



Men don't just get mad; they get even: Revenge but not anger mediates gender differences in physical aggression

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ABSTRACT

Past research indicates that men are more physically aggressive than women, but very little research has examined mediators of this gender difference. Indeed, the only established finding to date is that one plausible mediator – namely trait anger – shows no reliable gender difference whatsoever. Drawing on sexual selection theory and social-learning theories, we predicted that revenge may mediate this gender difference even though anger does not. Three studies using both personality questionnaires (Studies 1 and 2) and objective laboratory measures of aggression (Study 3) provided support for this contention. The results provide some of the first evidence for a reliable mediator of gender difference in physical aggression.

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1. Introduction

Men are more physically aggressive than women. This gender difference has been documented time and time again (see Archer (2004), Bettencourt and Miller (1996) and Eagley and Steffen (1986) for meta-analytic reviews). It has been found across different ages (Baillargeon et al., 2007; Tremblay et al., 1999) and different cultural groups (Archer, 2004). Moreover, it has been found using diverse methodologies, including self-report questionnaires (Archer, 2004), observational measures (Archer, 2004), objective laboratory measures (Bettencourt & Miller, 1996), and crime statistics (e.g., Daly & Wilson, 1988).

Despite this clear gender difference, psychologists have struggled to explain *why* men are more physically aggressive than women. Traditionally, explanations have highlighted either evolutionary pressures (e.g., Archer, 2009) or social-learning processes (e.g., Eagley & Wood, 2009; Wood & Eagley, 2002). A recent exchange between these two groups of theorists (Archer, 2009; Eagley & Wood, 2009) involved a great deal of speculation regarding potential mediators of the gender difference in physical aggression. Throughout this exchange, the only established empirical finding presented was that one plausible mediator – namely trait anger – exhibits no reliable gender difference whatsoever (see Archer (2004) for a meta-analytic review).

As such, the current investigation was designed to examine the psychological processes mediating the gender difference in physical aggression. It is important to note that our goal was not

to directly address the evolution versus social-learning debate (Archer, 2009; Wood & Eagley, 2002). Nonetheless, we drew upon existing evolutionary and social-learning theories to inform our predictions. We specifically proposed that while angry affect does not mediate gender differences in physical aggression, revenge motivation does. We conducted three studies using both personality questionnaires and laboratory measures to test this hypothesis.

1.1. Evolutionary pressures for men to retaliate

Sexual selection theory is the most prominent evolutionary explanation of gender differences in physical aggression (Archer, 2009; Buss & Duntley, 2006; Clutton-Brock, 2007; Daly & Wilson, 1988). According to this theory, men are typically under greater evolutionary pressures to behave aggressively than women. Because women are sometimes unavailable for reproduction due to pregnancy, women are argued to be a more valuable reproductive resource for which men must compete. Men can do so by aggressively excluding other men from mating opportunities or by seeking to attract women. Evolutionary theorists have traditionally argued that men mainly seek to attract women by establishing a more dominant position in the social hierarchy (e.g., Buss, 1994).

According to Daly and Wilson (1988), these factors have converged and made men more prone to aggressive retaliation in the face of minor provocations. In order to deter male rivals from aggression and to achieve a dominant status, men need to establish a reputation for “toughness” (i.e., that they are not vulnerable to mistreatment by others). Thus, even minor insults demand swift and forceful retaliation.

Consistent with this, crime statistics (Daly & Wilson, 1988; Wilson & Daly, 1985) and laboratory experiments (Griskevicius et al., 2009) have both shown that men are more likely to respond

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to trivial provocations with extreme retaliation. A large proportion of murders can be attributed to men responding to minor provocations, but similar incidences are exceedingly rare among women (Daly & Wilson, 1988; Wilson & Daly, 1985). Moreover, laboratory experiments show that priming status goals leads men (but not women) to be more physically aggressive in the face of minor provocations (Griskevicius et al., 2009).

1.2. Social pressures for men to retaliate

While evolutionary and social-learning theorists frequently disagree, it is interesting to note that an emphasis on male retaliation is quite compatible with many social-learning theories (e.g., Bandura, 1973; Nisbett & Cohen, 1996; Wood & Eagley, 2002). Social-learning theorists have largely acknowledged that men are genetically predisposed toward greater physical strength than women (Eagley & Wood, 2009; Wood & Eagley, 2002). Because of this, men often occupy higher status positions across many (but not all) cultures, and they are often more responsible for providing resources as well (Eagley & Wood, 2009; Wood & Eagley, 2002).

Once placed in such social roles, basic social-learning processes could reinforce men for their physically aggressive behaviors (Bandura, 1973). Social rewards (e.g., verbal praise or status conferral) have been found to reinforce individuals for their aggressive actions (Geen & Pigg, 1970; Geen & Stonner, 1971, 1973; Staples & Walters, 1964). For example, being told that aggression is a sign of “masculinity and maturity” increases aggression in men (Baron, 1974). In cultures where men have privileged access to high-status positions, they are more likely to be reinforced in this manner. Moreover, there are several sources of data indicating that aggression is likely to result in status rewards. Aggression can be used as a punishment to deter other men from seeking the high-status positions and resources one desires (see Tedeschi & Felson, 1994). Men who are the victim of such aggressive actions can also use aggression to retaliate against their attackers, thus punishing them for their aggressive actions and discouraging such behavior in the future (e.g., Baron, 1971, 1974; Pisano & Taylor, 1971).

In combination with ecological features in the local environment, these basic social-learning processes can lead to increased rates of male physical aggression in some cultures compared to others. Nisbett and Cohen's (1996) culture of honor theory provides an apt illustration of this. This theory focuses on cultures which were originally based on a herding economy, such as the American South. In such cultures, the costs of theft were quite high, as men could lose their herd and thus their entire subsistence to a single act of theft. Men in these cultures were thus under great pressure to establish a reputation for toughness to discourage such thefts. Crime statistics (Nisbett, 1993; Nisbett & Cohen, 1996) and laboratory experiments (Cohen, Nisbett, Bowdle, & Schwarz, 1996) both support this theory, in that men from the American South are more likely to retaliate against trivial provocations (e.g., a minor insult) relative to men from the American North. In sum, the suggestion that men are under greater social pressure to retaliate is quite compatible with many social-learning theories (Baron, 1974; Nisbett & Cohen, 1996; Wood & Eagley, 2002).

1.3. Anger and revenge as related but distinct constructs

Based on the above-reviewed theories, some have suggested that gender differences in aggression may be mediated by individual differences in anger. After all, the emotion of anger is clearly associated with goals and action tendencies toward revenge (Roseman, Wiest, & Swartz, 1994), with approach motivation (Carver & Harmon-Jones, 2009), and with the associated neural signature of left-lateralized prefrontal activity (Carver & Harmon-Jones, 2009). Thus, it is plausible that men developed greater

proneness toward anger in order to motivate them to retaliate when provoked. There is only one problem with this argument. Study after study has shown that men are no more anger-prone than women (Archer, 2004; Campbell, 2006). Thus, anger clearly cannot mediate gender differences in physical aggression.

However, a close inspection of sexual selection theory (Archer, 2009; Buss & Duntley, 2006; Clutton-Brock, 2007; Daly & Wilson, 1988) and social-learning theories (e.g., Nisbett & Cohen, 1996) reveals that both theories refer most directly to *revenge* and not *anger*. While revenge and anger are certainly related constructs, they are nonetheless distinct. Conceptually, anger refers to a subjective emotional experience that is frequently elicited following provocation (McCullough, Bono, & Root, 2007; Spielberger, 1988; Wilkowski & Robinson, 2008); while revenge refers to the motivation to act aggressively toward one's provocateur (McCullough et al., 2007). Consistent with this distinction, we use the term *anger* to refer to an affective state, and we use the term *revenge* to refer to a motivation. We reserve the term *aggression* to refer to behavioral acts intended to harm another person (Baron, 1977), and we reserve the term *retaliation* to refer to instances of behavioral aggression that follow provocation (Martin, Watson, & Wan, 2000; Wilkowski & Robinson, 2008).

Empirically, there is evidence that angry affect and revenge motivation are related but distinct concepts. For example, Denson, Pederson, and Miller (2006, Study 3) found that measures of trait anger and trait revenge-planning were correlated at $r = .54$. Similarly, Fehr, Gelfand, and Nag (2010) found that state anger and state revenge motivation were correlated at $r = .41$ in a meta-analytic review. These findings clearly indicate that anger and revenge are significantly related, but their correlations are not so high as to suggest equivalence.

Beyond such conceptual and empirical distinctions, there is evidence that revenge motivation can sometimes be associated with a very different emotion than anger. Specifically, revenge motivation is sometimes accompanied by positive emotions. The first source of evidence for this comes from neurological research suggesting that people feel more positive affect while pursuing revenge goals. Specifically, de Quervain et al. (2004) scanned participants while they were contemplating whether to retaliate against a “free-riding” partner who had taken an unfair share of money from them. During this time, activity in the striatum increased, and individuals who showed greater striatum activity subsequently spent a greater amount of money to punish their “free-riding” partner. Activity in the striatum has been repeatedly linked to reward processing and the pursuit of positive incentive stimuli (e.g., Knutson & Bhanji, 2006).

Follow-up research by Singer et al. (2006) also indicates a clear gender difference in this pattern. When men watched a “free-rider” undergo a painful procedure, they exhibited a clear increase in striatum activity, and this increase was correlated with their level of self-reported revenge motivation. However, women exhibited a different neurological response under these conditions, centered in the anterior cingulate cortex and indicative of empathy and shared pain. Thus, neurological research suggests that there is a gender difference in the tendency to experience positive affect while pursuing revenge-related goals.

Research also suggests that retaliating against one's provocateur can sometimes lead to feelings of satisfaction. Gollwitzer, Meder, and Schmitt (2011) provided participants with the opportunity to take revenge against a person who had given them an unfair, negative evaluation. When the other person sent a note indicating they understood that revenge was punishment for improper behavior, revenge-taking participants felt a great deal of satisfaction.

Finally, developmental research indicates that retaliatory acts can sometimes be motivated by the proactive pursuit of status,

rather than angry emotional reactions (see Hubbard, McAuliffe, Morrow, and Romano (2010) for a recent review). This literature has isolated a group of children who behave aggressively for entirely proactive and instrumental purposes. When these individuals are provoked, they expect others to respect and like them more if they retaliate, and they expect to feel better following such acts (see Smithmyer, Hubbard, and Simons (2000) for an especially illustrative study; cf. Arsenio, Gold, and Adams (2004), Crick and Dodge (1996), Dodge, Lochman, Harnish, Bates, and Pettit (1997) and Schwartz et al. (1998) for similar results). Interestingly, this same group of children is no more prone to anger than completely non-aggressive children (Hubbard et al., 2002). In sum, this literature indicates that proactive aggressors engage in behavioral retaliation because they expect the positive outcome of increased status, not because they are angry.

These findings suggest an important hypothesis. Sexual selection theory (Daly & Wilson, 1988) and social-learning theories (e.g., Baron, 1974; Nisbett & Cohen, 1996) propose that men are ultimately seeking status through their retaliatory acts. Since revenge motivation can sometimes be accompanied by positive affect and expectations of increased status rather than angry affect (de Quervain et al., 2004; Gollwitzer et al., 2011; Smithmyer et al., 2000), revenge may mediate gender differences in physical aggression even though anger does not. We considered this an intriguing hypothesis. After all, past research showing that men are no more prone to angry affect than women (Archer, 2004) could easily suggest that men are no more prone to revenge motivation than women.

While we could locate no prior study which directly tested this hypothesis, past gender difference research is consistent with it. Archer's (2004) meta-analysis found no significant gender difference in angry affect, but Miller, Worthington, and McDaniel's (2008) meta-analysis indicated that men exhibit much stronger tendencies toward revenge motivation than women. As such, we conducted three studies to test this hypothesis.

2. Study 1

In Study 1, we administered well-validated personality questionnaires which measure angry affect (Buss & Perry, 1992), revenge motivation (Denson et al., 2006), and physical aggression (Buss & Perry, 1992). We predicted that revenge motivation but not angry affect would mediate gender differences in physical aggression.

2.1. Method

2.1.1. Participants

Eighty-nine undergraduate psychology students (64 women; 25 men; M age = 20.1) from the University of Wyoming participated in exchange for course credit.

2.1.2. Procedures and apparatus

Participants arrived at the laboratory, provided informed consent and basic demographic information, and then completed the measures in a randomized order. These measures were all completed on one of five Windows-based computers using E-Prime software (version 2.0). Within each questionnaire, individual items were presented in a randomized order.

2.1.3. Measures

2.1.3.1. Aggression questionnaire. Study 1 participants completed the physical aggression and trait anger subscales of Buss and Perry's (1992) Aggression Questionnaire. The physical aggression scale contains nine statements indicative of tendencies toward

physically aggressive behaviors (e.g., "I get into fights a little more than the average person"). The trait anger subscale contains seven items indicative of tendencies toward angry affect (e.g., "Some of my friends think I'm a hothead"). Participants indicated how well each statement described them using a 1 (extremely uncharacteristic of me) to 5 (extremely characteristic of me) response scale. Both scales contain one reverse-scored item. Final scores were calculated by averaging participants' responses across all items (physical aggression: $M = 2.06$; $SD = .82$; angry affect: $M = 2.03$; $SD = .81$). Both scales exhibit strong convergent, discriminant, and criterion validity and test-retest reliability (Bettencourt, Talley, Benjamin, & Valentine, 2006; Bushman & Anderson, 1998; Buss & Perry, 1992; Martin et al., 2000), and both scales were internally reliable in the current study (physical aggression $\alpha = .83$; angry affect $\alpha = .84$).

2.1.3.2. Displaced aggression questionnaire. To measure revenge motivation, the revenge-planning subscale of the Displaced Aggression Questionnaire (Denson et al., 2006) was also administered in Study 1. This scale contains eleven statements indicative of tendencies toward revenge motivation (e.g., "When someone makes me angry, I can't stop thinking about how to get back at this person"). Participants indicated how well each statement described them using a 1 (extremely uncharacteristic of me) to 7 (extremely characteristic of me) response scale ($M = 1.91$; $SD = .84$). This scale exhibits strong convergent, discriminant, and criterion validity and test-retest reliability (Denson et al., 2006), and it was internally reliable in the current study ($\alpha = .90$).

2.1.3.3. Scale inter-correlations. Consistent with past research (Buss & Perry, 1992; Denson et al., 2006; Martin et al., 2000), physical aggression was positively correlated with both angry affect, $r = .38$, $p = .0003$, and revenge motivation, $r = .62$, $p < .0001$. Moreover, angry affect and revenge motivation were also positively correlated, $r = .45$, $p < .0001$. While these correlations were all statistically significant, none of them were so high as to suggest equivalence.

2.2. Results

2.2.1. Analytic plan

According to traditional standards (Baron & Kenny, 1986), mediation is confirmed when four criteria are met: (1) the predictor exhibits a significant zero-order relationship with the outcome; (2) the predictor exhibits a significant zero-order relationship with the hypothesized mediator; (3) the hypothesized mediator exhibits a significant relationship with the outcome when the predictor is statistically controlled; and (4) the relationship between the predictor and the outcome is reduced in magnitude once the hypothesized mediator is statistically controlled.

These criteria were applied to test the hypothesis that revenge motivation but not angry affect would mediate the relationship between gender and physical aggression in the current studies. Since gender (the predictor) is a dichotomous variable, independent sample t -tests were used to test Baron and Kenny's (1986) first and second criteria. To facilitate comparisons with later analyses, effect sizes for these analyses are reported in terms of Pearson's correlation coefficient r . To test Baron and Kenny's third and fourth criteria, a regression analysis was conducted in which gender (contrast coded 1 = men; -1 = women), angry affect, and revenge motivation were simultaneously entered as predictors of physical aggression.

More recently, it has been argued that researchers should provide more straightforward statistical tests of the indirect effect (i.e., the effect of the predictor on the outcome through the hypothesized mediator; Preacher & Hayes, 2008). These tests are

especially valuable when testing multiple possible mediators, as they can provide separate estimates of the indirect effect through each possible mediator (e.g., angry affect & revenge motivation). Preacher and Hayes (2008) have recently recommended a bootstrapping procedure for the estimation of indirect effects in such multiple mediation analyses. This test is more statistically appropriate than alternative tests of the indirect effect (e.g., the Sobel test), in that it does not assume a normal distribution of the indirect effects (MacKinnon, Lockwood, & Williams, 2004). It provides 95% confidence intervals for the indirect effects. If such confidence intervals exclude zero, the indirect effect is considered significant. We also applied this test in the current studies.

2.2.2. Gender differences in physical aggression

All mediation analyses from Study 1 are graphically summarized in Fig. 1. The gender difference in physical aggression was significant in this study. Men's reports of physical aggression ($M = 2.85$; $SD = .81$) were higher than women's reports ($M = 1.76$; $SD = .61$), $t(87) = 6.90$, $p < .0001$, $r = .59$.

2.2.3. Gender differences in possible mediators

It was next predicted that men would report significantly higher levels of revenge motivation but not angry affect. Consistent with this, men's reports of revenge motivation ($M = 2.26$; $SD = 1.18$) were significantly higher than women's reports ($M = 1.75$; $SD = .75$), $t(87) = 4.08$, $p < .0001$, $r = .40$. However, men's reports of angry affect ($M = 2.23$; $SD = .91$) were not significantly higher than women's reports ($M = 2.01$; $SD = .76$), $t(87) = 1.18$, $p = .23$, $r = .13$. Thus, Baron and Kenny's (1986) second criterion for mediation was met for revenge motivation but not angry affect.

2.2.4. Regression analysis

It was next predicted that revenge motivation but not angry affect would significantly predict physical aggression even when gender is controlled for, and that the magnitude of the gender-aggression relationship would be reduced once these potential mediators had been controlled for. To test this, gender (coded 1 = men; -1 = women), revenge motivation, and angry affect were simultaneously entered as predictors of physical aggression in a multiple regression. Revenge motivation significantly predicted physical aggression, $\beta = .39$, $p < .0001$, but angry affect did not, $\beta = .15$, $p = .07$. Moreover, the relationship between gender and physical aggression was reduced in magnitude, $\beta = .42$, $p < .0001$, relative to these variables' zero-order relationship, $r = .59$, $p < .0001$. Thus, Baron and Kenny's (1986) third and fourth criteria

for mediation were met for revenge motivation but not for angry affect.

2.2.5. Bootstrapping analysis

Finally, we used the bootstrapping procedure recommended by Preacher and Hayes (2008) to provide separate estimates for the indirect effect through revenge motivation and angry affect. The 95% confidence intervals for the indirect effect through revenge motivation (.06, .29) excluded zero. Thus, this indirect effect was significant. By contrast, the 95% confidence intervals for the indirect effect through angry affect (-.008, .08) included zero, and thus this indirect effect cannot be considered significant. In summary, revenge motivation but not angry affect significantly mediated the gender difference in physical aggression according to all recommended criteria of mediation (Baron & Kenny, 1986; Preacher & Hayes, 2008).

3. Study 2

Study 1 revealed that revenge motivation but not angry affect mediated the gender difference in physical aggression. To ensure that this finding was not isolated to one specific personality measure of angry affect, we sought to replicate this pattern in Study 2 using a different measure (Spielberger, 1988). In addition, Study 2 was also designed to rule out a potential confound. It has been suggested that men have a stronger propensity to express anger outwardly, even if they do not experience stronger subjective feelings of anger (see Fehr, Baldwin, Collins, Patterson, and Benditt (1999) for a discussion of the mixed history of this idea). To control for the possibility that revenge motivation is just a reflection of such outward anger expression tendencies, we also included a measure of anger-out (Spielberger, 1988) in Study 2.

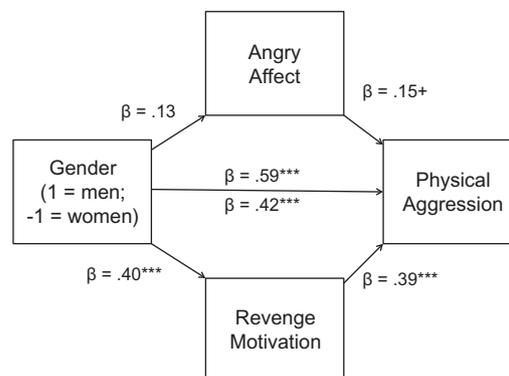
3.1. Method

3.1.1. Participants

Sixty-nine undergraduate psychology students (50 women; 19 men; M age = 19.6) from the University of Wyoming participated in exchange for course credit.

3.1.2. Apparatus, procedures, and measures

All apparatus, procedures, and measures were the same as in Study 1, with the following exceptions: To ensure that Study 1's findings are not particular to a one measure of angry affect, a different measure was administered in Study 2. Specifically, the trait



Note: All values represent standardized betas. *** indicates $p < .0001$; ** indicates $p < .001$; * indicates $p < .05$; + indicates $p < .10$. For the gender-aggression relationship, values above the arrow indicate the zero-order relationship, and values below the arrow represent the relationship controlling for the candidate mediators.

Fig. 1. Summary of mediation analyses, Study 1.

anger scale from the State-Trait Anger Expression Inventory (Spielberger, 1988) was administered. To provide discriminant validity regarding Study 1's revenge motivation findings, the anger-out scale from the same instrument was also administered.

The trait anger scale contains ten statements indicative of one's tendencies toward the internal experience of angry affect (e.g., "I feel infuriated when I do a good job and get a poor evaluation"). The anger-out scale contains seven statements indicative of one's tendencies toward the outward expression of anger (e.g., "When I feel angry or furious, I argue with others"). Participants indicate how frequently these statements are true of them using a 1 (almost never) to 4 (frequently) scale (angry affect: $M = 1.80$; $SD = .48$; anger-out: $M = 1.85$; $SD = .51$). These scales exhibit strong convergent, discriminant, and criterion validity and test-retest reliability (Bettencourt et al., 2006; Deffenbacher, 1992; Martin et al., 2000; Spielberger, 1988). They were also internally reliable in the current study (trait anger $\alpha = .82$; anger-out $\alpha = .75$). Physical aggression ($M = 2.16$; $SD = .77$; $\alpha = .83$) and revenge motivation ($M = 2.32$; $SD = 1.23$; $\alpha = .93$) were measured using the same scales as in Study 1 (Buss & Perry, 1992; Denson et al., 2006).

3.1.2.1. Scale inter-correlations. Consistent with past research (e.g., Denson et al., 2006; Martin et al., 2000; Spielberger, 1988), physical aggression was positively correlated with angry affect, $r = .65$, $p < .0001$, anger-out, $r = .50$, $p < .0001$, and revenge motivation, $r = .64$, $p < .0001$. Moreover, angry affect was positively correlated with anger-out, $r = .71$, and revenge-planning, $r = .69$, and anger-out and revenge motivation were also positively correlated, $r = .42$. All correlations were significant, all $ps < .0005$. One should note that these constructs tended to exhibit stronger positive correlations in Study 2 compared to Study 1. Nonetheless, they seldom were high enough to suggest equivalence, and the results of Study 1 and other past studies (e.g., Denson et al., 2006; Martin et al., 2000; Spielberger, 1988) indicates that their correlations do not consistently reach criteria for construct equivalence.

3.2. Results

3.2.1. Gender differences in physical aggression

All mediation analyses from Study 2 are graphically summarized in Fig. 2. The gender difference in physical aggression was significant in this study. Men's reports of physical aggression ($M = 2.60$; $SD = .83$) were higher than women's reports ($M = 1.99$; $SD = .68$). $t(67) = 3.10$, $p = .003$, $r = .35$. Thus, Baron and Kenny's (1986) first criterion of mediation was satisfied.

3.2.2. Gender differences in possible mediators

It was next predicted that men would report higher levels of revenge motivation but not angry affect or anger-out. Consistent with this, men's reports of revenge motivation ($M = 3.20$; $SD = 1.45$) were higher than women's reports ($M = 1.98$; $SD = .95$), $t(67) = 4.06$, $p = .0001$, $r = .44$. Also consistent with expectations, men's reports of anger-out ($M = 1.93$; $SD = .47$) did not differ from women's reports ($M = 1.81$; $SD = .53$), $t(67) = .85$, $p = .40$, $r = .10$. Unexpectedly, there was a significant gender difference in reports of angry affect (men: $M = 2.01$; $SD = .47$; women: $M = 1.71$; $SD = .46$), $t(67) = 2.55$, $p = .01$, $r = .30$. However, this unexpected difference was smaller in magnitude than the corresponding gender differences in both physical aggression and revenge motivation. In sum, revenge motivation and angry affect both met Baron and Kenny's (1986) second criterion for mediation, but anger-out did not.

3.2.3. Regression analysis

It was next predicted that revenge motivation but not angry affect or anger-out would significantly predict aggression even when

gender was controlled, and that the magnitude of the gender-aggression relationship would be reduced once these candidate mediators had been controlled for. To test this, gender (coded men = 1; women = -1), angry affect, anger-out, and revenge motivation were all simultaneously entered as predictors of physical aggression in a multiple regression. When this was done, revenge motivation significantly predicted physical aggression, $\beta = .35$, $p = .01$, but trait anger, $\beta = .26$, $p = .09$, and anger-out, $\beta = .15$, $p = .22$, did not. Once these various candidate mediators were controlled for, gender no longer significantly predicted physical aggression, $\beta = .11$, $p = .29$. Thus, revenge motivation met Baron and Kenny's (1986) third and fourth criteria for mediation, but angry affect and anger-out did not.

3.2.4. Bootstrapping analysis

Finally, we employed the bootstrapping procedure recommended by Preacher and Hayes (2008) to provide separate estimates of the indirect effects through angry affect, anger-out, and revenge motivation. The 95% confidence intervals for the indirect effect through revenge motivation (.006, .42) excluded zero, and thus this indirect effect is significant. By contrast, the 95% confidence intervals for the indirect effects through both angry affect (-.03, .23) and anger-out (-.02, .11) included zero, and thus these indirect effects cannot be considered significant. In sum, revenge-planning met all recommended criteria for mediation (Baron & Kenny, 1986; Preacher & Hayes, 2008), but angry affect and anger-out did not.

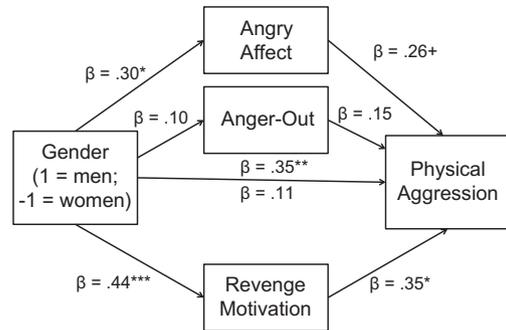
4. Study 3

Studies 1 and 2 provided support for the prediction that revenge motivation mediated gender differences in physical aggression but angry affect and anger-out did not. Nonetheless, both studies relied on questionnaire measures of physical aggression. While these measures are certainly well-validated (Bettencourt et al., 2006; Bushman & Anderson, 1998; Martin et al., 2000), confidence in this pattern would be increased if the same pattern was replicated with a more objective, laboratory-based measure of physical aggression. Studies 1 and 2 also relied on retrospective trait reports of angry affect and revenge motivation. Such retrospective reports have also been questioned due to reporting biases that can sometimes contaminate their accuracy (Robinson & Clore, 2002). Thus, confidence would also be increased if this pattern was replicated using online reports of current state anger and current state revenge motivation.

Study 3 was designed to rectify this situation. A modified version of Taylor's (1967) competitive reaction time task was administered. In this task, participants can administer loud, aversive noise blasts to an ostensible opponent as part of a competition. The selection of higher intensity noise blasts serves as a valid measure of physical aggressive behaviors (Bushman & Anderson, 1998; Giancola & Parrott, 2008; Giancola & Zeichner, 1995). Past studies have indicated a clear gender difference in the tendency to behave aggressively in this and similar tasks (see Bettencourt & Miller (1996) for a meta-analytic review).

Following completion of this task, online reports of participants' current angry affect and revenge motivation were obtained. Because it has been suggested that general negative affect can also motivate aggression (Berkowitz, 1990), we also included a state measure of this construct. We predicted that revenge motivation but not angry or negative affect would mediate gender differences in laboratory aggression.

The design of Study 3 also permitted a preliminary test of an additional hypothesis. Based on prior research (de Quervain et al., 2004; Gollwitzer et al., 2011; Smithmyer et al., 2000), we theorized that men's revenge motivation would be accompanied



Note: All values represent standardized betas. *** indicates $p < .0001$; ** indicates $p < .001$; * indicates $p < .05$; + indicates $p < .10$. For the gender-aggression relationship, values above the arrow indicate the zero-order relationship, and values below the arrow represent the relationship controlling for the candidate mediators.

Fig. 2. Summary of mediation analyses, Study 2.

by positive affect but not anger. Tests of this prediction at the trait level are quite difficult given that no standardized instruments are available (that we could locate) which measure positive affect in the context of revenge-seeking specifically. At the state level, however, it is quite possible to administer a positive affect scale while participants are engaged in an aggressive competition. We predicted that men would exhibit an increase in positive affect within this context, and that positive affect would be systematically related to revenge motivation and aggressive behaviors.

We consider such positive affect-related evidence quite preliminary. After all, a single retrospective report of generalized positive affect could not specify the point in time at which men are prone to positive affect (e.g., during the pursuit of revenge goals or after the attainment of revenge); nor could it specify the type of positive affect which men are prone to (e.g., wanting versus liking; see Section 5 for a further elaboration). Nonetheless, such data would provide evidence that men's revenge goals are associated with positive affect rather than anger.

4.1. Method

4.1.1. Participants

Ninety-five undergraduate psychology students (55 men, 40 women; M age = 19.6) from North Dakota State University participated in exchange for course credit.

4.1.2. Apparatus

All participants completed the study on one of six Windows-based computers using E-Prime software (version 1.2). These computers were located in separated cubicles to facilitate the deception, and all computers were equipped with headphones for the delivery of noise blasts.

4.1.3. Procedures and measures

Participants arrived at the laboratory and were seated in one of the six separated cubicles. Participants provided informed consent and were told that they would be competing against another participant located in a separate cubicle. Their main job in this competition was simply to press the spacebar as quickly as possible upon hearing a brief beep. Participants were told that to encourage them to respond faster, the winner of each trial would choose a loud noise blast to administer to their opponent. The selection of louder noises serves as a well-validated laboratory measure of aggression (Bushman & Anderson, 1998; Giancola & Parrott, 2008; Giancola & Zeichner, 1995).

At the beginning of each trial, participants choose between nine intensities of noise, ranging from 60 dB to 100 dB in 5 dB intervals,

as well as a no-noise, non-aggressive option. These options were presented to participants on a 0 (no-noise) to 9 (100 dB) scale ($M = 4.68$; $SD = 1.65$). To create the appearance of a realistic opponent with variable response times, a 0, 2, or 4 s delay (randomly-determined) followed, during which participants were told to wait for their opponent. Participants were then instructed to get ready to press the spacebar. To create the appearance of a difficult reaction time competition, this message varied between 1, 1.5, and 2 s in duration across trials (randomly determined).

A brief beep was then played to participants through their headphones. Participants had 750 ms following this beep to press the spacebar. A one second pause followed, and participants were informed of the outcome of the trial via a 2.5 s message. If the participant lost, they were informed of the noise blast intensity they would be receiving, and then they received the noise blast for 1 s. If the participant won the trial, they were first told that their opponent would receive the noise blast intensity that they had previously selected, and then they were told that their opponent was receiving the noise blast for 1 s.

In reality, there was no opponent. The computer randomly determined whether the participant won or lost each trial, as well as the noise blast intensities the participant received on "lost" trials. The following constraints were placed on this random selection process: The participants always lost the first trial and received an 80 dB noise blast. By default, participants typically won 10 of the subsequent trials and lost the remaining 10 trials. To ensure the appearance of a realistic reaction time competition, however, these default settings were overridden and the participant lost the trial if they failed to respond within 750 ms. They received an 80 dB noise blast on such trials. On the remaining "lost" trials, the participant received each of the following noise blast intensities twice: 70, 75, 80, 85, and 90 dB.

Following the reaction time competition, participants reported on their current affective state using Watson and Clark's (1994) well-validated Positive Affect and Negative Affect Schedules – Expanded (PANAS-X). The general positive affect (10 items; e.g., proud, active, determined; $M = 3.13$; $SD = .81$; $\alpha = .88$), general negative affect (10 items; e.g., upset, nervous, ashamed; $M = 1.86$; $SD = .63$; $\alpha = .81$), and angry affect (6 items; e.g., angry, hostile, irritable; $M = 1.78$; $SD = .69$; $\alpha = .83$) scales were administered. Participants reported on their emotional state during the reaction time competition using a 1 (not at all) to 5 (extremely) response scale. For the purposes of the current study, two items measuring anger (i.e., hostile & irritable) were removed from the general negative affect scale to ensure this scale measured forms of negative affect other than anger.

Participants then reported on the level of revenge motivation they experienced during the reaction time competition using the

Anderson Motivation Scale (Anderson & Murphy, 2003). This scale contains four items (e.g., “I wanted to pay my opponent back for the noise level they set”; $M = 2.18$; $SD = 1.06$; $\alpha = .76$) which were specifically designed to tap revenge motivation in the competitive reaction time task. Participants rated the extent to which they experienced each goal during the reaction time competition, using a 1 (no, not at all) to 5 (definitely) response scale. This scale has been used in numerous past studies of laboratory aggression, and it is invariably positively correlated with laboratory aggression in these studies (e.g., Anderson, Buckley, & Carnegey, 2008; Anderson & Murphy, 2003; Anderson et al., 2004).

Finally, participants completed a full-funnel probe for suspicion (Bargh & Chartrand, 2000). In it, participants responded to three open-ended questions which subtly probed their beliefs concerning the existence of their opponent without overtly revealing the deception. Seven participants (5 men; 2 women; 7.4% of the sample) expressed some suspicion concerning the existence of their opponent. These participants were excluded from the analyses reported below, resulting in an effective sample size of 88 participants.

4.1.3.1. Inter-correlation of measures. Angry affect was significantly positively correlated with revenge motivation, $r = .33$, $p = .002$, but this correlation was not so strong as to suggest equivalence. Additionally, angry affect was significantly positively correlated with general negative affect, $r = .61$, $p < .0001$, but not general positive affect, $r = .15$, $p = .17$. General negative affect was positively correlated with general positive affect, $r = .21$, $p = .048$, but not revenge motivation, $r = .14$, $p = .19$.

4.2. Results

4.2.1. Gender differences in physical aggression

All mediation analyses in Study 3 are graphically summarized in Fig. 3. Once again, the gender difference in physical aggression was significant in this study. Men ($M = 5.09$; $SD = 1.78$) were more aggressive in their noise blast selections than women ($M = 4.14$; $SD = 1.28$), $t(86) = 2.78$, $p = .007$, $r = .29$. Thus, Baron and Kenny's (1986) first criterion for mediation was satisfied.

4.2.2. Gender differences in potential mediators

It was next predicted that men would exhibit greater revenge motivation but not angry or general negative affect. Consistent with this prediction, men ($M = 2.46$; $SD = 1.16$) displayed greater revenge motivation than women ($M = 1.18$; $SD = .78$), $t(86) = 2.92$, $p = .004$, $r = .30$. However, men ($M = 1.85$; $SD = .70$) did not display more angry affect than women ($M = 1.69$; $SD = .69$), $t(86) = 1.10$, $p = .27$, $r = .12$. There were also no significant gender difference in general negative affect (men: $M = 1.81$; $SD = .66$; women: $M = 1.91$; $SD = .60$), $t(86) = -.71$, $p = .48$, $r = -.08$. In sum, revenge motivation but not angry or general negative affect met Baron and Kenny's (1986) second criterion for mediation.

4.2.3. Regression analyses

It was next predicted that revenge motivation but not angry or general negative affect would significantly predict aggression with gender controlled, and that the magnitude of the gender-aggression relationship would be reduced once these various candidate mediators were statistically controlled. To test this prediction, gender (coded men = 1; women = -1), revenge motivation, angry affect, and general negative affect were simultaneously entered as predictors of aggression. Consistent with predictions, revenge motivation significantly predicted aggression in this analysis, $\beta = .41$, $p = .0002$. By contrast, neither angry affect, $\beta = -.003$, $p = .98$, nor general negative affect, $\beta = -.08$, $p = .52$, significantly

predicted aggression. Moreover, gender no longer significantly predicted aggression once these variables were controlled for, $\beta = .15$, $p = .12$. Thus, revenge motivation but not angry affect or general negative affect met Baron and Kenny's (1986) third and fourth criteria for mediation.

4.2.4. Bootstrapping analysis

We next conducted the bootstrapping analysis recommended for multiple mediation models (Preacher & Hayes, 2008). The 95% confidence intervals for the indirect effect through revenge motivation excluded zero (.07, .42), and thus this indirect effect was significant. By contrast, the 95% confidence intervals for the indirect effect through angry affect (-.08, .06) and general negative affect (-.02, .10) included zero. As such, these indirect effects cannot be considered significant. Thus, revenge motivation but not angry or general negative affect met all recommended criteria (Baron & Kenny, 1986; Preacher & Hayes, 2008) for mediation.

4.2.5. Positive affect analyses

In a subsidiary and preliminary hypothesis, we predicted that men's revenge goals are associated with positive affect rather than anger. If so, men should display increased positive affect in this situation, and this increase in positive affect should be systematically correlated with revenge motivation and aggression. Consistent with predictions, men ($M = 3.32$; $SD = .72$) displayed higher levels of positive affect compared to women ($M = 2.87$; $SD = .86$) in this context, $t(86) = 2.62$, $p = .01$, $r = .27$. Beyond this, positive affect was systematically correlated with revenge motivation, $r = .28$, $p = .007$, and aggression, $r = .23$, $p = .03$. While we acknowledge that this evidence is quite preliminary, it is nonetheless consistent with the suggestion that men's increased tendencies toward revenge are associated with positive affective experiences rather than angry affect.¹

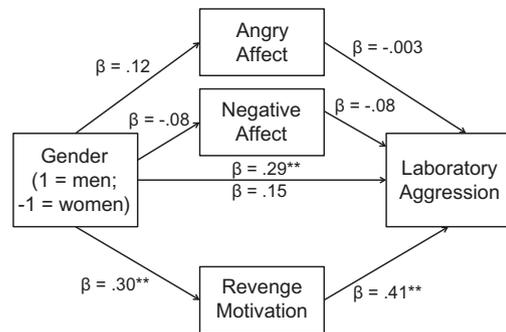
5. General discussion

5.1. Summary of findings

While there is robust evidence for a gender difference in physical aggression (see Archer (2004), Bettencourt and Miller (1996) and Eagley and Steffen (1986) for meta-analytic reviews), there is precious little research explaining *why* men are more physically aggressive than women. In a recent exchange (Archer, 2009; Eagley & Wood, 2009), the only established finding reviewed was that men and women exhibit no reliable difference in angry affect whatsoever (Archer, 2004; Campbell, 2006). Drawing on sexual selection theory (Archer, 2009; Buss & Duntley, 2006; Clutton-Brock, 2007; Daly & Wilson, 1988) and social-learning theories (e.g., Baron, 1974; Nisbett & Cohen, 1996), we predicted that gender differences in physical aggression would be mediated by revenge motivation rather than angry affect.

Three studies provided support for this contention. Studies 1 and 2 both employed personality questionnaire measuring physical aggression, angry affect, and revenge motivation (Buss & Perry,

¹ Given that Study 3 employed a single retrospective measure of positive affect, we had no strong *a priori* prediction regarding whether positive affect would mediate the gender-aggression relationship, or whether aggression would instead mediate the gender-positive affect relationship (see General Discussion for theoretical elaboration). Nonetheless, we conducted mediation analyses testing both possibilities for exploratory purposes. The results of both analyses were non-significant by traditional standards, as the 95% confidence intervals for both indirect effects narrowly included zero (gender-PA-aggression: $-.01$, $.25$; gender-aggression-PA: $-.008$, $.11$). We attribute this finding to the non-specificity of the positive affect measure used in Study 3. As such, we recommend that future research include multiple measurements of different forms of positive affects to better understand the role of the reward system in male revenge-seeking.



Note: All values represent standardized betas. *** indicates $p < .0001$; ** indicates $p < .001$; * indicates $p < .05$; + indicates $p < .10$. For the gender-aggression relationship, values above the arrow indicate the zero-order relationship, and values below the arrow represent the relationship controlling for the candidate mediators.

Fig. 3. Summary of mediation analyses, Study 3.

1992; Denson et al., 2006; Spielberger, 1988). Across both studies, revenge motivation but not angry affect mediated gender differences in physical aggression. This was true even though different measures of angry affect were used across these studies (Study 1: Buss & Perry, 1992; Study 2: Spielberger, 1988). Moreover, the mediating role of revenge motivation could not be attributed to the broader construct of *anger-out* (Spielberger, 1988), as Study 2 included a measure of this construct and found that revenge motivation was a significant mediator even though anger-out was not.

To add confidence to the pattern obtained in Studies 1 and 2, Study 3 used a more objective laboratory measure of physical aggression (Taylor, 1967), as well as online reports of current angry affect, general negative affect (Watson & Clark, 1994), and revenge goals (Anderson & Murphy, 2003). Consistent with predictions, gender differences in laboratory aggression were mediated by revenge goals but not by angry affect or negative affect. Thus, revenge motivation's mediating role is apparent in both personality questionnaires and in laboratory behavior.

It is important to note that revenge motivation only partially mediated gender differences in physical aggression in some studies. Thus, revenge motivation is not the *only* mediator of gender differences in physical aggression. Indeed, others have suggested that impulsivity or anxiety may also play an important mediating role (Campbell, 2006), and empathy also seems like a plausible candidate mediator. Future research should investigate these possibilities. It would be especially interesting to investigate these variables' potential mediating role under no-provocation conditions, where revenge motivation could not readily explain gender differences.

Before proceeding, it is useful to briefly comment on the broader evolution versus social-learning debate. In the current investigation, we drew upon evolutionary (Archer, 2009; Buss & Duntley, 2006; Clutton-Brock, 2007; Daly & Wilson, 1988) and social-learning (Baron, 1974; Nisbett & Cohen, 1996) theories to inform our hypothesis that revenge motivation but not angry affect mediates gender differences in physical aggression. In doing so, our goal was to better understand the psychological processes mediating this gender difference, and not to resolve the long-standing evolution versus social-learning debate. Thus, we make no conclusions regarding this larger debate on the basis of our data. Nonetheless, we believe that the current results may provide a useful tool for researchers on both sides of this debate. Since the current studies establish revenge motivation as a reliable mediator of gender differences in physical aggression, future researchers can examine cross-cultural variation and developmental influences on this gender difference to test the differential predictions of evolutionary versus social-learning theories.

5.2. The reward system and revenge motivation in men

In the current investigation, we suggested that the reward system may underlie the increased pursuit of revenge by men. Consistent with this, Study 3 found that men experience more positive affect in an aggressive context, and that positive affect was systematically related to revenge motivation and physically aggressive behaviors. However, we must acknowledge that this evidence is quite preliminary. After all, we used a single retrospective report of positive affect. This measure cannot specify the time point at which men are prone to positive affect (e.g., while pursuing a revenge goal or after obtaining it), nor can it specify the type of positive affect to which men are prone. Thus, an important focus for future research will be to better determine how the reward system is involved in male tendencies toward revenge motivation.

Past research indicates that there are at least three separable components of the reward system which are supported by unique neural systems (Berridge, 2009; Berridge & Robinson, 2003). Specifically, one can distinguish between liking, wanting, and cognitive outcome expectancies. Liking is typically conceptualized as the subjective experience of pleasure or by facial expressions indicative of pleasure. It occurs after one obtains a positive incentive stimulus. In contrast, wanting occurs during the pursuit of positive incentive stimuli and does not directly refer to an experience of pleasure. Instead, it refers to incentive value or the desire a person has to obtain a reward. Finally, cognitive outcome expectancies consist of people's conscious expectations of the likelihood of specific rewards and how they can be obtained. Especially in cases of unconscious liking or wanting, cognitive outcome expectancies can become divorced from wanting or liking (Winkielman & Berridge, 2003; Winkielman, Berridge, & Wilbarger, 2005).

Research has linked all three of these components of the reward system to the pursuit of revenge. Activity in wanting-linked neural regions has been found to increase while people are contemplating the costly punishment of one's provocateur (de Quervain et al., 2004). After enacting retaliatory behaviors, individuals feel a subjective sense of satisfaction (or "liking") if the target of their vengeful actions confesses they were wrong to behave as they did (Gollwitzer et al., 2011). Finally, there is evidence that retaliatory actions can be caused by cognitive outcome expectancies that others will respect one more if one retaliates (Smithmyer et al., 2000).

Future research should explore whether men's increased tendencies toward revenge motivation are due to wanting, liking, cognitive outcome expectancies, or some combination thereof. These three separate aspects of the reward system should be measured at multiple points in time (i.e., before and after obtaining revenge). If wanting or cognitive outcome expectancies underlies

male revenge-seeking, then clearly measures of these constructs taken before obtaining revenge should mediate the gender–aggression relationship. If pleasure (or “liking”) underlies male revenge-seeking, then aggressive behavior should instead mediate the relationship between gender and pleasure felt *after* obtaining revenge. Some theorists suggest that this pleasurable response to goal attainment would reinforce this behavioral tendency in the future (e.g., Baumeister, Vohs, DeWall, & Zhang, 2007). An increased pleasurable response to retaliation in men may be theoretically important because it reinforces aggressive behavior in the future.

6. Conclusion

In conclusion, three studies using diverse measures and methodologies provided support for the contention that revenge motivation but not angry affect mediates gender differences in physical aggression. These studies provide some of the first evidence (that we are aware of) for a reliable mediator of this gender difference. Moreover, these studies suggest several important avenues for future research, including the role of various components of the reward system in male tendencies toward revenge motivation.

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