of the experience because of the heightened attention they pay to their own experience. In that case, the presence of an observer would also magnify invisible parts of the experience (e.g., the taste of food), as well as omitted actions (e.g., inactions). By contrast, we expect that being observed magnifies only experiences that are accessible to observers, because the consideration of multiple perspectives, rather than self-awareness, is what magnifies action.

The Present Research

To test whether being observed affects the perceived magnitude of one's actions, we conducted five studies. In Study 1, we tested whether participants observed by a camera (vs. unobserved) perceive they have had eaten a larger food portion. In Study 2, we tested whether mere arousal during consumption could instead be the mechanism underlying Study 1's effect. To do so, only after they had taken the action (in this case, eating) did we inform participants in the observed condition that they had been observed, and we expected that information would still magnify their recollection of the magnitude of the action (how much they had eaten).

In Study 3, we further tested whether social desirability (or reputational concerns), instead of (or in addition to) the adoption of multiple perspectives, could account for the effects, by exploring whether being observed magnifies the perception of one's failures in addition to one's successes. In the context of completing a test, our proposed multiple-perspectives account would predict that observed participants would report both more correct and more incorrect answers compared with unobserved participants. Next, moving to a field study, Study 4 looked at perceived contribution to a team in badminton tournaments. We tested whether the amplification of the perceived contribution to both positive and negative outcomes would increase with the number of observers (i.e., audience members): players would perceive they contributed more to their team's success as well as failure.

Finally, in Study 5, we further tested the process by identifying a critical moderator: we expected that only salient actions would be amplified, and not inactions, which, by definition, observers cannot witness. Specifically, we tested whether, when observed, participants would recall solving more test problems (action), but not skipping more problems (inactions).

Study 1: Being Observed Magnifies Consumed Food Portions

Previous research has shown that videotaping participants had similar effects to directly observing them (Laughlin & Wong-McCarthy, 1975); hence, in Study 1, we had participants consume corn chips while being videotaped or not. We predicted that observed (i.e., videotaped) participants would perceive they had eaten larger food portions than unobserved (i.e., not videotaped) participants.

Method

Participants and design. We recruited 82 students at the University of Chicago (37 women; $M_{age} = 21.61$, $SD = 4.83$) in exchange for $1 for a one-factorial between-subjects design (camera vs. control). We predetermined a sample size of at least 40 participants per condition. No data were excluded from analyses.

Materials and procedure. An experimenter gave each participant a small, snack-sized bag (28 g) of conventional corn chips for an alleged taste test, and told him or her that the study was about how people consume snacks, and emphasized they needed to finish the whole bag (to ensure observed and unobserved participants would eat the same amount of chips). The majority of participants finished the whole 28 g portion of chips (leftovers: $M = 2.05$ g, $SD = 5.66$).

In the camera condition, we set up a camera next to the participant to provide a manipulation of feeling observed while snacking. After giving the participant the snack, the experimenter visibly switched on the camera. A light indicated the camera was recording the participant while he or she was eating. In the control condition, no camera was present. In both conditions, the experimenter left the room before the participant started eating, and came back after 3 min to collect any leftovers and, without the knowledge of the participant, to weigh them in another room. In the camera condition, the experimenter switched off the camera when collecting the leftovers so that participants in both conditions were aware they were unobserved when responding to the dependent variable.

Next, participants completed a survey in which the first item was their perception of the portion size they had eaten, which is our critical dependent measure ("How big was the food portion?" 1 = *very small*, 9 = *very big*). Because participants were asked to finish the whole bag, as the majority of participants did, the served portion and the consumed portion were nearly identical; thus, we only asked participants about the size of the portion they ate. To corroborate the cover story of a taste test, the other questions in the survey referred to how many calories participants thought the food contained, how much the food had contributed to their caloric intake that day, and how much they had enjoyed the food (each on a 9-point scale). To provide an additional check of whether participants had indeed finished the food, they also rated how much of the food they had eaten (1 = *all*, 2 = *most*, 3 = *a bit*, 4 = *none*). As a manipulation check, at the end of the survey, participants rated "How observed did you feel while eating the food?" (1 = *not at all*, 9 = *very much*).

Results and Discussion

Our manipulation check confirmed that participants in the camera condition felt more observed than participants in the control condition ($M_{camera} = 5.51$, $SD = 2.27$ vs. $M_{control} = 2.84$, $SD = 2.48$), $t(80) = 5.08$, $p < .001$, 95% confidence interval [CI; 1.628, 3.723], $\eta^2 = .244$.

In support of the hypothesis, participants felt that the food portion they had eaten was larger when they were observed by a camera while eating ($M_{camera} = 4.85$, $SD = 1.94$; $M_{control} = 4.00$, $SD = 1.53$), $t(80) = 2.20$, $p = .030$, 95% CI [0.082, 1.610], $\eta^2 = .057$. Notably, there was no difference in how much participants actually ate (leftovers in grams: $M_{camera} = 2.64$ g, $SD = 5.74$; $M_{control} = 1.51$ g, $SD = 5.61$), $t(80) = 0.90$, $p = .370$, 95% CI [−1.366, 3.624]. Further, we found no differences in the irrelevant "taste test" items (calorie and enjoyment perceptions) or in how much of the food they reported to have eaten, all $ps > .125$. The null effects of being observed on participants' calorie and enjoyment perceptions are consistent with our prediction that perceptions of invisible features of the food are not magnified.

In Study 1, we show that feeling observed increases an individual's perception of how much he or she has eaten. One limitation of Study 1 is that videotaping people while they are eating is a somewhat unusual procedure that potentially caused some arousal or mild discomfort. Such arousal, in addition to adopting others' perceptual experience, could explain why observed participants felt they had eaten more. Hence, in Study 2, we provide a stricter test of our theory by only informing observed participants postaction that they had been observed.

Study 2: Learning One Has Been Observed Magnifies Perception of Consumed Food Portions

In Study 2, we did not let participants know until they had finished eating some snacks that they had been observed (or not, in the control condition). We expected that those participants who learned they had been observed while eating would report having eaten more than would those in the control condition.

Method

Participants and design. We recruited 105 students at the University of Chicago (57 women, $M_{age} = 20.18$, $SD = 4.22$) in exchange for $2 for a one-factorial between-subjects design (observed vs. control). We predetermined a sample size of at least 40 participants per condition, as in Study 1, and collected more data because the data acquisition went more quickly than expected. No data were excluded from analyses.

Materials and procedure. An experimenter told participants that they had 5 min to eat as much as they wished from three bowls filled with grapes (200 g), almonds (100 g), and M&Ms (100 g), for an alleged taste test. In this study, we did not ask participants to finish a certain amount of food to ensure that the amount eaten would be the same across conditions. Instead, we introduced our manipulation (observed vs. control) only after the action (eating) had already happened, so that any potential differences in the amount that people ate cannot be because of the manipulation. We provided participants with three relatively large portions of food from which to eat, to make keeping track of how much exactly they ate more difficult for participants.

During the study, participants were sitting in a research lab with their back to the door, which had a small window. The experimenter briefly observed each participant (in both conditions) twice during the 5-min taste test to make sure any differences between conditions would not be because of participants perhaps noticing they were being observed. Next, the experimenter entered the room to collect the leftover food. In the observed condition, the experimenter casually said, "Thanks for sampling the food. By the way, I observed you a bit during the taste test." In addition, the experimenter pointed at the little window in the door through which participants had been observed. In the control condition, the experimenter simply thanked participants for sampling the food. The experimenter then left the room again in both conditions, and participants answered the dependent measures about their food consumption alone.

To assess participants' perceived amount of consumed food, they first listed how many individual grapes, almonds, and M&Ms they had eaten. We had them report the number of individual pieces because it is easier to recall than the amount of consumed food in grams or ounces. We further weighed the leftovers.

Because the study was allegedly a taste test, participants answered some general questions about the food we had served them. These items referred to the overall portion that was served and included (a) how big the food portion had been, (b) how many calories the food contained, (c) how much the food had contributed to their caloric intake that day, (d) how much they enjoyed the experience, (e) how satisfied they were with the food they sampled, and (f) how satisfied they were with the selection of food that was presented (each on a 9-point scale). Next, we measured whether participants had felt observed while eating (two items: "Did you feel observed when you were eating the food?" "Did you feel anyone was looking at you while you were eating the food?" 1 = *not at all*, 9 = *very much*; $r = .81$). We averaged these two items into a single measure of having felt observed.

Results and Discussion

We z-transformed the number of pieces participants recalled eating for each food (because participants ate more grapes than M&Ms, the distributions varied considerably between the foods), and took their average as a measure for each participant's subjective amount of food eaten. In support of the hypothesis, participants in the observed condition reported having eaten more individual pieces of food ($M = 0.42$, $SD = 2.15$) than those in the control condition ($M = -0.43$, $SD = 1.89$), $t(103) = 2.14$, $p = .035$, 95% CI [−1.63, −0.06], $\eta^2 = .043$.[1]

One possibility is that observed participants indeed ate more; however, they did not. The observed and control participants consumed similar amounts,[2] $p > .355$. Further, we found no difference in accuracy of perception between conditions. We calculated accuracy in recall as the difference between reported consumption (transformed into grams) and actual consumption (positive values indicate that participants ate larger amounts than they subjectively thought). We find that both observed and control participants overestimated the amount of food they had eaten, yet they were similarly accurate across conditions ($M_{observed} = 29.17$ g, $SD = 37.15$ vs. $M_{control} = 35.77$ g, $SD = 45.14$), $t(102) = 0.81$, $p = .418$.

As expected, we found no difference between conditions on the six "taste test" items (how big the food portion was, how many calories it contained, how much such a portion would have contributed to their daily caloric intake, how much participants enjoyed the taste test, how satisfied they were with the food, and how satisfied they were with selection of food), all $ps > .545$. Notably, whereas observed participants perceived they had eaten more than unobserved participants, they did not perceive the overall size of the food portion as bigger. Finally, as expected, we found no difference between conditions in how observed people had felt while eating, that is, before knowing that they had been observed, $p = .253$.

As these results show, arousal from being observed is not a sufficient explanation for our effects, because participants felt equally observed while eating and were unaware of any observance. Possibly, participants in the observed (vs. unobserved) condition might still have been more aroused when answering the questions, as a result of learning in retrospect that they had been observed. However, arousal while learning that one has been observed is less likely to affect the reporting of the amount eaten, because participants are less likely to have misattributed the arousal to the amount they had eaten (or to potentially having overeaten). Instead, we would expect participants to attribute their arousal (if they experienced any) to the much more salient and unambiguous fact that they had unknowingly been observed. Moreover, as in Study 1, there is no effect of being observed on the invisible aspects of the experience, such as the enjoyment of the food.

In the first two studies, participants may have felt more inclined to engage in impression management and to give socially desirable answers when they were observed, because of the reputational concerns that being observed might activate (Haley & Fessler, 2005; Rigdon et al., 2009). Specifically, participants might have felt that reporting larger portion sizes is socially desirable (after all, they were part of an experiment that asked them to consume food); therefore, we find larger portion-size ratings when participants were observed. To address this concern, in Study 3, we investigate whether participants' perception of the magnitude of their failures or mistakes is also affected by being observed. If people simply are trying to give more socially desirable answers when observed, they should report their success as larger but their failures as smaller. If, however, as we predict, being observed increases the magnitude of one's actions, participants should amplify both their successes and their failures.

Study 3: Being Observed Magnifies Both Successes and Failures

To assess whether being observed magnifies perceptions of both successes and failures, we had participants in Study 3 engage in an alleged test of their ability to detect fake smiles, during which they received (false) feedback after each trial. We chose this task because participants had little experience with such a test and did not have insights into their ability to detect fake smiles, which would make the feedback more credible. All participants received the same number of successful trials (allegedly correct answers) and unsuccessful trials (allegedly incorrect answers) in the same order. If being observed motivates people to answer in a socially desirable way, we expected observed participants would enhance their successes (report gaining more points for correct answers) and downplay their failures (report losing fewer points for incorrect answers). If, however, being observed magnifies people's perception of their actions, we expected an amplification of both successes (gained points) and failures (lost points) when observed.

Method

Participants and design. We recruited 97 students at the University of Chicago (53 women, $M_{age} = 20.57$, $SD = 4.12$) in exchange for $1 for a one-factorial between-subjects design (observed vs. control). We predetermined a sample size of at least 40 participants per condition, and collected more data because data collection went more quickly than expected. The data from one participant were excluded from analyses because he reported an excessively high value for the dependent measure of points gained in the experiment (147 *SD* above the mean).

Materials and procedure. Participants completed a test to assess their ability to detect fake smiles, in which they needed to determine whether they thought someone's smile was real (the person was truly happy or amused) or fake (the person just smiled for the camera). Participants looked at 31 pictures (in random

[1] Participants' subjective reports on how many individual pieces they thought they had eaten per food type: grapes: $M_{observed} = 20.64$, $SD = 11.47g$ versus $M_{control} = 15.63$, $SD = 8.83$, $p = .014$; almonds: $M_{observed} = 14.13$, $SD = 10.59$ versus $M_{control} = 11.63$, $SD = 8.93$, $p = .195$; M&Ms: $M_{observed} = 12.79$, $SD = 11.75$ versus $M_{control} = 11.61$, $SD = 8.28$, $p = .555$.

[2] Actual amount eaten: grapes: $M_{observed} = 84.35$ g, $SD = 53.56$ g, versus $M_{control} = 74.94$ g, $SD = 52.51$ g, $p = .372$; almonds: $M_{observed} = 17.63$ g, $SD = 15.82$ g, versus $M_{control} = 15.73$ g, $SD = 11.33$ g, $p = .482$; M&Ms: $M_{observed} = 13.71$ g, $SD = 14.08$ g, versus $M_{control} = 14.10$ g, $SD = 10.14$ g, $p = .873$. Accuracy: grapes: $M_{observed} = 25.41$ g, $SD = 33.74$ g, versus $M_{control} = 29.76$ g, $SD = 40.19$ g, $p = .555$; almonds: $M_{observed} = 0.81$ g, $SD = 8.42$ g, versus $M_{control} = 1.77$ g, $SD = 7.96$ g, $p = .553$; M&Ms: $M_{observed} = 3.43$ g, $SD = 6.35$ g, versus $M_{control} = 4.80$ g, $SD = 6.71$ g, $p = .288$.

order) of smiling people of different sexes, age groups, and races (18 women, 13 men). For each picture, participants were asked, "Is this smile real or fake?" (1 = *real*, 2 = *fake*). After each trial, participants received (false) feedback about their performance, learning their answer was correct or incorrect. In addition, participants learned they had gained (in the allegedly correct trials) or lost (in the allegedly incorrect trials) a number of points, ranging in what appeared to be a random number between 5 and 10. We did not explain to participants why they received different points for different trials. The success feedback and order of alleged gains and losses was the same for all participants (only the order of the pictures varied randomly between participants). Thus, all participants received the same amount of success feedback in the same order, but which picture was paired with which feedback varied randomly. Participants read that the number of total points would result in a bonus at the end of study, such that more points would result in a higher bonus, although we did not specify the translation of points into bonus.

The point system served the purpose of obscuring the number of total gains and losses, thus making keeping track of one's performance practically impossible. Whereas participants may have attempted to count the number of correct and incorrect trials, keeping count of their actual number of points was significantly more difficult because the gain/loss per trial was inconsistent. In total, each participant allegedly gained 125 points in 18 success trials and lost 84 points in 13 failed trials, for a total of 31 trials. At no point were these numbers presented to participants. We provided more successes overall to assimilate an achievement task in which participants have a fair chance of getting the majority of the answers right, to thus minimize frustration.

To manipulate feeling observed, a research assistant sat next to participants in the observed condition during the entire task, allegedly to "get a better sense of the novel experimental procedure." The research assistant watched the computer screen together with the participant until the fake smile test was completed. The research assistant left the room before the participants reached the dependent variable items about their performance. Using this procedure, participants were only observed during the action (correct and incorrect answers in the test), and not while reporting their performance. In the unobserved condition, the research assistant simply went over the instructions with the participant, and left the room before the fake-smile test started.

To measure participants' subjective assessment of their performance, they reported after the fake-smile test how many points they thought they had gained (for correct answers) and lost (for incorrect answers), and how many total points (points gained minus points lost) they had gotten. Participants further reported how observed they had felt during the test (1 = *not observed at all*, 9 = *observed*). For exploratory purposes (i.e., we wanted to know whether being observed also increases perceived success relative to others), participants also guessed how many points the last 10 participants had gained and lost. Without any information on others, participants rated others the same as the self (r = .85 for correct answers and r = .82 for incorrect answers), rendering these items uninformative. Once they completed the posttask survey, participants were fully debriefed and received an additional $1 bonus.

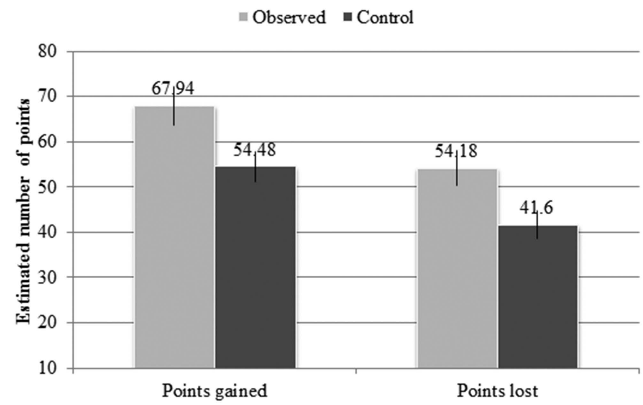

Figure 1. Mean estimates for the number of points gained and lost as a function of being observed versus control in Study 3. Being observed increases the perceived number of points gained as well as points lost. Error bars indicate 1 *SE*.

Results and Discussion

In support of the manipulation, participants who completed the fake-smile test in the presence of a research assistant felt more observed than participants who did the task alone ($M_{observed}$ = 5.84, SD = 2.33 vs. $M_{unobserved}$ = 3.40, SD = 2.61), $t(95) = 4.86$, $p < .001$, $d = 0.99$.

On the dependent variable, a repeated measures MANOVA of the effects of being observed versus control on participants' reported gains and losses revealed two main effects (see Figure 1): participants recognized that they had gained more points than they had lost, $F(1, 95) = 47.45$, $p < .001$, $\eta^2 = .33$, $CI_{difference}$ = [9.48, 17.15], as was indeed the case in the fake-smile test. More important, participants thought they had both gained and lost more points when they were observed than when they were alone, $F(1, 95)$ = 7.48, $p = .007$, $\eta^2 = .07$, $CI_{difference}$ = [3.57, 22.25], supporting our hypothesis that being observed magnifies successes and failures. The interaction term was not significant, $F(1, 95) = 0.05$, $p = .820$, indicating that the presence of an observer similarly magnified successes and failures. Specifically, participants recalled having gained more points when they were observed, $M_{observed}$ = 67.94, SD = 29.15 versus $M_{unobserved}$ = 54.48, SD = 26.04, $t(95) = 2.30$, $p = .019$, $d = 0.49$, $CI_{difference}$ = [2.31, 24.61], while also having lost more points when they were observed, $M_{observed}$ = 54.18, SD = 24.07, versus $M_{unobserved}$ = 41.60, SD = 21.26, $t(95) = 2.73$, $p = .008$, $d = 0.55$, $CI_{difference}$ = [3.42, 21.74].

We also analyzed participants' reported total number of points they thought they had received. Because the total number of points received is the net difference between the points gained and points lost, we expected and found no difference between conditions on this measure, $M_{observed}$ = 15.86, SD = 18.62, versus $M_{unobserved}$ = 15.08, SD = 19.13, $t(95) = 0.20$, $p = .840$, $d = 0.04$, $CI_{difference}$ = [−6.84, 8.38].

An interesting find was that on average, participants underestimated the number of points they had gained as well as lost. Observed participants thought they had gained on average 57.06 (SD = 29.15) fewer points than the 125 points they had actually gained, $t(49) = 13.70$, $p < .001$, and had lost on average 29.81

(SD = 24.07) fewer points than the 84 points they had actually lost, $t(48) = 8.67$, $p < .001$. Similarly, unobserved control participants thought they had gained on average 70.52 (SD = 26.04) fewer points than the 125 points they had actually gained, $t(47) = 18.76$, $p < .001$, and had lost on average 42.39 (SD = 21.26) fewer points than the 84 points they had actually lost, $t(47) = 13.82$, $p < .001$. This underestimation was not part of our hypothesis and likely reflects the fact that participants had collected and lost a relatively large number of points (125 points gained and 84 points lost). Because observed participants thought they had gained more points than did unobserved participants, and had also lost more points, observed participants in this study gave more accurate estimates than unobserved participants.

Study 3 shows participants amplified both their successes (correct answers) and their failures (incorrect answers) when they were observed, which suggests social desirability was less likely to underlie the effect. Next, we move to a field demonstration of this amplifying effect of observers on both successes and failures, in badminton tournaments with a varying number of audience members for each game.

Study 4: The Number of Spectators Increases Players' Perceived Contribution to a Team's Success or Failure

In Study 4, we explored whether the magnifying effect of being observed also occurs when reporting the perception of one's contribution to a group. If being observed magnifies the perception of one's actions, we would expect people to perceive their contribution to a (both positive and negative) group outcome as larger. To test this hypothesis, we surveyed players in badminton tournaments and recorded the points each player scored, the number of spectators during each game, and the outcome for each team (i.e., winning or losing). Afterward, players indicated their subjective contribution to their own teams. We predicted that the larger the group of spectators, the greater the contribution the players would claim toward the teams' outcome, which was either winning or losing.

Method

Participants and design. We surveyed 121 badminton players (36 women) in two different badminton tournaments in Shanghai, China. Age was not recorded, although participants were predominantly college students in Tournament 1 and predominantly university staff and faculty in Tournament 2. Because of the field setting, we recruited as many participants as possible during the two different badminton tournaments. The total number of preregistered players across both tournaments was 190 (the actual number was presumably lower because of some players not showing up), out of which 121 players were willing to complete the survey. No data were excluded from analyses.

Materials and procedure. Badminton is usually played either by two opposing individual players (singles) or two opposing pairs (doubles). Because both tournaments in our study were amateur tournaments, the rules differed slightly from standard badminton, allowing also doubles to play against singles. Whether people played in a single or double had no effect on the dependent variable (perceived contribution to the team), and inclusion of game type in the model did not change the results; thus, we collapsed across singles and doubles. Whether players took part in Tournament 1 or 2 also had no effect on perceived contribution to the team, and inclusion of tournament type in the model did not change the results; thus, we also collapsed across tournaments.

About 2 weeks before the tournaments, players were allocated to teams of 17–20 players (for the first tournament: M = 18.83, SD = 0.75, range = 18–20; for the second tournament: M = 19.25, SD = 1.5, range = 17–20). In the tournaments, 10 teams played against each other. We only surveyed the first round of matches (where Team A plays against Team B, Team C plays against Team D, and so forth) to make sure we included every team and every participant only once in the survey. Two teams played against each other in a match, which consists of up to 10 games.

In each match, the first game starts with both players having 21 points (15 points in Tournament 1). A double also gets 21 (15) points to start with. The first player (Player A) strikes a shuttle with his or her racket to pass it to the opponents' (Player B) half of the court. If the shuttle lands in B's half of the court, B loses one of his or her points, and A keeps his or her points. The game continues until one player has lost all points. In that case, a new game begins. If B has lost all points, A moves on to play with the next player from B's team (e.g., Player C). Player A retains the points from the previous game and Player C starts with 21 (15) points. The game finishes when again one of the players has lost all points. Because of these rules, not all players actually get a chance to play in the first round of the tournament, because one team can run out of players before the opponent's team has had all players at least start the game. Indeed, the number of players per team who actually got a chance to play in the first round of the tournament ranged from 7 to 16. A match between two teams finishes when all players from one team have lost all their points, or after 10 games have been played. The winning team then moves on to the next round of the tournament (that we did not record). Given these rules, the order of the players is important because stronger players last more rounds. For each of the teams, the team leader determined in a pretournament meeting the order in which players would play, based on the player's previous performance. As a rule, lower-level players were required to play first. On average, each player played in M = 1.413 individual games (SD = 0.715).

For each player, we calculated the number of points this player "cost" the opposing team (for doubles, we counted the number of points that double cost the opposing team toward each player of the double). This number is the objective performance of this player. Furthermore, for each player, we recorded the type of games (1 = single, 2 = double), earned points, number of spectators, outcome of the team (1 = win, 0 = loss), and gender (1 = male, 0 = female).

In this study, we recorded the number of spectators each game had as a proxy for feeling observed. The more people are watching, the more a player should feel observed. Spectators included friends, family, and some members of each playing team, who were sitting and standing around the courts to watch the games, and often moved on after one game ended. The number of spectators varied for each game and ranged from 6 to 33. To record the number of spectators, an experimenter took photos of the courts at the end of each game and counted how many people were around the court. All the people within five meters around the court (except the judge and the players themselves) were counted as spectators. We could not distinguish between spectators who were on one's team or the other team, or did not play in the tournament.

After the first round of tournament had finished (i.e., all teams had played one time), the experimenter presented the players of Tournament 1 with a brief questionnaire.[3] In the questionnaire, players indicated their subjective contribution to the team, which was our dependent measure ("To what extent do you consider your performance contributed to the team's success or failure?" 1 = *not at all*, 10 = *extremely*). This question was meant to capture both contribution to winning and contribution to losing, regardless of the outcome. Next, participants recalled their performance ("How many points have you scored?" open-ended; participants had almost perfect memory of this number, which we recorded independently, $r = .98$, $p < .001$). Players provided their names as part of the tournament registration, which we used to match their recorded performance to their answers in the questionnaire.

Results and Discussion

To examine our hypothesis that being observed leads players to magnify their contribution to the team, we first conducted a linear regression on players' subjective contribution, using the number of spectators, outcome of the team (win vs. lose), and their interaction term as predictors. The analysis revealed the predicted main effect for the number of spectators, (unstandardized) $\beta = 0.11$, $t(117) = 3.98$, $p < .001$, 95% CI [0.06, 0.17], $f^2 = 0.13$. The greater the number of spectators watching a given game, the larger participants thought their contribution was. We found no main effect for the team outcome, $\beta = -0.44$, $t(117) = -0.86$, $p = .390$, 95% CI [−1.44, 0.57], $f^2 = 0.03$. Whether the team lost or won did not affect how large participants thought their contribution was. As predicted, the interaction between the number of spectators and the team outcome was not significant, $\beta = -0.01$, $t(117) = 0.03$, $p = .980$, 95% CI [−0.06, 0.06], $f^2 < 0.01$. Thus, the greater the number of observers, the larger players perceived their contribution to the team's outcome to be, regardless of whether the team lost or won. In other words, more spectators magnified one's subjective contribution to success as well as to failure.

The correlational design of Study 4 allows for some alternative explanations. For instance, better players could have drawn greater numbers of spectators, in which case, possibly being a better player (rather than being observed) made one feel that one's successes and failures loom larger. To address this possibility, we looked at two measures of a player's strength: number of points they earned and the order in which players joined the game. Recall that in these tournaments, better players came after lower-level players within each team (a higher number indicates a better player). Further, teams could have filed a complaint against each other for breaking this rule (no complaint was filed in our two tournaments). These two measures of players' level are not correlated with the number of spectators presence (for number of points scored: $r = .051$, $p = .580$; for order: $r = .011$, $p = .907$), which speaks against a strong relationship between performance in the game and the number of spectators. In addition, adding these variables to the regression of perceived contribution on number of spectators does not affect the positive effect of spectators on perceived contribution. Specifically, regressing perceived contribution on the number of spectators and points earned yielded a main effect of points earned ($\beta = .043$, $t(120) = 3.02$, $p = .003$), as players who had earned more points perceived their contribution to the team (win or lose) to be larger, and the predicted main effect of the number of spectators, which remained significant ($\beta = .112$, $t(120) = 4.03$, $p < .001$). Similarly, regressing perceived contribution on the number of spectators and order (i.e., level) yielded a main effect of order ($\beta = .20$, $t(120) = 2.58$, $p = .011$), indicating that the later players joined the game (i.e., the better they were), the more they believed they had contributed to the team (win or lose), in addition to the predicted main effect of number of spectators, which remained significant ($\beta = .115$, $t(120) = 4.12$, $p < .001$).

Taken together, Study 4 shows in a field setting that the number of spectators increased players' perceived contribution to their team's outcome, whether the team won or lost. The greater the number of people who were present, the larger players believed their own contribution to be. Whereas Studies 1–3 show that whether someone is observed or alone affects perceptions, Study 4 suggests the extent to which someone is observed can also affect their perception of their own actions. In this study, no player was unobserved while scoring or losing points. However, the greater the number of observers who were present, the larger the players perceive their own actions to be.

Study 5: Being Observed Magnifies Actions, but Not Inactions

In Study 5, we test whether being observed magnifies action because people adopt the perspective of the observer in addition to their own, or whether being observed affects perception by increasing self-awareness. In the former case, being observed should increase only the visible, salient parts of the action, whereas invisible parts of the action should remain unaffected. However, in the latter case, the whole experience should appear magnified because the actor would pay more attention to his or her experience and thus would perceive every aspect of it as magnified. In Study 1, we found some indication that people adopt the perspective of the observer and, therefore, magnify their perception of the visible, salient features of actions, but do not amplify the taste (invisible feature). Similarly, we expect an amplification effect only on observable actions (commissions), and not on inactions or omissions of actions.

To test for this hypothesis, in Study 5, participants worked on a matrix-solving task in which they solved matrices to win points (actions) and lost points for incorrect answers. Critically, participants could also skip matrices without losing points (omission). Whether a participant truly skipped (i.e., decided against working on) a particular matrix or whether he or she decided to first work on other matrices was invisible to the observer. Thus, in this study, we measured whether people magnify the number of solved but

[3] In Tournament 2, players received the link to the questionnaire 2 hr after the game, and the vast majority of players completed the questionnaire within 24 hr ($M = 17.88$ hr, $SD = 3.80$, after receiving the link). Including the tournament in the regression model does not change the pattern or the significance of results.

not skipped matrices, because the former is a visible action and the latter is an invisible inaction.

Method

Participants and design. We recruited 261 students at a Fudan University (96 women, $M_{\text{age}} = 19.28$, $SD = 1.24$) in exchange for 30 Chinese Yuan (approximately $5) for a two-factorial between-subjects design (observed vs. control) × (report action vs. report inaction). We predetermined a sample size of at least 40 participants per condition, but ended up collecting more because data collection went more quickly than expected on the consecutive days on which the study was scheduled. No data were excluded from analyses.

Materials and procedure. Participants completed a computerized matrix-solving game, which had them solve as many matrices as they could within 4 min. The instructions read that each matrix consisted of nine three-digit numbers (e.g., 8.46), and the goal was to find two numbers per matrix that added up to 10 (adapted from Mazar, Amir, & Ariely, 2008). The task consisted of 50 matrices in total (see Appendix), and on average, participants solved 16.67 matrices ($SD = 5.73$) within 4 min. Of these solved matrices, the average number of incorrectly solved matrices was 0.75 ($SD = 3.18$). The onscreen instructions emphasized that correctly solved matrices would be counted as one point, incorrectly solved matrices would be counted as minus one point, and skipped matrices would be counted as zero. Hence, participants could skip matrices they thought were too difficult, and could solve those they considered easier to maximize their points within the time limit. Participants additionally learned that those who scored more matrices than the median would be included in a lottery for an extra monetary reward of 50 Chinese Yuan (approximately US$8).

In both the observed and the control condition, participants learned that whether their screen was going to be recorded (i.e., observed) to gain insight into how people solve matrices would be randomly determined. In reality, we did not record any participants' screen activity. Control participants read that their screen had been randomly determined to not be recorded, and a crossed-out icon of watching eyes was displayed on their screen during the entire matrix-solving task. Observed participants read that their screen had been randomly determined to be recorded, and an icon of watching eyes was displayed on the screen during the entire matrix-solving task (see Figure 2). After the matrix task, but before the dependent measure, in both conditions, the icon immediately disappeared and participants responded to a manipulation-check item asking them whether they had been observed during the matrix task. This procedure ensured participants would feel observed while working on the matrix task, but would feel unobserved while responding to the dependent variable. Previous research has found that the presence of virtual others can have similar psychological effects to the physical presence of others (Blair, Foster Thompson, & Wuensch, 2005).

We designed this task such that skipping matrices (i.e., inaction) was not per se visible to the observer watching the screen, because participants saw all 50 matrices at once on the same page. Because an observer would not know in which order the participant would solve the matrices, if at all (e.g., vertically, every other one, etc.), the observer could not tell whether a participant explicitly decided to not work on a particular matrix (skipping) or whether the participant decided to work on another matrix first.

Next, participants responded to the critical measure, which asked them to estimate either the number of matrices they had solved (in the action condition) or the number of matrices they had skipped (in the inaction condition). We measured actions versus inactions between subjects (instead of within subjects) to avoid any spillover between the two measures. We did not ask participants to report the number of incorrect answers they thought they had given: the task was to find numbers that added up to 10, and had participants thought they had made a mistake on this task, they could have easily corrected it. Thus, participants should have had no insight into the number of incorrect answers they had given.

Four participants misreported their condition on the item asking them whether they had been observed during the matrix task. Excluding their responses did not change the pattern or the statistical significance of the results, so we retained them.

Results and Discussion

To test whether being observed increases the perceived number of actions (solved matrices) but not inactions (skipped matrices), we conducted a 2 (observed vs. control) × 2 (action vs. inaction) ANOVA. We found a significant main effect of action versus inaction, $F(1, 256) = 333.81$, $p < .001$, $\eta^2 = .57$. Participants (correctly) believed they solved more matrices ($M = 15.42$, $SD = 6.21$) than they skipped ($M = 3.11$, $SD = 4.62$). The main effect of being observed was not significant, $F(1, 256) = 0.86$, $p = .354$, $\eta^2 = .003$. In support of the hypothesis, the interaction of being observed and action versus inaction was significant, $F(1, 256) = 6.90$, $p = .009$, $\eta^2 = .026$. Simple contrasts revealed that when estimating how many matrices they had correctly solved, participants in the observed condition reported they had solved more matrices ($M = 16.65$, $SD = 6.90$), compared to those in the control condition ($M = 14.25$, $SD = 5.26$), $F(1, 256) = 6.47$, $p = .012$, 95% CI [−4.25, −0.54], $\eta^2 = .026$. Thus, participants' actions were magnified when observed. However, when estimating how many matrices they had skipped, being observed did not influence the estimates ($M_{observed} = 2.56$, $SD = 4.48$ vs. $M_{control} = 3.70$, $SD = 4.73$), $F(1, 256) = 1.408$, $p = .237$, 95% CI [−0.76, 3.04], $\eta^2 = .005$ (see Figure 3).

Being observed did not affect how many matrices participants actually solved correctly. In the action condition, observed partic-

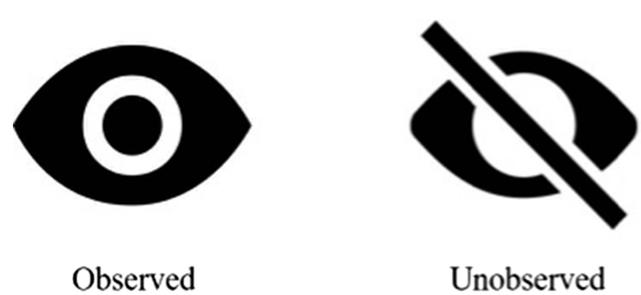

Figure 2. The manipulation of being observed in Study 5. Participants in the observed condition saw the icon on the left on their screen to indicate that their screen was recorded. Participants in the unobserved condition saw the icon on the right on their screen to indicate that their screen was not recorded.

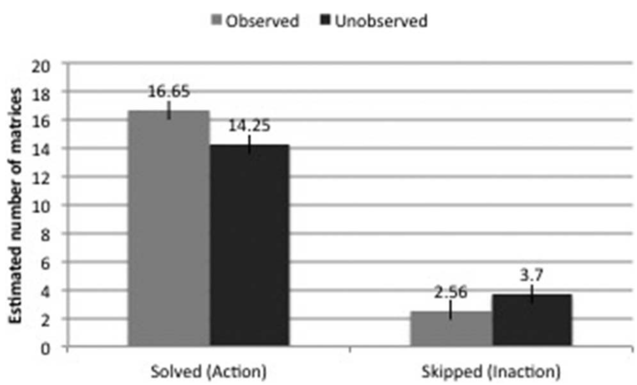

Figure 3. Mean estimated number of matrices solved and skipped as a function of being observed versus unobserved in Study 5. Being observed increases only the perceived number of solved matrices (action), not of skipped matrices (inaction). Error bars indicate 1 *SE*.

ipants on average solved 17.09 ($SD = 5.87$) matrices, and unobserved participants solved 16.16 ($SD = 5.43$) matrices, $p = .350$. In the inaction condition, observed participants on average solved 17.34 ($SD = 6.18$) matrices, and unobserved participants solved 16.07 ($SD = 5.38$) matrices, $p = .209$. Thus, the effects of being observed on subjective performance cannot be attributed to the actual performance differences.

When looking at the accuracy of participants' estimates, we can only compute accuracy scores in the action condition where we ask about the number of solved matrices. We do not know how many matrices participants looked at but decided not to work on (as mentioned above, skipping cannot be distinguished from working on the matrices in nonlinear order). When subtracting participants' estimated number of solved matrices from their actual number of solved matrices, a score of 0 indicates perfect accuracy, whereas a positive (negative) value indicates an underestimation (overestimation). We found no significant difference between observed and unobserved participants in accuracy of estimates ($M_{observed} = 0.45$, $SD = 6.49$, vs. $M_{unobserved} = 1.91$, $SD = 4.01$), $F(1, 131) = 2.48$, $p = .118$, $\eta^2 = .019$.

Taken together, being observed magnified participants' subjective perception of their actions, but not their inactions. This result is consistent with our assumption that people add the perspective of the observer to their own and thereby magnify their actions, because only those aspects of the action that the observer could see (solved matrices) were amplified. By finding this moderator, we further show that being observed did not merely alter participants' response behavior in a way that led them to give amplified answers. If it had, all answers (also inactions) would have been amplified. Instead, being observed magnified participants' perceptions of their own observable actions. Whether or not one has been observed does not affect people's perceptions of their inactions, or omissions of actions.

One alternative explanation for the lack of effect of the presence of observers on invisible inactions might be that inactions were relatively rare in this study, enabling participants to more easily remember the exact number, and thus leaving less room for a magnification effect of being observed. Against this explanation, we note that the standard deviations of the number of skipped matrices indicate the existence of considerable variance in participants' estimates: $M_{observed} = 2.56$, $SD = 4.48$ versus $M_{control} = 3.70$, $SD = 4.73$, which speaks against a simple floor effect on this measure. In addition, counting the number of skipped matrices was not a straightforward task, because participants did not know in advance that we would ask them about the number of matrices they solved or skipped, and they are unlikely to have anticipated such a question. Moreover, because participants' performance needed to be in the upper half of all participants to receive the bonus, counting the number of skipped matrices would have been uninformative and quite difficult given that participants worked on the matrices under time pressure.

Notably, we found no social facilitation or social inhibition effect in this study, because the number of solved matrices did not differ between conditions. Presumably, solving matrices was neither clearly very easy nor clearly very difficult for most participants; therefore, solving matrices may not be a task that is prone to producing social facilitation or inhibition effects.

General Discussion

In five studies, we find that being observed fundamentally alters how people perceive their own actions. The presence of observers magnifies one's action, and leads people to think they ate larger portions of food (Studies 1 and 2), to think they had more successes as well as more failures (Study 3), to claim a larger contribution to their team's successes and failures (Study 4), and to magnify their actions but not their inactions (Study 5). The presence of others magnifies one's actions because, by sharing the reality of the observer, people's perception of their own action is enhanced and validated. In this way, the perspective of another person is added to the target's perspective. We find that the greater the number of observers, the larger is the extent of shared reality, and thus the larger the amplification effect of being observed (Study 4). Moreover, the presence of observers amplifies the salient, visible parts of reality (Studies 1 and 5), but not the nonsalient parts that are invisible to the observer (taste of food, inactions).

Implications and Boundary Conditions

So far, we have discussed one boundary condition for the magnifying effect of observers, namely, that the action needs to be observable. Another boundary condition refers to whether the observer provides an independent estimate of the magnitude of participants' actions. Our model assumes an additive relationship between participants' own perception of their actions and the observers' perception: the presence of observers enhances the participant's perspective of his or her action. Such an additive model might at first seem inconsistent with the averaging models in estimation and perception research (e.g., anchoring; Mussweiler & Strack, 2000). According to an averaging model, another person's estimate serves as a standard to which one's own estimate is assimilated. However, for such an averaging model to hold, the person would need some insight into the observers' thoughts and feelings about his or her actions. In none of our studies did the participant know anything about the observers' thoughts, so that he or she most likely projected his or her own thoughts onto the perceiver rather than averaging the different perspectives.

Indeed, in the absence of information about others' perceptions or estimates, an averaging model by which the participants average their own perceptions with their projected perceivers' perceptions would predict no impact of observers (i.e., the average perspective = the participant's perspective). Our studies consistently provide a test for such a prediction based on an averaging model and find support for our additive model and no support for the averaging model. However, insight into the observers' perspective might be a boundary condition to the magnification effect of being observed. If, for example, in Study 1, the perceiver commented that the participant had eaten a very small quantity of chips, the participant might have anchored on this small number and provided an estimate that was smaller than if the perceiver had not mentioned an estimate. Such a low estimate expressed explicitly by the observer could serve as a boundary condition for the magnifying effect of being observed.

In a similar vein, whenever the observer changes the observed person's behavior, such an influence could pose a boundary condition to the magnifying effect of being observed. For instance, supportive others reduced nervous behavior (e.g., pacing or shifting nervously) among anxious people who were waiting for a painful procedure (Schachter, 1959). Hence, the presence of others could minimize the display and, therefore, the perception of nervous actions. In our studies, we do not see these effects because participants were observed with no social support or affiliation. Unresponsive observers typically do not elicit feelings of social support (Kane, McCall, Collins, & Blascovich, 2012). However, the presence of supportive observers could have served as a boundary condition. Notably, the above influences of observers—independent lower estimates and social support—might also be orthogonal to the magnifying effect of being observed, such that each factor displays an independent effect on estimation.

One could speculate on a number of related explanations for our effects. For example, research has demonstrated how shared attention, or coattention, can influence the perception and evaluation of actions and objects. Objects or actions that are simultaneously attended to with another person elicit more intense emotions and evaluations, and are better remembered (Boothby et al., 2014; Eskenazi et al., 2013; Shteynberg, 2015; Shteynberg, Hirsh, Apfelbaum, Larsen, Galinsky, & Roese, 2014). Conceptually speaking, some overlap indeed exists between being observed while doing an action and attending to an action simultaneously with another person. However, research has found that coattention influences the evaluation of the attended object, for instance, the taste of a food (Boothby et al., 2014). By contrast, in our studies, being observed affects the perceived magnitude of action, whereas the evaluation of the object remains unchanged (e.g., taste of the food is unaffected in Studies 1 and 2). Thus, being observed seems to magnify the visible aspects of the observed action, whereas invisible evaluative aspects remain unaffected.

One might also wonder whether being observed increases the accuracy of one's perceptions. Our studies show mixed evidence: whereas in Studies 2 and 5, we find no difference in accuracy between observed and unobserved participants, in Study 3, observed participants were more accurate than unobserved participants. Specifically, all participants underestimated the number of points they lost and gained in Study 3 (presumably because of the large number of points gained and lost), but observed participants underestimated both numbers to a lesser extent. Note that Studies 1 and 4 measure the dependent variable with Likert-type rating scales, so we cannot compute accuracy scores for these studies. Future research should address whether the presence of observers has a systematic effect on people's accuracy in perceptions. However, we find no such systematic effect in our studies.

Undoubtedly, being observed increases self-awareness (Duval & Wicklund, 1972), which typically leads people to focus on themselves as objects. For instance, the presence of a camera (Hass, 1984), an audience, or even a mirror (Baldwin & Holmes, 1987; Carver & Scheier, 1978) increases self-awareness. Through higher self-awareness, people might similarly magnify their actions because they might pay more attention to their actions and invest more cognitive capacity in thinking about them. Although increased self-awareness might plausibly be part of why observers magnify actions, self-awareness cannot be the only mechanism. If it were, higher self-awareness would magnify the whole experience and not just the observable part of the experience. Therefore, people should also experience a magnification of the unobservable features of the experience, such as the taste of the food they are eating, or their memory of their inactions. However, we find that only observable aspects of actions are amplified.

One may speculate about downstream consequences of our effects. For example, in Study 4, we find that an individual's perception of his or her contribution increases with the number of people who observed that contribution. Similarly, one common finding in group settings is overclaiming, which describes individuals' tendency to claim a larger share of the group's efforts than others in the group (Leary & Forsyth, 1987; Paulhus, Harms, Bruce, & Lysy, 2003; Ross & Sicoly, 1979). Typically, every group member overestimates the percentage of the total work that they have done, so that the sum of all percentage estimates provided by the group members far exceeds 100% (Paulhus et al., 2003). People's egocentric perspective on their own work commonly explains this cognitive bias. When people are observed, this bias might be even larger because the additional perspective of the observer might enhance one's egocentric perspective and thus magnify one's efforts even more. Thus, being observed might increase overclaiming of one's contribution in group work.

Conclusion

The presence of observers fundamentally affects people's perceptions of their own behavior. By experiencing a shared reality, which enhances one's experiences, people magnify their actions when observers are present. Thus, we show how the social context influences not only *what* people do, but also *how* people think about what they do.

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Appendix

Screenshot of the Matrix Task in Study 5 (Translated From Mandarin)

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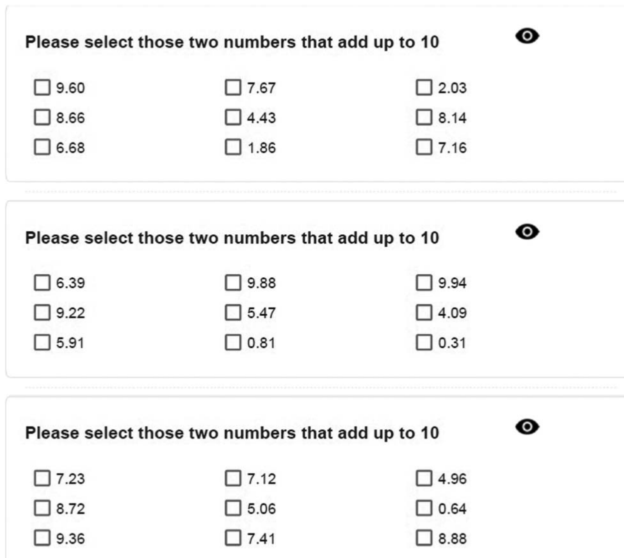

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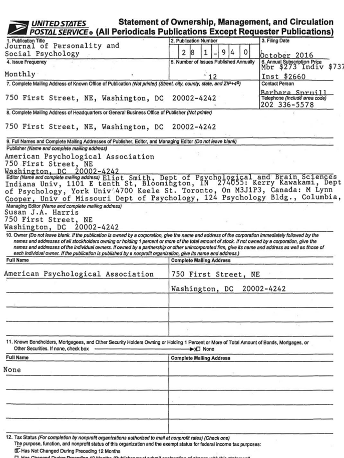

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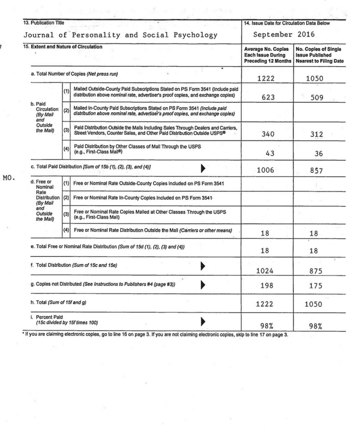

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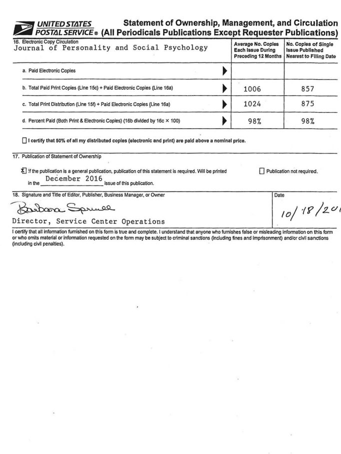

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