



# Pride before the fall: (Over)confidence predicts escalation of public commitment



Richard Ronay\*, Janneke K. Oostrom, Nale Lehmann-Willenbrock, Mark Van Vugt

Vrije Universiteit Amsterdam, The Netherlands

## HIGHLIGHTS

- We examined the effect of overconfidence on escalation of commitment.
- In a private context, overconfidence is unrelated to escalation decisions.
- In a public context, overconfidence is positively related to escalation decisions.
- Individual differences in overconfidence are related to reputation sensitivity.
- Reputational concerns drive publicly announced investment decision.

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## ABSTRACT

In four studies we examined the effect of overconfidence on escalation of commitment in investment tasks. Study 1 ( $N = 105$ ) revealed a positive relationship between overconfidence and decisions to escalate. In contrast, Study 2 ( $N = 121$ ) showed that overconfidence was negatively related to escalation of commitment. The reversal of this effect appeared to emerge as a function of the public (Study 1) versus private (Study 2) context in which the investment decisions were made. In Study 3 ( $N = 108$ ) and Study 4 ( $N = 380$ ) we experimentally replicated this pattern of findings and found support for the explanatory role of reputational concerns. A meta-analysis of the findings from our four studies showed that overconfidence is positively related to escalation of commitment in public contexts, and that this relationship is absent when decisions are made privately.

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## 1. Introduction

*"I am in blood – Stepped in so far that, should I wade no more, returning were as tedious as go o'er."*

[*Macbeth*]

Macbeth's bloody pursuit of the Scottish crown is a potent tale of the hazards of overconfidence. Fueled by the false confidence instilled in him by three witches who recognized and preyed upon his ambition, Macbeth embarks on a murderous course of action from which he is unable to extricate himself, even after his conscience and better judgment lead him to recognize the error of his plight. But people do not need witches to instill in them overly optimistic views of their future outcomes. Indeed, overconfidence and its associated perils are so widely

experienced that they have featured in the canons of human history from the antiquities to today.

There is an intuitive association between confidence and decision-making: We are most likely to commit our time, effort, and financial resources to pursuing those decisions about which we are most confident (e.g., McCarthy, Schoorman, & Cooper, 1993). Decisions that arise from high levels of confidence often lead decision-makers to persevere with plans, even in the face of objective evidence that their initial decision may have been a poor one (Lichtenstein, Fischhoff, & Phillips, 1982). The problem with using one's confidence as a compass to navigate uncertainty in this way is that we have a near universal tendency to see ourselves as more in control of our outcomes than we actually are (for a review, see Moore & Healy, 2008). Although people are quick to recognize this folly in others (Pronin, Gilovich, & Ross, 2004), they also tend to see themselves as rare unicorns whose unique ability to control transparently random events (Langer, 1975) leads to unrealistic optimism about their own goals (Weinstein, 1980). Moreover, individual differences in overconfidence predict people's willingness to mistakenly bet on their own future success (Campbell, Goodie, & Foster, 2004). Thus,

\* Corresponding author at: Vrije Universiteit Amsterdam, Department of Experimental and Applied Psychology, Van der Boerhorststraat 1, 1081 BT Amsterdam, The Netherlands. E-mail address: [r.ronay@vu.nl](mailto:r.ronay@vu.nl) (R. Ronay).

while appropriate levels of confidence can direct action and goal perseverance in a functional way, overconfidence might misdirect action and goal perseverance toward suboptimal outcomes. Overconfidence might then be associated with goal perseverance even in the face of obviously looming losses. The relationship between confidence and goal perseverance suggests that overconfidence, defined as a belief that one is more skilled, intelligent, and capable than one actually is (Epley & Whitchurch, 2008; Kruger & Dunning, 1999; von Hippel & Trivers, 2011), may play a role in escalation of commitment.

### 1.1. Escalation of commitment

Escalation of commitment can occur when a decision maker allocates money or resources to the pursuit of a goal and then learns that his or her initial investment decision may have been a poor one. At such a point he or she must decide whether to persist or withdraw from the previously chosen course of action; persistence in the face of disheartening feedback captures what is meant by escalation of commitment (Brockner, 1992). Since Staw's (1976, 1981) seminal work on escalation of commitment, researchers in the fields of economics and social and organizational psychology have showed a steady interest in this phenomenon, which has been noted as one of the most robust and costly of organizational decision errors (Sleesman, Conlon, McNamara, & Miles, 2012).

Various explanations for escalation of commitment have been offered (see Brockner (1992), Sleesman et al. (2012), for an overview). Staw's (1981) earliest work on escalation of commitment revealed that people escalate in an effort to rationalize their initial behavioral errors. Such attempts at rationalization may be directed at the self (Aronson, 1976), but they may also be directed externally. For instance, Brockner, Rubin, and Lang (1981) found that entrapment, the feeling of having invested too much to quit, is influenced by social anxiety and the presence of an audience. A meta-analytic review by Sleesman et al. (2012) concludes that in terms of factors affecting escalation of commitment, "one of the most powerful drivers is whether a decision maker faces a strong ego threat. Thus, the desire to 'save face', or prove oneself and maintain one's reputation appears to be a strong force affecting the tendency to escalate." (Sleesman et al., 2012, p.554).

### 1.2. Overconfidence and escalation of commitment

Explanations for overconfidence have largely focused on intrapersonal hedonic benefits such as higher self-esteem (e.g., Dunning, Leuenberger, & Sherman, 1995; Taylor & Brown, 1988). Such motivations to bolster and protect one's own self-esteem may play a role in shaping decisions regarding whether or not to persevere with an initially chosen course of action, even after receiving objective feedback that this is proving less successful than anticipated. Accordingly, escalation of commitment can follow from internal justification processes; people attempt to protect their own self-image by avoiding conceding flaws in their initial reasoning (Aronson, 1976).

It has also been suggested that overconfidence might be interpersonally motivated (von Hippel & Trivers, 2011). Recent work supports this notion by demonstrating that overconfident people emerge as leaders within small groups (Anderson, Brion, Moore, & Kennedy, 2012) and leadership selection contexts (Ronay, Oostrom, & Lehmann-Willenbrock, 2016; Ronay, Oostrom, & Rusch, 2016), and are also more successful in driving away romantic competitors (Murphy et al., 2015). Von Hippel and Trivers (2011) argue that overconfidence is a form of self-deception that serves the goal of interpersonal deception by convincing others that one's enhanced self-views are not overstated. Thus, overconfidence might be associated with heightened sensitivity to reputational concerns, which may also play a role in escalation of commitment. Indeed, Staw and Ross (1980) demonstrated that leaders who have successfully followed a consistent course of action are most positively evaluated. They labeled the strong interaction effect of

success and consistency the "hero effect". We expect that if overconfidence is motivated in part by interpersonal motives, then higher levels of confidence may make the prospect of basking in this hero effect loom especially large, and so drive decisions toward escalation.

In short, our reading of the separate literatures on overconfidence and escalation of commitment revealed complementary theoretical accounts for the causes of overconfidence (Dunning et al., 1995; Taylor & Brown, 1988; von Hippel & Trivers, 2011) that dovetail to suggest a positive association between overconfidence and escalation of commitment. Although others have shown that conceptually related variables such as self-efficacy (Whyte, Saks, & Hook, 1997), self-esteem (Sivanathan, Molden, Galinsky, & Ku, 2008), and egotism (Zhang & Baumeister, 2006) influence escalation decisions, or related decision-making processes such as sunk-cost effects (Arkes & Blumer, 1985) and entrapment (Brockner & Rubin, 1985), to our knowledge, only one study has empirically tested the relationship between overconfidence and escalation of commitment. McCarthy et al. (1993) reported that when entrepreneurs' confidence in their own ventures exceeded their confidence in the likely success of others' comparable business ventures, they were more likely to escalate commitment to their project. Compared to other variables such as financial indicators, overconfidence provided the clearest signal that the individual was at risk of escalation bias in future decisions. However, because the target of entrepreneurs' overconfidence (i.e., their project) was also used as the measure of escalation in this earlier work, it is unclear whether this finding reflects an association between trait overconfidence and escalation of commitment, or rather some misappraisal of the details surrounding their specific project and/or the market competition.

### 1.3. Our approach

We conducted four studies that examined whether individual differences in people's overconfidence in an unrelated domain (i.e., their general knowledge) is associated with escalation of commitment to financial investment decisions. Along the way we encountered some surprises in our data that led us to modify our initial hypotheses and refine our understanding of the processes underlying our reported effects. Thus, we offer a narrative recount of the inductive process we followed during this series of studies. We report all measures, manipulations, and exclusions across all four studies.

## 2. Study 1

The goal of Study 1 was to examine the relationship between overconfidence and escalation of commitment. We hypothesized that overconfidence would be positively related to escalation of commitment.

### 2.1. Method

#### 2.1.1. Participants and procedure

We had a two week window available for data collection in our laboratory and aimed to collect a minimum of 100 participants in that time. In total, 105 university students at Vrije Universiteit, Amsterdam (81% Dutch; 32 male;  $M_{\text{age}} = 21.84$ ,  $SD = 4.21$ ) participated in exchange for either €7 or course credits. Participants were told the experiment would involve testing general knowledge and decision-making.<sup>1</sup> Participants were scheduled to attend the experimental session in groups (2–5) and spent 5–10 min introducing themselves and describing the stage and focus of their university studies. They were informed that their group would reconvene after the individual components of the experiment had been completed, and at that stage they would be asked to explain and justify their investment decisions to their group. The purpose

<sup>1</sup> These data were collected as part of a masters student project that included additional questions and variables – 2D:4D, overclaiming (Paulhus, Harms, Bruce, & Lysy, 2003), and a rank ordering of personal values.

of the introduction and instructions was to make reputational concerns salient. However, after receiving the instructions, participants went to a private cubicle to complete the key measures – overconfidence and an escalation of commitment task – individually, and the group never reconvened.

## 2.1.2. Measures

**2.1.2.1. Overconfidence.** Following Schraw (1996) and others (Bornstein & Zickafosse, 1999; Pallier et al., 2002; Stankov & Crawford, 1996; West & Stanovich, 1997), we take the perspective that overconfidence is trait like and generalizable across domains. As others have done, we operationalized overconfidence as confidence controlled for competence (Anderson et al., 2012; Cohen, Cohen, West, & Aiken, 2013; Cronbach & Furby, 1970; DuBois, 1957; John & Robins, 1994). Confidence and competence (i.e., accuracy) were measured via a general knowledge questionnaire (GKQ; Michailova, 2010; Michailova & Katter, 2014). Since overconfidence is most evident in general knowledge items of moderate or extreme difficulty (0–66% accuracy; Lichtenstein et al., 1982; Michailova, 2010), we used the 18 items from Michailova's (2010) original measure (e.g., *How many days does a hen need to incubate an egg?*) and added six further items of moderate and extreme difficulty ( $M_{\text{accuracy}} = 42\%$ , range = 11–57%). Participants were instructed to choose the correct answer from three alternatives and to provide a number between 33% and 100% indicating their confidence in the accuracy of that answer.

**2.1.2.2. Escalation of commitment.** To measure escalation of commitment, participants completed a decision-making task that consisted of three questions on capital investment (Staw, 1976). Participants were first given information on business investment opportunities of company X, 50% chance of €1700 and 50% chance of €900. Expected value for this first investment was therefore €1300. They were told that their initial investment had to be €1000 and asked to indicate, on a scale from 0% (*absolutely no*) to 100% (*absolutely yes*), their willingness to continue to invest in company X. As cognitive dissonance theory (Festinger, 1957) deems that people become more strongly committed to their opinion when these opinions are expressed publicly, they also provided a brief written explanation for their course of action and were informed that they would be asked to justify their decisions when they reconvened with the other participants. Following new project information for company X (30% chance of €1800, or 70% chance of €700; expected value = €1030), participants were again asked if they wanted to continue investing and to explain why. For a third time, participants were given updated project information for company X (20% chance of €1900 and 80% chance of €600). Thus, for the third round decision the expected value (€860) dropped below the investment sum. Again, they were asked to indicate their willingness to continue to invest in company X and to explain their decision.

## 2.2. Results

Because gender differences have been documented in overconfidence (e.g., Reuben, Rey-Biel, Sapienza, & Zingales, 2012), as well as risk taking (Byrnes, Miller, & Schafer, 1999; Ronay & Kim, 2006), and escalation of commitment has been viewed as a form of risk taking (Brockner, 1992; Whyte, 1986), we included gender (dummy coded:  $-1 = \text{female}$ ,  $+1 = \text{male}$ ) as a covariate during our hypothesis testing in all studies.<sup>2</sup>

<sup>2</sup> We also tested all hypothesized effects without gender in the model. All effects remained significant, with the exception of Study 2's negative relationship between confidence and escalation, where the  $p$  value changed from 0.03 to 0.08. See supplementary information for complete results.

### 2.2.1. Overconfidence

Participants were significantly more confident ( $M = 57.28$ ,  $SD = 8.43$ ) than they were accurate ( $M = 46.44$ ,  $SD = 9.58$ ),  $t(104) = 9.87$ ,  $p < 0.001$ ,  $d = 1.94$ . In total 84.8% of participants expressed greater confidence than was warranted by their accuracy scores on the GKQ.

### 2.2.2. Escalation of commitment

Initial support for investing in company X was quite strong,  $M = 76\%$ ,  $SD = 26\%$ . Once people learned that the projected outcomes had declined, continued investment declined,  $M = 36\%$ ,  $SD = 31\%$ . At Round 3, where the expected value of investment for the first time dropped below the cost of continued investment, endorsement once again declined,  $M = 27\%$ ,  $SD = 31\%$ .

Initial investment decisions were not affected by participants' gender,  $b = 3.13$ , 95%CI[ $-2.48, 8.75$ ],  $t(101) = 1.11$ ,  $p = 0.27$ ,  $d = 0.22$ , nor accuracy,  $b = -0.31$ , 95%CI[ $-5.49, 4.88$ ],  $t(101) = -0.12$ ,  $p = 0.91$ ,  $d = -0.02$ , or confidence,  $b = 0.60$ , 95%CI[ $-4.72, 5.93$ ],  $t(101) = 0.23$ ,  $p = 0.82$ ,  $d = 0.05$ . At Round 2, again neither gender,  $b = 0.06$ , 95%CI[ $-6.78, 6.90$ ],  $t(101) = 0.02$ ,  $p = 0.99$ ,  $d = 0.00$ , nor accuracy,  $b = 0.94$ , 95%CI[ $-5.37, 7.25$ ],  $t(101) = 0.30$ ,  $p = 0.77$ ,  $d = 0.06$ , or confidence  $b = 4.02$ , 95%CI[ $-2.47, 10.50$ ],  $t(101) = 1.23$ ,  $p = 0.22$ ,  $d = 0.24$  showed significant effects on continued investment. At Round 3 (the first decision in which expected value dropped below the costs of continued investment) we again saw a non-significant effect of gender,  $b = -0.04$ , 95%CI[ $-6.72, 6.64$ ],  $t(101) = -0.01$ ,  $p = 0.99$ ,  $d = 0.00$ , and accuracy  $b = -4.84$ , 95%CI[ $-11.00, 1.32$ ],  $t(101) = -1.56$ ,  $p = 0.12$ ,  $d = -0.31$ . However, consistent with our hypothesis, we observed a significant positive effect of confidence,  $b = 7.33$ , 95%CI[ $1.00, 13.66$ ],  $t(101) = 2.30$ ,  $p = 0.02$ ,  $d = 0.46$ . No interaction between confidence and accuracy emerged,  $b = -0.35$ , 95%CI[ $-5.98, 5.28$ ],  $t(100) = -0.12$ ,  $p = 0.90$ ,  $d = -0.02$ , meaning that confidence was positively related to escalation at all levels of accuracy.

## 2.3. Discussion

Consistent with our expectations, the results of Study 1 revealed a positive relationship between confidence and decisions to escalate commitment beyond the point of rationality, regardless of whether that confidence was matched by appropriate levels of competence. Our finding might follow from the well documented relationship between overconfidence and self-esteem maintenance (Dunning et al., 1995; Taylor & Brown, 1988). As escalation of commitment emerges in part from a desire to protect and defend one's self-image by denying initial errors in one's judgement (Aronson, 1976), the foundations of the bias are conceptually aligned with such motivations toward self-esteem maintenance. On the other hand, by informing participants that they would have to publicly justify their decisions to a tangible group, Study 1 also made salient reputational concerns. As such, our finding may also follow from von Hippel and Trivers' (2011) interpersonal account of self-deception, whereby overconfidence emerges from social goals such as reputation enhancement. The observed positive relationship may then be driven by overconfident participants' attempts to publicly demonstrate the rationality of their original courses of action.

## 3. Study 2

The goal of Study 2 was to test the robustness of Study 1's findings. Specifically, we wanted to examine whether the same effect would emerge on a different escalation paradigm with a different dependent variable that did not require participants to publicly justify their decisions. If the positive relationship between overconfidence and escalation of commitment is being driven by self-esteem maintenance, overconfidence should also be positively related to escalation of commitment when participants make their decisions privately. However, if Study 1's effect is being driven by social reputational motives, then



we might expect to see attenuation of the effect when there is no threat to one's "face". As the majority of the overconfidence literature has focused on the relationship between overconfidence and self-esteem maintenance, we once again hypothesized that overconfidence would be positively associated with escalation of commitment.

### 3.1. Method

#### 3.1.1. Participants and procedure

We had a two week window for data collection and aimed to collect a minimum of 100 participants within that time frame. In total 121 students (91% Dutch; 32 male;  $M_{\text{age}} = 21.02$ ,  $SD = 3.04$ ) at Vrije Universiteit, Amsterdam participated in exchange for either €7 or course credits. In contrast to Study 1, participants in Study 2 were scheduled for individual sessions. Participants were told the experiment would involve testing general knowledge and decision-making and they completed a measure of overconfidence and an escalation of commitment task.<sup>3</sup>

#### 3.1.2. Measures

**3.1.2.1. Overconfidence.** Confidence and competence were measured as per Study 1.

**3.1.2.2. Escalation of commitment.** To measure escalation of commitment, participants were placed in the role of manager of research and development (R&D) for a hypothetical company that consisted of two divisions: Consumer Products and Industrial Products (Bazerman, Giuliano, & Appelman, 1984). Participants read that each division typically received €10 million in funding for R&D every three years but that the directors had recently decided to make an additional €10 million available for R&D. This money needed to be allocated in full to either Consumer Products or Industrial Products. Participants chose one of the two divisions, after which they were presented with the sales and earnings of that division for the following three-year period. Regardless of the chosen division, the data showed a steady net loss in earnings. Participants then read that the directors had decided to make an additional €20 million available for R&D and that this time the money could be distributed across the two divisions in any proportion the participant chose. Escalation of commitment was measured by the amount of funds allocated to the initially chosen division during the second decision round. Participants were asked to explain their decision in an open-ended text box following each decision round.

### 3.2. Results

#### 3.2.1. Overconfidence

Participants were significantly more confident ( $M = 60.40$ ,  $SD = 10.86$ ) than they were accurate ( $M = 52.43$ ,  $SD = 9.46$ ),  $t(120) = 7.78$ ,  $p < 0.001$ ,  $d = 1.42$ . In total 76.9% of participants expressed greater confidence than was warranted by their accuracy scores on the GKQ.

#### 3.2.2. Escalation of commitment

More participants chose to invest in Industrial Products ( $n = 76$ ) than in Consumer Products ( $n = 45$ ). On average people chose to further invest €10.52 million ( $SD = 5.29$ ) to the initially chosen division. A one-sample  $t$ -test (test value = 10) revealed no main effect for escalation,  $t(120) = 1.08$ ,  $p = 0.28$ ,  $d = 0.20$ . Regression analysis showed a positive but non-significant relationship for gender, such that males tended toward escalation more than females,  $b = 0.92$ , 95%CI[−0.22, 2.06],  $t(117) = 1.60$ ,  $p = 0.11$ ,  $d = 0.30$ . We observed no effect for accuracy,  $b = -0.04$ , 95%CI[−1.07, 0.98],  $t(117) = -0.08$ ,  $p = 0.93$ ,  $d = -0.01$ . In contrast to our hypothesis, we observed a negative

relationship between confidence and escalation decisions,  $b = -1.24$ , 95%CI[−2.33, −0.14],  $t(117) = -2.24$ ,  $p = 0.03$ ,  $d = -0.41$ . There was no interaction between confidence and accuracy,  $b = -0.40$ , 95%CI[−1.15, 0.35],  $t(116) = -1.05$ ,  $p = 0.30$ ,  $d = -0.19$ , meaning that confidence is negatively related to escalation at all levels of accuracy.

### 3.3. Discussion

Counter to our predictions and the results of Study 1, Study 2 revealed a negative relationship between confidence (controlled for competence) and escalation of commitment, irrespective of competence levels. The most pronounced difference between Study 1 and Study 2 was the presence versus absence of group members to whom participants were accountable. Thus, one interpretation of our contrasting effects is that the effects of overconfidence on escalation decisions interact with public accountability, and that this moderation is mediated by social reputational concerns. If individual differences in overconfidence originate in part from an interpersonal motive, then accountability of one's decisions to others might moderate the relationship between overconfidence and escalation of commitment.

## 4. Study 3

The goal of Study 3 was to replicate the pattern of findings from Studies 1 and 2 by experimentally manipulating the public versus private context in which participants made their investment decisions. Specifically, we hypothesized that the relationship between overconfidence and escalation of commitment would be moderated by social accountability – positive when decisions are made in a public context, but negative when such decisions are made privately. Study 3 also allowed us to test an alternative account of our contrasting effects from Studies 1 and 2; the inverted effects may have resulted from switching escalation paradigms between the two studies.

### 4.1. Method

#### 4.1.1. Participants and procedure

We again had access to the laboratory for two weeks. Although we would have liked to double our sample size for our experimental design, we were constrained by the number of participants we could attract within this window. In total 108 students at Vrije Universiteit, Amsterdam (99% Dutch, 29 male,  $M_{\text{age}} = 20.73$ ,  $SD = 2.91$ ) participated in exchange for either €7 or course credits. Participants completed the experiment in one of two experimental conditions – in groups of 2–5 ( $n = 49$ ) or individually ( $n = 60$ ). Note that cells became unbalanced because when only one participant arrived for the experimental session, they were allocated to the individual condition.

Participants in the group condition spent 5–10 min introducing themselves and describing the stage and focus of their university studies. They then entered a private cubicle where the modified GKQ (Michailova, 2010) and escalation of commitment task (Schmidt & Calantone, 2002) were completed. As per Study 1, those in the group condition were informed that their group would reconvene after the individual components of the experiment had been completed, and at that stage they would be asked to explain and justify their investment decisions to their group. As per Study 2, those in the individual condition proceeded to a private cubicle immediately after granting informed consent and received no information regarding the need to publicly defend their decisions.

#### 4.1.2. Measures

**4.1.2.1. Overconfidence.** Confidence and competence were measured as per Studies 1 and 2.

<sup>3</sup> These data were collected as part of a masters student project that included the PANAS (Watson, Clark, & Tellegen, 1988) and a rank ordering of personal values.

**4.1.2.2. Escalation of commitment.** To measure escalation of commitment, we modified a paradigm used by Schmidt and Calantone (2002) that placed participants in the role of manager of new product development for a fictional company. They were informed that it was their responsibility to decide which products are most likely to capture a large portion of market share. An internal benchmark for successful product development was set at securing >30% market share. Participants were then presented with two new products, both designed to improve automobile safety (i.e., an airbag sensor or an antilock brake sensor). Participants were informed that both products would require an initial investment of €0.5 million, and that data regarding likely market share or profitability were not yet available. Once participants had selected one of the two products for development, they were asked to explain in an open-ended text box why they had chosen this product. Participants in the group condition received additional information stating, “We will make this information available for you to help debrief your team during the group discussion.” Participants were then asked to imagine six months had passed and received new information regarding the product’s estimated future costs (3.18 million for next stage), sales (€24.5 million), and market share (26%). As the internal benchmark for successful development was set at >30% market share, this new information revealed the chosen product was likely to fail. To probe the rationale participants employed during this decision process, we asked them to indicate their loyalty to their chosen product (*loyalty*), likelihood of the product’s success (*success*), the degree to which they would feel guilty if they abandoned the product (*guilt*), and the extent to which they felt the product would positively impact on their annual performance evaluation (*reputation*). All responses were given on a seven-point scale anchored (1 = *strongly agree* and 7 = *strongly disagree*). To measure escalation of commitment we then asked participants to respond to the following question on a scale ranging from 0 to 100%, “How likely is it that you would authorize the funds necessary to complete the next stage of this new development project?”

## 4.2. Results and discussion

### 4.2.1. Overconfidence

Participants were significantly more confident ( $M = 61.99$ ,  $SD = 9.89$ ) than they were accurate ( $M = 49.90$ ,  $SD = 10.05$ ),  $t(107) = 10.65$ ,  $p < 0.001$ ,  $d = 2.05$ . In total 86.2% of participants expressed greater confidence than was warranted by their accuracy scores on the GKQ.

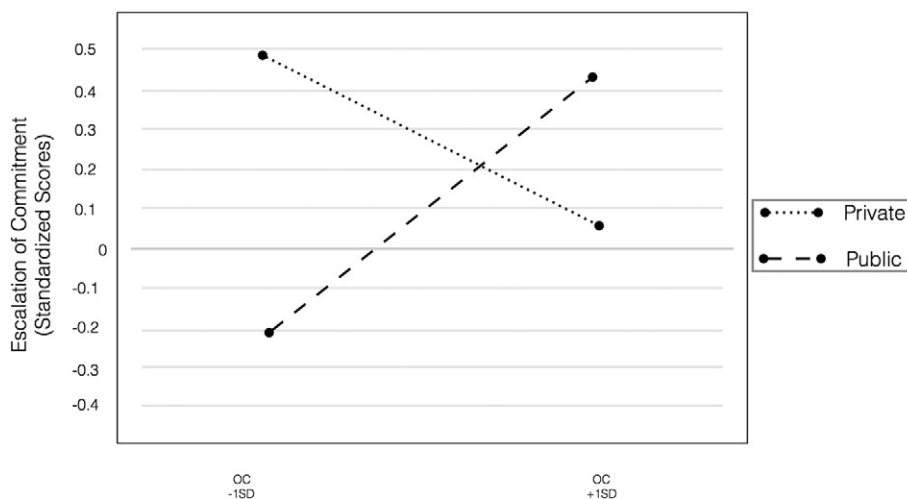
### 4.2.2. Escalation of commitment

After learning that the projected market share of the chosen product was below that of the internal benchmark (i.e., 26% < 30%) participants were still generally in favor of continuing with development,  $M = 70\%$ ,  $SD = 14\%$ . Regression analysis revealed a significant positive effect for gender such that males escalated to a greater extent than did females,  $b = 4.93$ , 95%CI[1.77, 8.10],  $t(103) = 3.09$ ,  $p < 0.01$ ,  $d = 0.61$ , a non-significant main effect for condition (dummy coded:  $-1 = \text{private}$ ,  $1 = \text{public}$ ),  $b = -1.43$ , 95%CI[-4.19, 1.33],  $t(103) = -1.03$ ,  $p = 0.31$ ,  $d = -0.20$ , and non-significant effects for both accuracy,  $b = -0.02$ , 95%CI[-0.30, 0.64],  $t(102) = -0.13$ ,  $p = 0.89$ ,  $d = -0.03$ , and confidence,  $b = 0.06$ , 95%CI[-0.23, 0.35],  $t(102) = 0.41$ ,  $p = 0.68$ ,  $d = 0.08$ . These non-significant main effects were qualified by the predicted interaction between confidence and condition,  $b = 0.38$ , 95%CI[0.11, 0.66],  $t(101) = 2.76$ ,  $p < 0.01$ ,  $d = 0.55$ .

Consistent with the pattern of results observed across Studies 1 and 2, the relationship between confidence and escalation of commitment was moderated by the public versus private context in which participants made their decisions,  $b = -0.37$ , 95%CI[-0.64, -0.10],  $t(101) = -2.70$ ,  $p < 0.01$ ,  $d = -0.54$ . Examination of the simple slopes (Fig. 1; Aiken, West, & Reno, 1991; Jaccard & Turrisi, 2003) revealed a positive effect of confidence on escalation in the group condition,  $b = 0.47$ , 95%CI[0.05, 0.89],  $t(101) = 2.22$ ,  $p = 0.03$ ,  $d = 0.44$ , and a non-significant negative relationship in the individual condition,  $b = -0.30$ , 95%CI[-0.66, 0.07],  $t(101) = -1.63$ ,  $p = 0.11$ ,  $d = -0.32$ . We also observed a marginal negative effect for accuracy in the group conditions,  $b = -0.38$ , 95%CI[-0.77, 0.00],  $t(101) = -1.97$ ,  $p = 0.05$ ,  $d = -0.39$ , and a marginal positive effect in the private condition,  $b = 0.35$ , 95%CI[-0.03, 0.73],  $t(101) = 1.84$ ,  $p = 0.07$ ,  $d = 0.37$ .

As per Studies 1 and 2, we observed no effects for the two-way interaction between confidence and accuracy,  $b = 0.00$ , 95%CI[-0.03, 0.02],  $t(100) = -0.21$ ,  $p = 0.84$ ,  $d = -0.04$ . There was no three-way interaction between confidence, accuracy, and condition,  $b = 0.00$ , 95%CI[-0.02, 0.02],  $t(99) = 0.07$ ,  $p = 0.94$ ,  $d = 0.01$ . Thus, once again confidence was positively related to escalation decisions.

When participants made their decisions in the context of a group, believing that they would need to justify their decisions to the other members of their group, confidence was significantly and positively related to their decisions to escalate. However, when decisions were made privately, with no need to publicly account for outcomes, confidence was negatively, though non-significantly related to escalation of commitment. The positive relationship in the public condition is consistent



**Fig. 1.** Study 3. Escalation of commitment as a function of confidence and public versus private contexts. Escalation decisions, confidence and accuracy were standardized for ease of comparison. Gender was dummy coded  $-1 = \text{female}$ ,  $+1 = \text{male}$ . Condition was dummy coded  $-1 = \text{private}$ ,  $+1 = \text{public}$ .

with von Hippel and Trivers' (2011) interpersonal account of overconfidence – the implicit motive to enhance one's social standing through overconfidence appears to be associated with escalation decisions, in the context of public accountability.

#### 4.2.3. Mediation Analyses

To examine the potential mechanisms driving the relationship between overconfidence and escalation decisions, we tested for indirect effects of confidence (controlled for competence) on escalation via *loyalty*, *success*, *guilt*, and *reputation*. While loyalty, success, and guilt, may shape escalation decisions, we had no theoretical reason to expect these to mediate the relationship between overconfidence and escalation. However, if overconfidence is interpersonally motivated (von Hippel & Trivers, 2011), reputational concerns should mediate the relationship in the public condition, though not the private condition. All analyses included gender as a covariate. Given the moderation effect described above, we looked for evidence of conditional indirect effects using the Process macro (Model 7) with 10,000 bootstrapped samples (Hayes, 2016). This revealed that in the individual condition confidence exerted a negative indirect effect on escalation via *reputation*,  $z = -0.23$ ,  $SE = 0.12$ ,  $95\%CI[-0.48, 0.00]$ , whereas in the group condition confidence exerted a positive indirect effect via *reputation*,  $z = 0.23$ ,  $SE = 1.02$ ,  $95\%CI[0.03, 0.44]$ . Confidence intervals for all other potential mechanisms included zero.

These additional analyses suggest that public versus private contexts exert diverging motivations on the overconfident, and that these motivations are associated with different decision outcomes. In both cases people received information that their decision was at risk of failing to meet expectations, yet this information influenced the overconfident in different ways depending on the private versus public context of their decision. When decisions were made in private, confidence was associated with a belief that the product choice would negatively influence their reputation,  $b = -0.04$ ,  $95\%CI[-0.06, -0.11]$ ,  $t(101) = -2.90$ ,  $p < 0.01$ ,  $d = -0.58$ , whereas when decisions were to be publicly defended, the overconfident reported that they thought their chosen product would positively influence their reputation,  $b = 0.03$ ,  $95\%CI[0.01, 0.06]$ ,  $t(101) = 2.30$ ,  $p = 0.02$ ,  $d = 0.46$ . These results are in line with the findings of Kanodia, Bushman, and Dickhaut (1989) who found that managers who worried that giving up a project might negatively influence their perceived competence, and thereby limit promotion opportunities, showed greater escalation of commitment.

## 5. Study 4

The goal of Study 4 was threefold. First, we wanted to replicate our pattern of findings from Studies 1, 2, and 3 with a larger and more diverse sample. Second, we wanted to see if these effects would hold when we incentivized participants to make careful decisions during the escalation task. And third, we wanted to more thoroughly probe the mechanism (i.e., reputational concerns) behind our observed effects.

Drawing from Staw and Ross's (1980) "hero effect" described in our introduction, we reasoned that if overconfidence is interpersonally motivated, then a combination of the public condition and higher levels of confidence should implicitly prime this hero motive, and so move decisions toward escalation. However, participants with low levels of confidence, who, according to an interpersonal account of overconfidence (von Hippel & Trivers, 2011) should be less influenced by reputational concerns in general, should *not* be primed with heroic striving by the public context alone. We therefore expected that directly priming heroic reputation would attenuate the relationship between confidence and escalation in the public condition, as overconfident participants would already be motivated toward escalation, whereas underconfident participants would be freshly primed with heroic sentiment, and this should increase their tendency toward escalation.

We hypothesized that overconfidence would be positively related to escalation of commitment when decisions were made in a public context, and negatively related to escalation decisions in the private condition. We also hypothesized that the positive relationship would be mediated by reputational concerns (as per Study 3) and that we would find mediation via our measure of state based reputation. Finally, we expected that directly priming heroic striving before the final escalation decision would attenuate the positive relationship between overconfidence and escalation of commitment in the public context.

### 5.1. Method

#### 5.1.1. Participants and procedure

As a second laboratory study would require us to draw from the same student sample used in Study 3, we were concerned that pre-exposure to the experimental design might introduce a confound. Thus, we opted to gather our data for Study 4 online and recruit Mturk workers as our participants. We did anticipate that the public condition would be harder to manipulate online and might thus produce weaker effects than we saw in the lab, so we decided to triple our sample size for Study 4.

The final sample included 380 Mturk workers<sup>4</sup> (173 male,  $M_{age} = 35.66$ ,  $SD = 10.14$ ) who participated in exchange for \$1.50. Participants completed the experiment in one of two experimental conditions; public,  $n = 187$ ; private,  $n = 193$ . In the public condition participants were informed that they would be placed in a team with two others. They were told that all three individuals would complete a decision-making task (escalation paradigm), and that if all three reached the specified goal then each would receive a bonus payment of \$1.50. To verify that the manipulation of accountability was the strongest possible, we further incentivized accountability with money – participants were also informed that even if they did not meet that specified target, they would still receive the additional \$1.50, if the bonus was approved by their two other team members, who would be presented with the participant's decisions and justifying text. To this end, at each decision round participants were asked to justify their decisions and were informed that these responses would be read by two other Mturk workers within the next 24 h. To increase the believability of this premise, at the end of the task participants read the responses of two other participants (generated during pre-testing) and were asked to indicate whether or not they thought these people should receive the performance bonus.

In order to fairly measure reputational concerns in both experimental conditions, participants in the private condition were also told that they would be placed in a team with two others, although in their case they remained private in process and independent in outcomes. As per Studies 2 and 3, they were still required to justify their decisions in open ended text boxes, but were explicitly informed that their team members would not see their responses. They were also informed that the bonus would be paid if they alone met their specified goal.

#### 5.1.2. Measures

**5.1.2.1. Overconfidence.** Confidence and competence were measured as per Studies 1, 2, and 3.

**5.1.2.2. Escalation of commitment.** Escalation of commitment was measured using the same paradigm (Schmidt & Calantone, 2002) as per Study 3. However, on this occasion there were three decision rounds which allowed us to more precisely measure escalation (our DV was second round decisions with first round decisions as a covariate). This approach also allowed us to measure commitment both before and after a within-subjects manipulation (i.e., the hero prime). At Escalation1 participants learned that the estimated costs for the next stage

<sup>4</sup> We removed four cases that had incomplete data and duplicate IP addresses, and we restricted our age range to between 18 and 60.



of development were €3.18 million, that expected annual sales were €24.5 million, and that market share was 26%. At Escalation2 participants learned that estimated costs for the next stage were €12 million, that expected annual sales were €21.5 million, and that expected market share was now 22%. At Escalation3 they read that the costs of proceeding to the next round of development were €0.25 million, that expected annual sales were now €17.1 million, and that expected market share was now at 17%. These three decision rounds allowed us to target changes in commitment to the product's development as the information unfolded. For all three escalation decisions we asked participants to respond to the following question on a scale ranging from 0 to 100%, "How likely is it that you would authorize the funds necessary to complete the next stage of this new development project?"

Consistent with Study 3, we also examined the rationale behind participants' decisions by asking them at each decision round to indicate their loyalty to their chosen product (*loyalty*), the likelihood of the product's success (*success*), the degree to which they would feel guilty if they abandoned the product (*guilt*), and the extent to which they felt the product would impact on their annual performance evaluation and future career prospects (*reputation*). All responses were given on a seven-point scale (1 = *strongly agree* and 7 = *strongly disagree*).

**5.1.2.3. Trait reputation.** To capture a baseline measure of reputational concerns that we could include as a covariate in our planned mediational analyses, we asked participants to respond to a purpose-built measure prior to the manipulation. The scale consisted of seven items (e.g., *I wish to have a good reputation*.) All responses were given on a five-point scale (1 = *not at all characteristic of me* and 5 = *extremely characteristic of me*). Coefficient alpha for this scale was 0.86.

**5.1.2.4. State reputation.** To explore our reputation based explanation for the effects of overconfidence on escalation decisions we included a purpose-built measure of reputational concerns immediately following the manipulation. As participants in both conditions were placed in a "team" with two others, the only difference being whether their responses were to be made public to the other team members, all participants completed this scale. The scale consisted of six items (e.g., *I want the other team members to evaluate me positively based on my decisions and responses*.) All responses were given on a seven-point scale (1 = *extremely unimportant* and 7 = *extremely important*). Coefficient alpha for this scale was 0.89.

**5.1.2.5. Hero prime.** The three decision rounds in the current experiment provided us with an opportunity to test the role of heroic striving in the relationship between overconfidence and escalation decisions. We did so by introducing a within-subjects manipulation prior to the third escalation decision. At that point participants completed a heroic risk taking scale (which we expected would not be recognized as a manipulation) consisting of eight items intended to prime heroic striving, (e.g., *Snatching victory from the jaws of defeat is very satisfying*.)

## 5.2. Results and discussion

### 5.2.1. Overconfidence

Participants were significantly more confident ( $M = 69.81$ ,  $SD = 10.71$ ) than they were accurate ( $M = 60.01$ ,  $SD = 10.71$ ),  $t(379) = 14.44$ ,  $p < 0.001$ ,  $d = 1.48$ . In total 76.3% of participants expressed greater confidence than was warranted by their accuracy scores on the GKQ.

### 5.2.2. Escalation of commitment

After learning that the projected market share of the chosen product was below that of the internal benchmark, 88.2% of participants were still in favor of continuing with development. This number dropped to 59.5% for the second decision round, and then to 46.1% for the third decision, following the "hero" prime.

Regressing Escalation2 onto Escalation1, gender, condition, accuracy, and confidence revealed no effects for gender (dummy coded:  $-1 = \text{females}$ ,  $1 = \text{males}$ ),  $b = -1.01$ , 95%CI $[-3.47, 1.46]$ ,  $t(374) = -0.80$ ,  $p = 0.42$ ,  $d = -0.08$ , or condition (dummy coded:  $-1 = \text{private}$ ,  $1 = \text{public}$ ),  $b = -0.21$ , 95%CI $[-2.65, 2.22]$ ,  $t(374) = -0.17$ ,  $p = 0.86$ ,  $d = -0.02$ . When we examined the main effects of accuracy and confidence we found a significant negative effect for accuracy,  $b = -0.31$ , 95%CI $[-0.52, -0.10]$ ,  $t(374) = -2.94$ ,  $p < 0.01$ ,  $d = -0.30$ , and a non-significant positive effect for confidence,  $b = 0.19$ , 95%CI $[-0.06, 0.44]$ ,  $t(374) = 1.51$ ,  $p = 0.13$ ,  $d = 0.16$ . As per Studies 1, 2, and 3, we observed no effects for the two-way interaction between confidence and accuracy,  $b = 0.01$ , 95%CI $[-0.01, 0.03]$ ,  $t(370) = 1.41$ ,  $p = 0.16$ ,  $d = 0.15$ , nor the three-way interaction between confidence, accuracy, and condition,  $b = 0.00$ , 95%CI $[-0.02, 0.02]$ ,  $t(370) = -0.11$ ,  $p = 0.92$ ,  $d = 0.01$ . Thus, once again confidence was positively associated with escalation decisions.

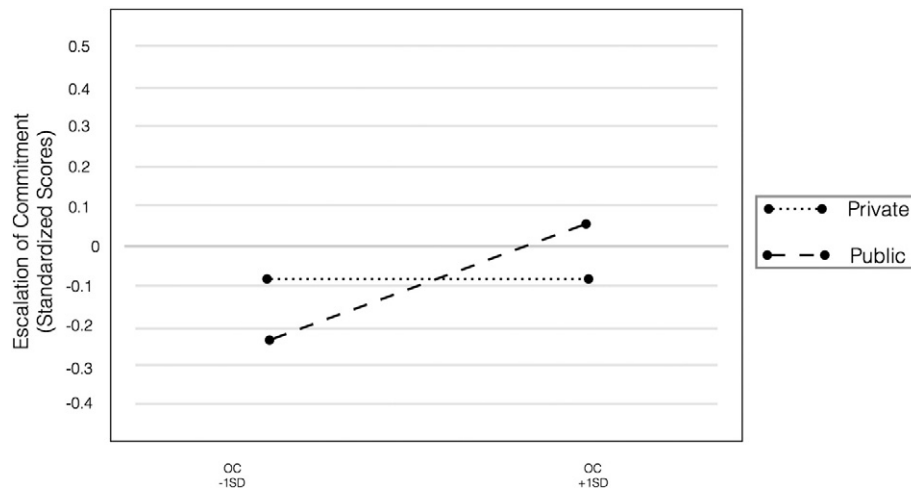
Fitting the interaction terms for the confidence by condition, and accuracy by condition interactions revealed a non-significant effect for accuracy by condition,  $b = -0.15$ , 95%CI $[-0.36, 0.46]$ ,  $t(372) = -1.40$ ,  $p = 0.16$ ,  $d = -0.14$ , and a marginal effect for the interaction between confidence and condition,  $b = 0.22$ , 95%CI $[-0.03, 0.46]$ ,  $t(372) = 1.73$ ,  $p = 0.08$ ,  $d = 0.18$ . Although the interaction between confidence and condition was marginally significant, we had strong predictions concerning the different effects of confidence on escalation in public and private conditions, and so we examined the simple slopes (Fig. 2). In the public condition we observed a positive effect of confidence on escalation,  $b = 0.41$ , 95%CI $[0.07, 0.76]$ ,  $t(372) = 2.35$ ,  $p = 0.02$ ,  $d = 0.24$ , and a negative effect of accuracy,  $b = -0.49$ , 95%CI $[-0.81, -0.17]$ ,  $t(372) = -3.02$ ,  $p < 0.01$ ,  $d = 0.31$ . In the private condition we observed no effects for either confidence,  $b = -0.02$ , 95%CI $[-0.37, 0.34]$ ,  $t(372) = -0.10$ ,  $p = 0.93$ ,  $d = -0.01$ , or accuracy,  $b = -0.19$ , 95%CI $[-0.47, 0.08]$ ,  $t(372) = -1.39$ ,  $p = 0.17$ ,  $d = 0.14$ . Thus, consistent with the pattern of results for Studies 1, 2, and 3, confidence was positively related to escalation of commitment only when decisions were made in a context that provided potential for public scrutiny.

### 5.2.3. Mediational analyses

We then turned to the question of moderated mediation, or whether any indirect effects might differ across the public versus private conditions (Model 7; Hayes, 2016). With the exception of *reputation*, indirect effects were not distinguishable between the public and private conditions, including our state-based measure of reputational concerns. However, consistent with Study 3, for *reputation* as it was measured in Study 3, we observed a non-significant indirect effect in the private condition,  $z = 0.03$ ,  $SE = 0.10$ , 95%CI $[-0.17, 0.22]$ , and a significant positive effect in the public condition,  $z = 0.23$ ,  $SE = 11$ , 95%CI $[0.01, 0.43]$ . Thus, we replicated Study 3's finding that the different effects in the public and private conditions were driven in part by diverging beliefs regarding the impact of escalation on career goals. In the public condition, confidence was associated with a belief that escalation would help career prospects, whereas in the private condition confidence was associated with a belief that the product would have a negative impact on career goals.

### 5.2.4. Hero prime

We then turned to the behavioral effects of our hero prime on round three escalation decisions. Regressing Escalation3 onto Escalation1 and Escalation2, gender, condition, accuracy, and confidence revealed a significant positive effect for gender (dummy coded:  $-1 = \text{females}$ ,  $1 = \text{males}$ ),  $b = 3.78$ , 95%CI $[1.83, 5.73]$ ,  $t(373) = 3.81$ ,  $p < 0.01$ ,  $d = 0.40$ . No effects emerged for condition (dummy coded:  $-1 = \text{private}$ ,  $1 = \text{public}$ ),  $b = -0.46$ , 95%CI $[-2.39, 1.46]$ ,  $t(373) = -0.47$ ,  $p = 0.64$ ,  $d = -0.05$ ; accuracy,  $b = -0.01$ , 95%CI $[-0.17, 0.16]$ ,  $t(373) = 0.06$ ,  $p = 0.95$ ,  $d = 0.01$ ; or confidence,  $b = -0.08$ , 95%CI $[-0.28, 0.12]$ ,  $t(373) = -0.79$ ,  $p = 0.43$ ,  $d = -0.08$ . Fitting the interaction terms



**Fig. 2.** Study 4. Escalation of commitment as a function of confidence and public versus private contexts. Escalation decisions, confidence and accuracy were standardized for ease of comparison. Gender was dummy coded  $-1 = \text{female}$ ,  $+1 = \text{male}$ . Condition was dummy coded  $-1 = \text{private}$ ,  $+1 = \text{public}$ .

revealed significant effects for the interactions between accuracy and condition,  $b = 0.19$ , 95%CI[0.03, 0.36],  $t(357) = 2.28$ ,  $p = 0.02$ ,  $d = 0.24$ , as well as confidence by condition (Fig. 3),  $b = -0.23$ , 95%CI[ $-0.43, -0.04$ ],  $t(357) = -2.39$ ,  $p = 0.02$ ,  $d = -0.25$ . In the private condition neither accuracy,  $b = -0.16$ , 95%CI[ $-0.37, 0.06$ ],  $t(371) = -1.44$ ,  $p = 0.15$ ,  $d = 0.15$ , nor confidence,  $b = 0.14$ , 95%CI[ $-0.14, 0.42$ ],  $t(357) = 1.00$ ,  $p = 0.32$ ,  $d = 0.11$ , returned significant effects. In the public condition, a marginal positive effect for accuracy emerged,  $b = 0.22$ , 95%CI[ $-0.03, 0.48$ ],  $t(371) = 1.73$ ,  $p = 0.08$ ,  $d = 0.18$ , and a negative effect for confidence,  $b = -0.33$ , 95%CI[ $-0.60, -0.05$ ],  $t(371) = -2.35$ ,  $p = 0.02$ ,  $d = -0.24$ . By virtue of the public context, overconfident participants in the public condition were already implicitly primed with heroic striving prior to our prime. Surprisingly however, following the hero prime, higher levels of confidence were associated with de-escalation of commitment. One possibility is that for the already escalating overconfident, the hero prime would have appeared to be priming their already chosen course of action, which may have triggered “reactance” (Brehm, 1966) in the form of a behavioral change aimed at reasserting their autonomy (see Brehm & Sensenig, 1966). As expected, following the explicit heroic striving prime, the underconfident were similarly moved to escalating commitment. In the private condition, where heroic striving had not been implicitly primed by the primary manipulation, participants both high and low in confidence chose to escalate, and so no effects for confidence emerged.

As our measure of state-based reputational concerns did not emerge as an indirect pathway, Study 4 revealed that reputation per se may not be the primary mechanism through which confidence exerts this effect. Nonetheless, we still expect the mechanism for the effects of (over)confidence on escalation decisions to be reputationally based, and Study 4 provided some evidence that the more precise mechanism may be heroic striving. While the public context alone was sufficient to implicitly motivate the overconfident to escalate, the underconfident required a more direct prime to make salient the allure of heroic striving and thereby motivate escalation.<sup>5</sup>

<sup>5</sup> Based on the suggestions of an anonymous reviewer, we also included a measure of self-esteem that was completed prior to the manipulation. To rule out the possibility that our effects were being driven by self-esteem, we asked participants to complete the Rosenberg Self Esteem Scale (Rosenberg, 1965) following the demographic variables. Including self-esteem in the model had no substantive effect on our reported results.

## 6. Meta-analytic overview

Our studies used three different paradigms to test the robustness of the relationship between overconfidence and escalation of commitment, but the methods and procedures were comparable across studies, so we conducted a small meta-analysis to summarize our findings and provide an additional test of the hypotheses. Below we report a random-effects meta-analysis across all four studies by estimating the differences in the partial correlations (partialing out accuracy and gender) between confidence and escalation of commitment across conditions (public versus private). We computed the partial correlations for the public and private conditions separately for Studies 3 and 4. In the public condition our meta-analysis revealed a significant positive effect,  $r = 0.20$ , 95%CI [0.10, 0.31],  $z = 3.69$ ,  $p < 0.01$ . In the private condition we saw a marginal effect of confidence on escalation decisions,  $r = -0.13$ , 95%CI [ $-0.26, 0.01$ ],  $z = -1.78$ ,  $p = 0.08$ .

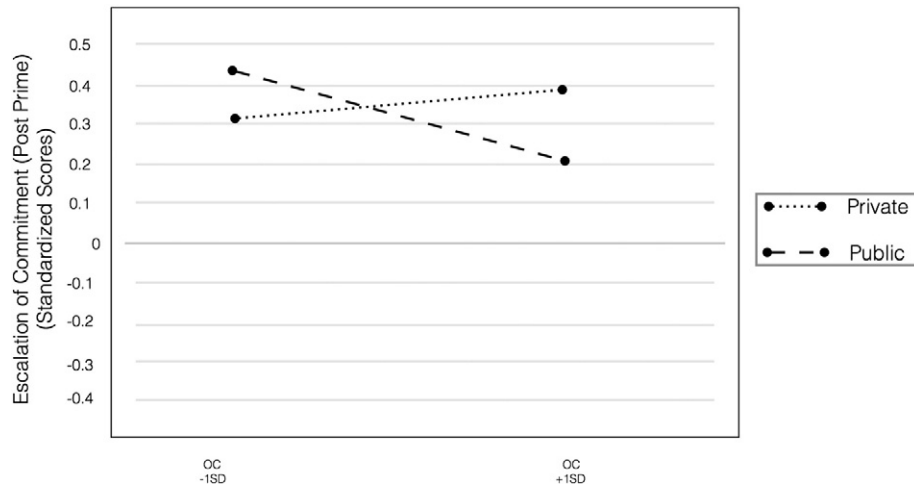
## 7. General discussion

Experimental research can be a disappointing business at times. Hypotheses often fail to find support in the captured data and time and resources are sacrificed to the file drawer. In the current research our initial hypothesis was turned on its head by the negative relationship that emerged in Study 2. This led us to consider how existing *intra-* and *interpersonal* accounts of overconfidence might lead to different decision processes in public versus private contexts. We then tested our moderator hypothesis by experimentally manipulating the presence or absence of public accountability in two experiments. The results of Studies 3 and 4 were consistent with our hypothesized moderation effect. When participants were publicly accountable for their decisions, overconfidence was significantly and positively related to escalation of commitment. When decisions were made privately and in the absence of public accountability, the relationship between overconfidence and escalation of commitment was attenuated.

### 7.1. Overconfidence directed toward self and others

This moderating role of public accountability in determining the relationship between overconfidence and escalation of commitment provides a window into what may be diverging functions of overconfidence in public versus private settings. On the one hand, our finding that overconfidence is positively related to escalation of commitment in public





**Fig. 3.** Study 4. Post hero prime, escalation decisions as a function of confidence and public versus private contexts. Escalation decisions, confidence and accuracy were standardized for ease of comparison. Gender was dummy coded  $-1 = \text{female}$ ,  $+1 = \text{male}$ . Condition was dummy coded  $-1 = \text{private}$ ,  $+1 = \text{public}$ .

contexts is consistent with an interpersonal account of overconfidence (von Hippel & Trivers, 2011), whereby overconfidence serves the social function of reputation enhancement. If overconfidence is in part socially motivated, we should expect the overconfident to be particularly sensitive to audience effects (Lerner & Tetlock, 1999; Moser, Wolff, & Kraft, 2013) and social reputational concerns (Brockner et al., 1981; Sleesman et al., 2012; Staw & Ross, 1980) when considering escalation decisions. Consistent with Staw and Ross's (1980) "hero effect", overconfident individuals' decisions to escalate commitment might be regarded as a high-risk, high-return strategy that offers a chance at heroic success. Indeed, in the public condition of both experiments, overconfidence was positively associated with the belief that the chosen product would lead to positive performance evaluations; and in both experiments this belief acted as an indirect mechanism in shaping escalation decisions in public, though not in private contexts.

What is less clear from our data is the relationship between confidence and escalation decisions in the absence of public accountability. While we found a negative effect in Study 2, the private conditions in both Studies 3 and 4 did not replicate our initial finding, and our small meta-analysis revealed a weak and marginally significant negative relationship between confidence and escalation, when decisions were made privately. We therefore remain ambivalent regarding the question of whether the absence of accountability attenuates or inverts the positive relationship between confidence and escalation of commitment. Future research might help to reveal whether any such effect is reliable.

## 7.2. Limitations and future research directions

We acknowledge several limitations that serve as avenues for future research. First, data in Studies 1, 2, and 3 were collected among students and in all studies we used laboratory-based, hypothetical escalation paradigms. Although we increased the generalizability of our findings by using three different investment paradigms, and recruiting non-student participants in Study 4, future studies should consider the consequences of overconfidence among actual organizational decision-makers in diverse cultural contexts where self-enhancement norms vary (e.g., Yates, Lee, & Bush, 1997).

Second, although our moderation finding and the indirect effects reported in Studies 3 and 4 suggest the possibility that diverging motives are driving the overconfidence-escalation relationship under public versus private conditions, future research might further pursue such a mechanistic explanation. Exploring psychophysiological mediators such as changes in cortisol or arousal state are two possibilities for future research. Fourth, an anonymous reviewer pointed us at the fact

that by our operationalization of overconfidence, i.e., testing the effects of confidence controlled for competence, we and many other researchers who followed this approach (e.g., Anderson et al., 2012; Cohen et al., 2013; Cronbach & Furby, 1970; DuBois, 1957; John & Robins, 1994) are actually testing the effects of confidence (cleaned for competence). Because most participants in our four studies (76.3%–86.2%) showed more confidence than warranted based on their competence levels, we believe our effects are driven by participants' overconfidence. However, we accept that the reviewer's point highlights a methodological issue concerning the measurement of overconfidence that is endemic in the literature and should therefore be addressed.

Finally, according to cognitive dissonance theory (Festinger, 1957) people become more committed to their opinion when opinions are expressed publicly. Escalation research has utilized this finding by systematically introducing procedures that enhance commitment, such as privately justifying their choice (e.g., Staw, 1981). The present study showed, however, that having participants privately document their reasons is not equivalent to the knowledge that investment decisions will need to be explained and justified to the group. Because the public versus private nature of the task affected the escalation bias, future studies should take this into account. Tetlock and others (e.g., Lerner & Tetlock, 1999; Tetlock & Kim, 1987) have also pointed to the debiasing effects of public accountability. Specifically, they find that public accountability serves to enhance the integrative complexity of people's judgements, and to attenuate their overconfidence in the accuracy of these judgements. Intriguingly, our data finds however that for the chronically overconfident, public accountability enhances rather than attenuates at least one bias in their decision making. Future research might draw from Tetlock et al.'s theoretical perspective and examine the boundary conditions surrounding the effects we report here.

## 8. Conclusion

The four studies (total  $N > 700$ ) presented here offer a narrative of the experimental process that led us to the conclusion that (over)confidence does not by itself accompany escalation of commitment. Rather, these findings reveal that it is public commitment that binds confidence to the costly pursuit of failing ventures. Returning to Shakespeare's cautionary tale of Macbeth with which we began, it seems The Bard too had a sense of this – although it was the witches who planted the seed of confidence in Macbeth's heart, it was his commitment to his wife and the declared promise of "the golden round" that saw those seeds bloom into a bloody rose.

## Appendix A. Supplementary information

Supplementary data to this article can be found online at doi:10.1016/j.jesp.2016.10.005.

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