The effect of anger on the intentionality bias

Baptiste Subra
Laboratoire de Psychologie (EA4139), Université de Bordeaux, Bordeaux, France

Word count = 5383

Acknowledgments

I would like to thank François Ric for valuable comments on a previous version of the manuscript and Stella Dujardin, Helena Ravalojoana and Carole Richard for assisting with data collection.

Conflict of Interest Statement

The author declares that there are no potential conflicts of interest. The author also confirms that this article adheres to ethical guidelines specified in the APA Code of Conduct as well as the author's national ethics guidelines.

Data Availability Statement

De-identified data and materials for the experiments are posted on the Open Science Framework: https://osf.io/s5wap/?view_only=99ac6c6442614b12ae7ea46e51863e41.

Correspondence: Baptiste Subra, Laboratoire de Psychologie – EA4139, Université de Bordeaux, 3 ter place de la Victoire, 33076 Bordeaux Cedex, France. Email: baptiste.subra@u-bordeaux.fr.

Abstract

More than a decade of research on emotions has demonstrated the role of affect in social judgments. Emotions influence the way individuals make inferences about others' behavior. Building on these previous findings, the present research investigates the effects of anger and sadness on the attribution of intentionality. In Experiment 1, angry, sad, or neutral participants read a series of sentences describing simple actions and had to indicate whether the actions were done intentionally or accidentally. Results showed that anger significantly predicted the proportion of intentional judgment when participants were asked to interpret ambiguous sentences. In Experiment 2, the effect of anger on intentionality was replicated. Angry participants endorsed more intentional explanations than neutral participants. This finding helps explain how anger increases the inclination to make hostile inferences.

Keywords: Intentionality bias; Anger; Sadness; Emotion; Attribution

The effect of anger on the intentionality bias.

Emotions play an important role in social perception. Our own emotions influence how we perceive other people. For example, we form a more positive impression of others when we are in a positive mood rather than a negative one (Forgas & Bower, 1987). Emotions also influence attributions we make about others' behavior. People's judgments of causality, responsibility and blame are indeed influenced by their emotional states (Goldberg, Lerner, & Tetlock, 1999; Keltner, Ellsworth, & Edwards, 1993; Quigley & Tedeschi, 1996). For instance, anger increases the attribution of responsibility and blame because angry individuals are more prone to think that the behavior of others is more likely under their personal control, thus emphasizing dispositional factors (Keltner et al., 1993). Given that anger leads people to overestimate personal agency of others, it should increase the perception that actions are performed intentionally. Thus, the present research examines the role of anger on the judgment of intentionality.

The preference for intentional explanations

In everyday interactions, we often have to make a distinction between intentional and unintentional actions. Deciding whether others' actions are made on purpose or not greatly influences the way we respond to them. Imagine someone bumps into you on the street, you might respond differently whether you think it was intentional or accidental. The perception of intentionality is thus essential when evaluating the actions of others. However, this issue has not been deeply investigated in the literature on social perception. Research on social attribution has studied the consequences of perception of intentionality, demonstrating for instance that people are more severely blamed when transgressing a norm intentionally than unintentionally (e.g., Ames & Fiske, 2015; Lagnado & Channon, 2008; but see Barrett et al., 2016, demonstrating cultural variations in the role of intention in blame attribution). Nevertheless, the question of why an action is perceived as intentional or unintentional has not received much attention from these approaches, in part because intentionality has been

encompassed with the concept of controllability (Heider, 1958; Shaver, 1985; Weiner, 1995; see Malle & Knobe, 1997 for a discussion). In contrast, this question has been extensively assessed in developmental psychology, and numerous studies have examined the children's acquisition of the concept of intentionality. These studies have shown that young children display a strong bias toward intentional explanation (e.g., Donovan & Kelemen, 2011; Kelemen, 2004; Smith, 1978). Models of automatic intentional inference have proposed that movement of self-propelled objects are automatically seen by infants as intentional (Baron-Cohen, 1995; Premack, 1990). With repeated experiences and cognitive maturation, children develop the ability to perceive that human actions are not *in essence* intentional, thus elaborating a distinction between goals, desires and actions (Flavell, 1999).

In line with this perspective, recent studies have demonstrated that adults also display an intentionality bias (Moore & Pope, 2014; Peyroux, Strickland, Tapiero, & Franck, 2014; Rosset, 2008; Slavny & Moore, 2018). In a series of three studies (Rosset, 2008), it has been demonstrated that adults tend to make spontaneously more intentional inferences than unintentional ones, unless the task allows them to make a more thoughtful judgment. For instance, in a first experiment, participants were more likely to judge actions as intentional when they had to make their decision quickly, compared to participants who had more time. Moreover, in a second experiment, participants provided more intentional explanations of actions unless accidental alternative explanations were explicitly reminded. Finally, it was demonstrated in a third experiment that participants recalled more unintentional actions than intentional actions after the judgment task, indicating that unintentional sentences required more cognitive processing that intentional ones.

These results support the two-step process model of intention inference proposed by Rosset (2008), which posits that social perception involves the co-action of an intuitive preconscious system and a deliberate conscious system (e.g., Gilbert & Malone, 1995; Kahneman, 2003; Kruglanski & Orehek, 2007; Morris & Mason, 2009). According to this

model, intentional inferences are the default mode of explaining others' behavior. These initial intentional explanations are elicited automatically, even in a few hundred milliseconds after encountering the stimulus (Decety & Cacioppo, 2012). To perceive an action as accidental, this prior automatic inference of intention should be overridden by higher cognitive processes. Processing additional information such as social norms, unintentional alternative causes, or behavioral cues will allow individuals to see alternative causes of actions and thus to consider unintentional explanations (Rosset, 2008). Consistent with this view, alcohol intoxication increases this intentionality bias, presumably because alcohol disrupts effortful cognitive abilities (Bègue, Bushman, Giancola, Subra, & Rosset, 2010).

The effects of incidental anger on social judgment

Emotions can also be an important factor influencing social information processing. The interplay between emotion and cognition is well documented in the literature and numerous studies have demonstrated how emotion and cognition can influence each other (see Storbeck & Clore, 2007). An Appraisal Tendency Framework has been proposed to account for the bidirectional relationship (ATF; Lerner & Keltner, 2000, 2001; Lerner & Tiedens, 2006). First, each specific emotion is defined by a core appraisal pattern. These cognitive evaluations of events are the determinant of emotional reactions. Anger, for instance, is elicited when we perceive an offense (Lazarus, 1991), associated with a sense of certainty about what happens and with the perception that the event is under individual control. Sadness, on the contrary, is elicited when and we have a feeling of loss, associated with a sense of uncertainty about what happens and with the perception that the event is outside individual control (Smith & Ellsworth, 1985). Second, once triggered, these emotional experiences influence our cognitive evaluations of subsequent situations. According to the ATF, emotions shape an implicit cognitive predisposition to appraise future events in line with the central appraisal patterns that characterize the emotion. For instance, angry individuals tend to attribute more blame than sad or neutral individuals (Ask & Pina, 2011;

Goldberg et al., 1999; Keltner et al., 1993; Lerner, Goldberg, & Tetlock, 1998; Quigley & Tedeschi, 1996). This is consistent with the fact that an anger appraisal implies that someone did something unpleasant. Similarly, angry individuals make more risky choice than fearful individuals, because personal control over the situation is a key appraisal of these two emotions, anger being associated with high personal control whereas fear being associated with low personal control (Lerner & Keltner, 2000, 2001). These findings demonstrate that the emotions elicited in one situation can influence judgments in a later, unrelated situation (i.e., incidental emotions).

These effects of incidental emotion on social perception are particularly relevant to the study of intentionality for two main reasons. First, previous research has shown that anger influences the way we perceive human agency. When explaining events, anger leads individuals to emphasize the role of the person as a causal agent, whereas sadness leads individuals to prioritize situational causes (Ask & Granhag, 2007; Ask & Pina, 2011; Keltner et al., 1993). Perceiving that an action is under personal control should lead to the conclusion that it was performed intentionally. Thus, anger should magnify the intentionality bias, whereas sadness should decrease it. At this point, a distinction should be drawn between the concept of intentionality, which refers to the action to be judged (Malle & Knobe, 1997) and the concept of personal agency, which refers to the agent who perform the action. An action is judged either as intentional or unintentional. And this judgment is partly determined by the perception of personal agency, that is the agent's capability to exert control over its own actions (e.g., Malle, Guglielmo, & Monroe, 2014; Weiner, 1995).

Second, emotions also influence the way we process information. Numerous studies have shown that emotions influence the depth of information processing. Sadness leads to more thorough, systematic processing of information (e.g., Krauth-Gruber & Ric, 2000) whereas anger leads to more heuristic processing of information (Small & Lerner, 2008). For instance, Tiedens (2001) found that angry participants made more inferences about others'

motives based on accessible cognitive scripts than sad participants did. Similarly, it has been shown that people induced to feel anger engaged more in stereotyping than people induced to feel sadness (Bodenhausen, Sheppard, & Kramer, 1994). Relying on the two-step process model of intentional inference (Rosset, 2008), the effects of emotions on depth of processing lead us to generate predictions regarding the attribution of intentionality: Intentional inferences are spontaneous, effortless, and automatic whereas accidental inferences necessitate more effortful cognitive processing. Thus, anger is expected to increase intentional inferences, whereas sadness is expected to decrease it.

Experiment 1

The first experiment tested whether anger and sadness influence the attribution of intentionality. Specifically, it was hypothesized that angry participants would make more intentional attributions than participants in a neutral state, and that sad participants would make less intentional attributions than participants in a neutral state.

Method

Participants and design. A total of 100 participants took part in this study, 4 of which did not finish the experiment and were therefore excluded from the analyses. The final sample consisted of 96 French undergraduate students (M_{age} = 20.92, SD = 3.82; 68 females). All were French native speakers. The experiment had a between-subjects design, with participants randomly assigned to one of the three conditions: anger (N = 32), sadness (N = 33), or control (N = 31). The sample size in this experiment was determined by the availability of participants. Entering the sample size into a sensitivity power analysis, we would have been able to detect a minimal effect size (Cohen's d) of 0.36, given α = 0.05 (two-tailed) and power = 0.80. All measures, manipulations, and exclusions in the study are disclosed. No additional data were collected once data analysis was started.

Materials and procedure. Participants were run individually. After providing informed consent, they were informed that they would participate in two unrelated studies that

had been put together for time convenience: The first study was presented as building an "inventory of life events". Participants had to write down a short essay (10 min) about a personal experience in which they had experienced anger, sadness, or to describe a typical day of their life (control condition, e.g., Strack, Schwarz, & Geschneidinger, 1985). In the ostensibly second study, participants read 50 sentences describing an agent's action (see Rosset, 2008; Bègue, et al., 2010). For each sentence, participants indicated whether the action was intentional or accidental. Of these 50 sentences, 20 test sentences describe actions that could be done either intentionally or accidentally. Of the test sentences there were two conditions: 13 ambiguous sentences describing prototypically accidental actions (e.g., "He set the house on fire") and 7 ambiguous sentences describing neutral or prototypically intentional actions (e.g., "She cut him off driving"). It has been shown that for accidental test sentences, individuals are more likely to perceive these actions as accidental, whereas for neutral/intentional test sentences, individuals are equally (neutral) or more likely (intentional) to perceive these actions as intentional (see Rosset, 2008). Additionally, 15 control sentences describe actions that could be done only intentionally (e.g., "He vacuumed the carpet") and 15 control sentences describe actions that could be done only accidentally (e.g., "She lost her keys"). Sentences were presented in a fixed randomized order.

It should be noted that the intentionality bias was investigated in this experiment using a verbal material. Participants had to determine intentionality by reading written description of actions, and not actions directly. Thus, as suggested (Rosset, 2008), it is possible that the judgment of intentionality depends on the phrasing of the sentences, which would imply that the observed intentionality bias reflects a linguistic bias. However, a recent study has replicated the intentionality bias using video stimuli, demonstrating that the intentionality bias is not merely a consequence of linguistic stimuli used (Moore & Pope, 2014).

Finally, a post-experimental questionnaire was proposed to verify the effectiveness of emotion inductions. Participants were asked to report how happy, sad, angry and calm they

felt (1 = not at all; 7 = extremely). This information was collected at the end of the procedure to be sure that the emotion check did not interfere with the main measure (Hauser, Ellsworth, & Gonzalez, 2018). Finally, participants were thanked and fully debriefed.

Results and Discussion

Emotion induction. To examine the effectiveness of the emotion induction, the data was submitted to a one-way ANOVA (anger, sadness, and control) on the level of anger with two contrasts: the first one comparing the anger condition with the control condition and the second one comparing the sadness condition with the control condition (dummy coding, Hardy, 1993). As expected, anger levels differed across conditions, $F(2, 93) = 6.00$, $p = .004$, $\eta^2_p = 0.11$, 90%[1] CI [0.02, 0.21]. Contrasts showed that participants in the anger condition rated themselves as more angry ($M = 3.00$, $SD = 1.98$) than those in the control condition ($M = 1.74$, $SD = 1.06$), $t(93) = 3.20$, $p = .002$, 95% CI [0.46, 2.06], $d = 0.80$, whereas participants in the sadness condition ($M = 1.94$, $SD = 1.48$) did not differ from participants in the control condition ($M = 1.74$, $SD = 1.06$), $t(94) = 0.51$, $p = 0.61$, 95% CI [-0.44, 0.84], $d = 0.16$. Similarly, a one-way ANOVA was conducted on the level of sadness. Results revealed no reliable differences concerning the level of sadness between the experimental conditions, $F(2, 93) = 1.40$, $p = .25$, $\eta^2_p = 0.03$, 90% CI [0.00, 0.09]. Contrasts showed that participants in the sadness condition ($M = 3.03$, $SD = 1.74$) did not differ from participants in the control condition ($M = 2.35$, $SD = 1.52$), $t(93) = 1.63$, $p = .107$, 95% CI [-0.14, 1.50], $d = 0.42$. There was also no significant difference between participants in the anger ($M = 2.84$, $SD = 1.71$) and control ($M = 2.35$, $SD = 1.52$) conditions, $t(93) = 1.17$, $p = .25$, 95% CI [-0.32, 1.30], $d = 0.31$. Thus, although the induction of anger was effective, the induction of sadness appears not to be effective[23].

Judgment of intentionality. An intentionality score, defined as the number of intentional judgments divided by the total number of responses, was computed for each participant for each sentence type (test sentences, intentional control sentences, accidental

control sentences). Each score was multiplied by 100 to give a percentage score (mean scores and standard deviations are shown in Table 1). The mean intentionality score for the test sentences was 40.96% (*SD* = 13.48), with a mean of 23.09% (*SD* = 16.09) for accidental test sentences and 74.11% (*SD* = 16.49) for neutral/intentional test sentences. These means are comparable to those obtained in previous studies (Bègue et al., 2010; Rosset, 2008; Slavny & Moore, 2018).

[Table 1 near here]

To test the effects of emotions on the judgment of intentionality, the data was submitted to a one-way ANOVA (anger, neutral, sadness) with two planned contrasts: the first one comparing the anger condition to the control condition and the second one comparing the sadness condition to the control condition (dummy coded). As expected, participants in the anger condition perceived more actions to be intentional (*M* = 45.1%, *SD* = 14.5) than did participants in the control condition (*M* = 37.6%, *SD* = 13.0), *t*(93) = 2.24 , *p* =.028 , 95% CI [0.6, 14.4], *d* = 0.55. However, the difference between participants in the sadness (*M* = 40.2%, *SD* = 12.3) and control (*M* = 37.6%, *SD* = 13.0) conditions was not significant, *t*(93) = 0.78 , *p* = .44, 95% CI [-3.9, 9.1], *d* = 0.19. Further analysis found that for accidental test sentences, participants in the anger condition perceived more actions to be intentional (*M*=28.2%, *SD* = 18.6) than did participants in the control condition (*M* = 19.4%, *SD* = 16.0), *t*(93) = 2.21, *p* = .029, 95% CI [0.1, 17.5], *d* = 0.52. However, for neutral/intentional test sentences, although the pattern of means was similar to the accidental test sentences, the difference between the anger (*M*=76.3%, *SD* = 15.2) and control (*M* = 71.4%, *SD* = 14.8) conditions did not reach significance, *t*(93) = 1.18, *p* = .24, 95% CI [-0.03, 0.12], *d* = 0.33. The data were also analyzed using a mixed model treating both participants and stimuli as random variables (Judd, Westfall, & Kenny, 2012). Given that responses to each sentence were dichotomous (i.e., intentional/accidental), a mixed model logistic regression was performed with emotion conditions as a between-subjects factor and sentence

types as a within-subjects factor. Importantly, the mixed model revealed a significant difference between the anger and control conditions for test sentences, Wald $z = 2.18$, $p = .03$, suggesting that we can generalize this effect not only to different participants, but also to different stimuli.

Although it was expected that emotions would influence judgment specifically when intentionality is ambiguous (i.e., tests sentences), responses on the control sentences were also analyzed. The mean intentionality score was 98.61% ($SD = 3.20$) for intentional control sentences and 2.57% ($SD = 4.87$) for accidental control sentences. These scores demonstrate that control sentences were unambiguous and that participants were correctly following instructions and understood the nature of the task. Concerning the comparison between emotion conditions, no differences were found between participants in the anger ($M = 99.0\%$, $SD = 3.0$), sadness ($M = 98.6\%$, $SD = 3.6$), and control ($M = 98.3\%$, $SD = 3.0$) conditions for intentional control sentences, $F(2, 93) = 0.35$, $p = 0.70$, $\eta^2_p = 0.01$, 90% CI [0.0, 0.4]. However, for accidental control sentences, participants in the anger condition perceived more actions to be intentional ($M = 3.8\%$, $SD = 6.1$) than did participants in the control condition ($M = 1.3\%$, $SD = 3.2$), $t(93) = 2.03$, $p = .046$, 95% CI [0.1, 4.9], $d = 0.52$. No differences were found between participants in the sadness ($M = 2.6\%$, $SD = 4.7$) and control ($M = 1.3\%$, $SD = 3.2$) conditions, $t(93) = 1.11$, $p = 0.28$, 95% CI [-0.7, 3.3], $d = 0.33$.

These results suggest that, compared to participants in a neutral state, angry participants made more intentional attributions when explaining an actor's action. It should be noted, however, that the effect of anger was significant only for accidental test sentences. Although this pattern is consistent with previous studies (Rosset, 2008; Slavny & Moore, 2018), the reasons remain unclear. A proposed explanation (see Slavny & Moore, 2018) is that accidental test sentences describe actions that people preferentially judge as accidental (the average proportion of intentional judgment for these sentences were 23% in the present

experiment), and thus are more sensitive to individuals' characteristics increasing intentional inferences. In line with this, it was found that anger also increases intentional inferences for accidental control sentences. This is an unexpected finding, given that the test sentences describe actions that are unambiguously accidental (e.g., "She lost her keys"). However, although unlikely, it is still possible to perceive intent in these actions.

Relatedly, one could argue that people are not biased toward intentional explanations given that overall, participants endorse more accidental interpretations than intentional ones when judging ambiguous actions (the overall proportion of intentional judgment for the test sentences was 41%). However, it should be kept in mind that 13 of the 20 test sentences describe actions that are usually done by accident (i.e., prototypically accidental actions), which leads to a low intentional base rate score. Anger increases the probability of judging these actions as intentional, although they are usually done by accident. Thus, the critical test relies on the relative comparison of intentionality scores between experimental conditions rather than the absolute proportion of intentional judgments.

However, sadness was not related to the judgment of intentionality in our experiment. The reason why the effect of sadness on the intentionality score was not observed is unclear. One possible explanation is that the induction of sadness was not effective. The difference in self-reported sadness between the participants in the sadness and control condition did not reach significance (p = .107). Another possibility is that ambiguous actions used in the intentionality task are more easily appraised as anger-related behavior rather than as sadness-related behavior. Indeed, the majority of ambiguous actions are actions that could generate negative outcomes for others (e.g., "She cut him off driving"), and inferring intentionality to these actions is more congruent with angry cognitions than with sad cognitions.

In line with this reasoning, it is possible that anger increases intentional inferences in the present experiment precisely because the majority of the ambiguous actions described in the test sentences could potentially inflict a cost on others. Adopting a functionalist

perspective, the goal that anger is designed to achieve is to deter transgressions through blame and aggression (Fessler, Pillsworth, & Flamson, 2004). Thus, it can be postulated that anger would increase intentional inferences specifically when the action of one agent could inflict a cost on another agent (e.g., “She cut him off the traffic”), but not when the action couldn’t inflict a cost on others (e.g., “She ate the bruised part of the apple”). To test this prediction, the analyses on the test sentences were performed by considering whether or not the action described in the sentence could be detrimental for others. Three independent judges had to read each of the twenty test sentences and had to determine whether or not the described action could have damaging consequences for others. Each sentence was classified into one of the two categories (i.e., cost infliction *vs.* no-cost infliction) when at least two of the three judges agreed in their choice. The Fleiss’ Kappa statistic was used as a measure of inter-rater reliability. The Fleiss kappa was 0.57, indicating a substantial agreement among raters (Landis & Koch, 1977). Finally, the effects of anger on the perception of intentionality were reanalyzed using a mixed model. The results revealed a significant difference between the anger and control conditions for test sentences, Wald $z = 2.3$, $p = .02$. More importantly, the interaction between emotion conditions and sentence types was not significant, Wald $z = 0.767$, $p = .44$, indicating that the effect of anger on the attribution of intentionality was not significantly different depending on the type of test sentences. Thus, there is no evidence that the observed effect of anger on intentional inferences is limited to actions that entail interpersonal cost infliction.

A second experiment was conducted in order to replicate the effect of anger on the intentionality bias and it was decided to increase the sample size given that the first experiment might have been underpowered. The sample size was determined based on the effect of Experiment 1. With an $\alpha = .05$ and power = .80, the projected sample size needed to detect an effect size of $d = 0.55$ is approximately $N = 53$ per condition.

Experiment 2

Method

Participants and design. A total of 106 participants took part in the experiment (69 females, M_{age} = 25.94, *SD* = 10.3, age range 18-65 years). Participants (mostly students) were recruited at a campus of a French university. The experiment had a between-subjects design, with participants randomly assigned to one of the two conditions: anger (*N* = 53) or control (*N* = 53).

Materials and procedure. The experimental procedure was similar to Experiment 1. Participants had first to write down a short essay about a personal experience in which they experienced anger or to describe a typical day of their life, second to complete the intention attribution task, and finally to report their emotional state.

Results and Discussion

Emotion induction. As expected, participants in the anger condition rated themselves as more angry (*M* = 2.45, *SD* = 1.58) than participants in the control condition (*M* = 1.83, *SD* = 1.24), *t*(104) = 2.26, *p* = .026, 95% CI [0.07,1.17], *d* = 0.44[45].

Judgment of intentionality. As in Experiment 1, an intentionality score was computed for each sentence type (see Table 2). For test sentences, the mean intentionality score was 40.90% (*SD* = 14.55), with a mean of 26.92% (*SD* = 15.47) for accidental test sentences and 66.85% (*SD* = 20.26) for neutral/intentional test sentences. These means are similar to those found in Experiment 1.

[Table 2 near here]

The analysis on the test sentences revealed that participants in the anger condition perceived more actions to be intentional (*M* = 43.7%, *SD* = 14.6) than did participants in the control condition (*M* = 38.1%, *SD* = 14.1), *t*(104) = 2.00 , *p* = .048 , 95% CI [0.1, 11.1], *d* = 0.39. Further analysis found that for neutral/intentional test sentences, participants in the anger condition perceived more actions to be intentional (*M*=70.9%, *SD* = 19.0) than did

participants in the control condition (M = 62.8%, SD = 20.8), $t(104) = 2.09$, $p = .039$, 95% CI [0.4, 15,8], $d = 0.41$. However, the difference between participants in the anger (M = 29.0%, SD = 15.9) and control (M = 24.8%, SD = 14.8) conditions was not significant for accidental test sentences, $t(104) = 1.41$, $p = .16$, 95% CI [-1.7, 10.1], $d = .28$. Thus, unlike Experiment 1, the difference between the anger and control conditions only reached significance for neutral/intentional test sentences. Again, to test whether we could generalize this effect to other participants as well as to other stimuli, a mixed model logistic regression was performed treating both participants and stimuli as random variables. This mixed model revealed a significant difference between the anger and control conditions for test sentences, Wald $z = 2.14$, $p < .03$. As in Experiment 1, the effect of anger on the perception of intentionality was also re-analyzed by considering the type of actions described in the test sentences (i.e., cost infliction vs. no-cost infliction). The analysis revealed a significant difference between the anger and control conditions for test sentences, Wald $z = 1.99$, $p = .046$, and a non-significant interaction between emotion conditions and sentence types, Wald $z = 0.52$, $p = .52$.

Concerning the control sentences, the mean intentionality score was 96.04% (SD = 7.41) for the intentional control sentences and 5.09% (SD = 7.45) for the accidental control sentences. The analysis on the control sentences revealed no differences between emotion conditions for accidental control sentences, $t(104) = 1.31$, $p = .19$, and intentional control sentences, $t(104) = 1.32$, $p = .19$.

Meta-analysis on intentionality scores. The results of Experiments 1 and 2 show that anger increases the probability to make intentional inferences for ambiguous sentences. However, when looking at each type of test sentences separately (i.e., accidental test sentences and neutral/intentional test sentences), the results of Experiment 1 indicate a significant effect of anger only for accidental test sentences, whereas the results of Experiment 2 indicate a significant effect of anger only for neutral/intentional test sentences.

To strengthen our confidence in the findings of the present research, a small-scale meta-analysis was conducted on the test sentences (with the metafor R package, Viechtbauer, 2010). For the comparison between anger and control conditions, a random effects model integrated standardized mean differences across the two experiments. Overall, the effect of anger was significant, *Estimate* = 0.44, *SE* = 0.16, *z* = 2.84, *p* = .004, 95% CI [0.14, 0.75]. More importantly, when analyzing separately accidental and neutral/intentional test sentences, results revealed that the effect was significant for both accidental test sentences, *Estimate* = 0.38, *SE* = 0.16, *z* = 2.47, *p* = .014, 95% CI [0.08, 0.69], and neutral/intentional test sentences, *Estimate* = 0.37, *SE* = 0.16, *z* = 2.41, *p* = .016, 95% CI [0.07, 0.68.]. Thus, the small-scale meta-analysis supports the results that anger increases the probability to make intentional inferences.

General discussion

The current research examined the effects of emotions on the judgment of intentionality. Specifically, it was expected that anger and sadness would influence the perception that others' actions are performed intentionally. In two experiments, it was demonstrated that anger increases the probability to make intentional inferences. Angry participants endorsed more intentional explanations about ambiguous human actions than did non-angry participants. These results are consistent with the hypothesis that anger, by inducing superficial cognitive processing (Small & Lerner, 2008) and by increasing reliance on the causal role of the actor over situational causes (Keltner et al., 1993), would favor intentional inferences about others' behavior. However, the interpretations of this finding rely on assumptions about underlying mechanisms (i.e., attribution tendencies, cognitive processing) that were not assessed in the present research. Future studies are needed to shed light on the contributing role of these postulated mechanisms on the anger-intentionality relationship. For instance, it is plausible that this finding could be only due to the effect of

anger on attribution tendencies, or only due to the effect of anger on cognitive processing, or that another underlying mechanism intervene in this relationship.

However, applying the same theoretical underpinning to sadness, the hypothesis that sadness, by promoting a systematic cognitive processing, would decrease the intentionality bias was not supported in Experiment 1. We did not find a difference between sad and neutral participants. Given that self-reported sadness was not influenced by the emotion induction, it is difficult to draw conclusion on the basis of this study about the effect of sadness on the intentionality bias. Noteworthy, these findings are consistent with a previous experiment showing that anger, but not sadness, increases the perception of criminal intent (Ask & Pina, 2011).

Further to demonstrate the effect of anger on the perception of intentionality, our results could shed light on the anger-aggression relationship. If angry people are prone to think that others' behaviors are done on purpose, they should make more hostile inferences when these actions have negative consequences. Following the work of Dodge and colleagues (Crick & Dodge, 1994; Dodge, 1980), previous studies have shown that a hostile information processing style is a key factor of aggressive behavior (Orobio de Castro, Veerman, Koops, Bosch, & Monshouwer, 2002). Thus, anger, by favoring an intentional interpretation of others' behavior, should increase the probability to react with hostility. In line with this, it has been shown that anger elicits heuristic processing, which increases hostile inferences in aggressive individuals because they relied more on chronically accessible scripts (Tiedens, 2001).

Consistent with this view, most of the ambiguous behavior in our study had negative outcomes (e.g., "She cut him off driving", "He bumped into a classmate in the hall"). However, if anger favors intentional inferences, it should do so when an ambiguous behavior has a positive outcome. Our theoretical claim, relying on process effects (i.e., how people think) and not on content effects (what people think) of emotions, would lead to expect that

the intentionality bias should also be increased for ambiguous actions bearing positive outcomes among angry individuals. It will be left to future research to explore whether the effect observed in the present study depends on the outcome desirability.

References

Ames, D. L., & Fiske, S. T. (2015). Perceived intent motivates people to magnify observed harms. *PNAS Proceedings of the National Academy of Sciences of the United States of America, 112*, 3599–3605.

Ask, K., & Granhag, P. A. (2007). Hot cognition in investigative judgments: The differential influence of anger and sadness. *Law and Human Behavior, 31*, 537–551.

Ask, K., & Pina, A. (2011). On Being Angry and Punitive: How Anger Alters Perception of Criminal Intent. *Social Psychological and Personality Science, 2*, 494-499.

Baron-Cohen, S. (1995). *Learning, development, and conceptual change. Mindblindness: An essay on autism and theory of mind.* Cambridge, MA, US: The MIT Press.

Barrett, H. C., Bolyanatz, A., Crittenden, A. N., Fessler, D. M. T., Fitzpatrick, S., Gurven, M., … Laurence, S. (2016). Small-scale societies exhibit fundamental variation in the role of intentions in moral judgment. *Proceedings of the National Academy of Sciences*, *113*, 4688–4693.

Bègue, L., Bushman, B. J., Giancola, P. R., Subra, B., & Rosset, E. (2010). "There is no such thing as an accident," especially when people are drunk. *Personality and Social Psychology Bulletin, 36*(10), 1301–1304.

Bodenhausen, G. V., Sheppard, L. A., & Kramer, G. P. (1994). Negative affect and social judgment: the differential impact of anger and sadness. *European Journal of Social Psychology Special Issue: Affect in social judgments and cognition, 24*, 45–62.

Crick, N. R., & Dodge, K. A. (1994). A review and reformulation of social information processing mechanisms in children's social adjustment. *Psychological Bulletin, 115*, 74–101.

Decety, J., & Cacioppo, S. (2012). The speed of morality: A high-density electrical neuroimaging study. *Journal of neurophysiology, 108,* 3068–3072.

Dodge, K. A. (1980). Social cognition and children's aggressive behavior. *Child Development, 51*, 162–170.

Donovan, E., & Kelemen, D. (2011). Just rewards: Children and adults equate accidental inequity with intentional unfairness. *Journal of Cognition and Culture, 11,* 137–150.

Fessler, D. M. T., Pillsworth, E. G., Flamson, T. J. (2004). Angry men and disgusted women: An evolutionary approach to the influence of emotions on risk taking. *Organizational Behavior and Human Decision Processes, 95*, 107-123.

Flavell, J. H. (1999). Cognitive development: Children's knowledge about the mind. *Annual Review of Psychology, 50*, 21–45.

Forgas, J. P., & Bower, G. H. (1987). Mood effects on person-perception judgments. *Journal of Personality and Social Psychology, 53*, 53–60.

Gilbert, D. T., & Malone, P. S. (1995). The correspondence bias. *Psychological Bulletin, 117*, 21−38.

Goldberg, J. H., Lerner, J. S., & Tetlock, P. E. (1999). Rage and reason: the psychology of the intuitive prosecutor. *European Journal of Social Psychology, 29*, 781–795.

Hardy, M. A. (1993). *Sage university papers series. Quantitative applications in the social sciences, Vol. 93. Regression with dummy variables.* Thousand Oaks, CA, US: Sage Publications, Inc.

Hauser, D. J., Ellsworth, P. C., & Gonzalez, R. (2018). Are Manipulation Checks Necessary? *Frontier in Psychology, 9*, 998.

Heider, F. (1958). *The Psychology of Interpersonal Relations*. New York: Wiley.

Judd, C. M., Westfall, J., & Kenny, D. A. (2012). Treating stimuli as a random factor in social psychology: A new and comprehensive solution to a pervasive but largely ignored problem. *Journal of Personality and Social Psychology, 103*, 54–69.

Kahneman, D. (2003). A perspective on judgment and choice: Mapping bounded rationality. *American Psychologist, 58*, 697–720.

Kelemen, D. (2004). Are children 'intuitive theists'? Reasoning about purpose and design in nature. *Psychological Science, 15*, 295–301.

Keltner, D., Ellsworth, P. C., & Edwards, K. (1993). Beyond simple pessimism: effects of sadness and anger on social perception. *Journal of Personality and Social Psychology, 64*, 740–752.

Krauth-Gruber, S., & Ric, F. (2000). Affect and stereotypic thinking: A test of the mood-and-general-knowledge-model. *Personality and Social Psychology Bulletin*, 1587–1597.

Kruglanski, A. W., & Orehek, E. (2007). Partitioning the domain of social inference: Dual mode and systems models and their alternatives. *Annual Review of Psychology, 58*, 291–316.

Lagnado, D. A., & Channon, S. (2008). Judgments of Cause and Blame: The Effects of Intentionality and Foreseeability. *Cognition, 108*, 754–770.

Landis, J. R., & Koch, G.G. (1977). The measurement of observer agreement for categorical data. *Biometrics, 33*, 159–174.

Lazarus, R. S. (1991). *Emotion and adaptation.* New York: Oxford University Press.

Lerner, J. S., Goldberg, J. H., & Tetlock, P. E. (1998). Sober second thought: the effects of accountability, anger and authoritarianism on attributions of responsibility. *Personality and Social Psychology Bulletin, 24*, 563–574.

Lerner, J. S., & Keltner, D. (2000). Beyond valence: Toward a model of emotion-specific influences on judgment and choice. *Cognition and Emotion, 14*, 473–493.

Lerner, J. S., & Keltner, D. (2001). Fear, anger, and risk. *Journal of Personality* and *Social Psychology, 81,* 146–159.

Lerner, J. S., & Tiedens, L. Z. (2006). Portrait of the angry decision maker: How appraisal tendencies shape anger's influence on cognition. *Journal of Behavioral Decision Making, 19,* 115–137.

Malle, B. F., Guglielmo, S., & Monroe, A. E. (2014). A theory of blame. *Psychological Inquiry, 25,* 147–186.

Malle, B. F., & Knobe, J. (1997). The folk concept of intentionality. *Journal of Experimental Social Psychology, 33,* 101–121.

Moore, J. W., & Pope, A. (2014). The intentionality bias and schizotypy. *Quarterly Journal of Experimental Psychology*, 2218–2224.

Morris, M., & Mason, M. (2009). Intentionality in intuitive versus analytic processing: Insights from social cognitive neuroscience, *Psychological Inquiry, 20*, 58–65.

Orobio de Castro, B., Veerman, J. W., Koops, W., Bosch, J. D., & Monshouwer, H. J. (2002). Hostile attribution of intent and aggressive behavior: A meta-analysis. *Child Development, 73*, 916–934.

Peyroux, E., Strickland, B., Tapiero, I., & Franck, N. (2014). The intentionality bias in schizophrenia. *Psychiatry Research, 219*, 426–430.

Premack, D. (1990). The infant's theory of self-propelled objects. *Cognition*, *36*, 1–16.

Quigley, B. M., & Tedeschi, J. T. (1996). Mediating effects of blame attributions on feelings of anger. *Personality and Social Psychology Bulletin*, *22*, 1280–1288.

Rosset, E. (2008). It’s no accident: Our bias for intentional explanations. *Cognition, 108,* 771–780.

Shaver, K. G. (1985). *The attribution of blame*. New York: Springer-Verlag.

Slavny, R. J. M., & Moore, J. W. (2018). Individual differences in the intentionality bias and its association with cognitive empathy. *Personality and Individual Differences, 122*, 104–108.

Small, D. A., & Lerner, J. S. (2008). Emotional policy: Personal sadness and anger shape judgments about a welfare case. *Political Psychology, 29*, 149–168.

Smith, C. A., & Ellsworth, P. C. (1985). Patterns of cognitive appraisal in emotion. *Journal of Personality* and *Social Psychology, 48*, 813–838.

Smith, M. C. (1978). Cognizing the behavior stream: The recognition of intentional action. *Child Development, 49*, 736–743.

Storbeck, J., & Clore, G. L. (2007). 'On the interdependence of cognition and emotion', *Cognition and Emotion, 21*, 1212–1237.

Strack, F., Schwarz, N., & Geschneidinger, E. (1985). Happiness and reminiscing: The role of time perspective, affect, and mode of thinking. *Journal of Personality and Social Psychology, 49*, 1460–1469.

Tiedens, L. Z. (2001). The effect of anger on the hostile inferences of aggressive and nonaggressive people: specific emotions, cognitive processing, and chronic accessibility. *Motivation and Emotion, 25*, 233–251.

Viechtbauer, W. (2010). Conducting meta-analyses in R with the metafor package. *Journal of Statistical Software, 36*, 1–48.

Weiner, B. (1995). *Judgments of responsibility: A foundation for a theory of social construct*. New York: Guilford Press.

[1] 90% confidence intervals for eta-squared were computed, because eta-squared cannot be negative and, therefore, 90% confidence intervals for eta-squared correspond to 95% confidence intervals for other indexes.
[2] No differences were found across conditions for self-reported happiness, $F(2,93) = 2.56$, $p = .08$, and self-reported calm, $F(2,93) = 0.15$, $p = .86$.
[3] In addition, a linguistic analysis was also performed on the participants' writing production in the emotion induction task. Using Pennebaker's LIWC 2015 software, the linguistic indicator of anger was operationalized as the frequency of anger-related words (e.g., hate, kill annoyed), whereas the linguistic indicator of sadness was operationalized as the frequency of sad-related words (e.g., crying, grief, sad). The linguistic analysis revealed that participants in the anger condition used significantly more anger-related words (M = 0.72, SD = 0.73) than did participants in the sadness ($M = 0.28$, $SD = 0.37$) and control ($M = 0.18$, $SD = 0.31$) conditions, $t(93) = 3.8$, $p < .001$. Moreover, participants in the sadness condition used significantly more sad-related words ($M = 1.68$, $SD = 1.27$) than did participants in the anger ($M = 0.71$, $SD = 0.83$) and control ($M = 0.42$, $SD = 0.55$) conditions, $t(93) = 4.9$, $p < .001$.
[4] No differences were found across conditions for self-reported happiness, $t(104) = 0.34$, $p = .74$, and self-reported calm, $t(104) = 0.39$, $p = .70$.
[5] As in Experiment 1, the frequency of anger-related words was computed for each participant's essay. The analysis revealed that participants in the anger condition used significantly more anger-related words ($M = 0.98$, $SD = 1.12$) than participants in the control condition ($M = 0.15$, $SD = 0.39$), $t(104) = 5.1$, $p < .001$.

Table 1.

Intentionality scores as a function of emotion condition and sentence type (Experiment 1)

	Control sentences				Test sentences					
	Accidental		Intentional		Accidental		Neutral/int.		All	
	M	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*
Control	1.3	3.2	98.3	3.0	19.4	16.0	71.4	14.8	37.6	13.0
Anger	3.8	6.1	99.0	3.0	28.2	18.6	76.3	15.2	45.1	14.5
Sadness	2.6	4.7	98.6	3.6	21.7	12.4	74.5	19.2	40.2	12.3

Table 2.

Intentionality scores as a function of emotion condition and sentence type (Experiment 2)

	Control sentences				Test sentences					
	Accidental		Intentional		Accidental		Neutral/int.		All	
	M	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*
Control	6.0	8.2	95.1	8.9	24.8	14.8	62.8	20.8	38.1	14.1
Anger	4.2	6.6	97.0	5.5	29.0	15.9	70.9	19.0	43.7	14.6