

Rumination, Emotion, and Forgiveness: Three Longitudinal Studies

Michael E. McCullough, Giacomo Bono, and Lindsey M. Root
University of Miami

In 3 studies, the authors investigated whether within-persons increases in rumination about an interpersonal transgression were associated with within-persons reductions in forgiveness. Results supported this hypothesis. The association of transient increases in rumination with transient reductions in forgiveness appeared to be mediated by anger, but not fear, toward the transgressor. The association of rumination and forgiveness was not confounded by daily fluctuations in positive affect and negative affect, and it was not moderated by trait levels of positive affectivity, negative affectivity, or perceived hurtfulness of the transgression. Cross-lagged associations of rumination and forgiveness in Study 3 more consistently supported the proposition that increased rumination precedes reductions in forgiveness than the proposition that increased forgiveness precedes reductions in rumination.

Keywords: forgiveness, rumination, emotion, personality, longitudinal

For some of us whose unforgiving emotions lurk beneath a barely civil surface, allowing ourselves to recall our hurts and offenses can plunge us straight into rumination and thus bitter unforgiveness. To forgive, we must recall the hurt and offense, but we must do it differently than we usually do. (Worthington, 2001, pp. 53–54).

In popular and professional writings on forgiveness, few pieces of conventional wisdom are more widely accepted than the notion that recalling the transgression and then deeply considering its implications for oneself is a fundamental preliminary step toward forgiveness (e.g., Enright, 2001; Worthington, 2001). Indeed, many of the theoretical models that have stimulated basic research and forgiveness interventions articulate this same point (McCullough & Worthington, 1994). But as the opening quotation suggests, it is unlikely that all forms of attention to a transgression are adaptive. Rumination about the transgression may be particularly counterproductive. This may especially be the case insofar as rumination leads to transient increases in negative emotion regarding the transgression.

When personality, social, and clinical psychologists read the word *rumination*, most likely they think of “engaging in a passive focus on one’s symptoms of distress and on the possible causes and consequences of these symptoms” (Nolen-Hoeksema & Jackson, 2001, p. 37), which has been a common way to think about rumination since Nolen-Hoeksema (1987) proposed that gender differences in this form of rumination accounted for the gender difference in depressive symptoms. However, Skinner, Edge, Alt-

man, and Sherwood (2003) defined rumination more generally as a coping strategy characterized by a “passive and repetitive focus on the negative and damaging features of a stressful transaction” (p. 242). Aggression researchers in particular have discussed rumination about previous provocations for over 30 years (Konecni, 1974), and a self-report measure of individual differences in this tendency is widely used (Caprara, 1986).

But whether one talks about rumination regarding one’s own negative moods or rumination regarding negative life events, such as interpersonal provocations, few recent ideas in personality-social psychology have drawn as much consensus as the idea that rumination is counterproductive for psychosocial adjustment and interpersonal functioning. For example, ruminating about the causes of one’s depressive symptoms appears to prolong depressed moods and negative affect (Mor & Winquist, 2002), ruminating about the causes of one’s anger appears to prolong anger (Rusting & Nolen-Hoeksema, 1998), and ruminating about an insult while hitting a punching bag appears to increase one’s likelihood of aggressing against the insulter (Bushman, 2002). Furthermore, rumination is an important factor in the phenomenon of triggered displaced aggression (Miller, Pedersen, Earleywine, & Pollock, 2003).

Rumination and Forgiveness: Predictions From a Cognitive Neoassociation (CNA) Model

In light of the consistently deleterious effects of rumination on psychological well-being and interpersonal behavior, it seems likely that rumination is also negatively associated with forgiveness. Indeed, self-report measures of forgiveness as a personality trait are negatively associated with rumination as a personality trait (Berry, Worthington, O’Connor, Parrott, & Wade, 2005; Berry, Worthington, Parrott, O’Connor, & Wade, 2001). Moreover, two studies have demonstrated that rumination about a transgression is related cross-sectionally to higher scores on measures of revenge and/or avoidance motivation for the transgressor (McCullough, Bellah, Kilpatrick, & Johnson, 2001; McCullough et al., 1998). McCullough et al. (2001) also found in a two-wave longitudinal

Michael E. McCullough, Giacomo Bono, and Lindsey M. Root, Department of Psychology, University of Miami.

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Correspondence concerning this article should be addressed to Michael E. McCullough, Department of Psychology, University of Miami, P.O. Box 248185, Coral Gables, FL 33124-0751. E-mail: mikem@miami.edu

study that changes in rumination were positively correlated with changes in avoidance and revenge motivation regarding the transgressor.

The CNA model of aggression (Berkowitz, 1990) and Miller et al.'s (2003) recent elaboration of this model help to explain why rumination may be negatively associated with forgiveness. Miller et al. (2003) proposed that transgressions elicit negative emotions in the victim that, in turn, activate other cognitive and motivational structures (including thoughts, feelings, perceptual biases, motivations, and even programs for motoric behavior) that are linked in an associative network. What the nodes in this network have in common is that they all pertain to perceiving and reacting to interpersonal harms. For example, anger caused by a transgression may trigger memories of previous transgressions and thus elicit physiological preparedness for fight-or-flight responding to the transgression. The strength of the associations among these nodes also influences the likelihood that they will be activated when future transgressions occur.

According to Miller et al. (2003), rumination about a transgression in the hours, days, or weeks after a transgression reactivates the associative network that is typically activated when one experiences a transgression *de novo*. By rehearsing memories or images of the transgression and considering its implications for the self, some of the negative affect that the transgression initially elicited is reelicited, and this negative affect spreads again to influence cognition, motivation, and physiological preparedness for fight-or-flight responding. Therefore, rumination may cause a reexperiencing of the cognitive, affective, motivational, and physiological consequences of the transgression as if it were occurring once again, although probably at a lesser magnitude. More to the point of the present article, whenever people ruminate about a transgression, they should experience a heightened readiness to avoid and/or seek revenge against a transgressor. In other words, rumination about an unresolved transgression may reenergize people's efforts to avoid and/or seek revenge against the person who harmed them. Reductions in these negative interpersonal motivations are how we have come to define interpersonal forgiveness (McCullough, Fincham, & Tsang, 2003; McCullough et al., 1998; McCullough, Worthington, & Rachal, 1997), so stated another way, our main hypothesis is that rumination is negatively associated with forgiveness.

Defining and Measuring Forgiveness

Forgiveness is a suite of prosocial changes in one's motivations toward an interpersonal transgressor such that one becomes less avoidant of and less vengeful toward the transgressor (and, perhaps, more benevolent as well; McCullough et al., 1997). Forgiveness is an unusual construct in psychology because it is not a state, but a process of change *per se*. Specifically, forgiveness is the change process by which an individual becomes more positively disposed and less negatively disposed toward an individual who has harmed him or her at some point in the past. Although nearly every forgiveness theorist posits that forgiveness involves changes in one's emotions, motivations, or behaviors regarding an interpersonal transgressor such that the person thinks, feels, or behaves more positively and less negatively toward the transgressor (Baumeister, Exline, & Sommer, 1998; Enright & Coyle, 1998),

few researchers have directly measured forgiveness as temporal change.

Modeling Forgiveness as Change

McCullough et al. (2003) proposed that forgiveness can be operationalized as change in two ways using repeated measures of people's transgression-related interpersonal motivations, or TRIMs. Specifically, they proposed decomposing repeated measures of people's TRIMs regarding a transgression according to the following statistical model:

$$TRIM_{ij} = \beta_{0j} + \beta_{1j}(Time)_{ij} + r_{ij}. \quad (1)$$

In this model, Person j 's score on one of the TRIMs (e.g., the amount of revenge he or she has for a transgressor) at Time i is modeled as a linear function of two higher level parameters—an initial status estimate of how much revenge motivation the person would have had *just after the transgression*, and an estimate of the rate of *subsequent linear change* in revenge. The latter parameter representing the degree of linear change in one's TRIMs indicates how much Person j has forgiven his or her transgressor (with declines in avoidance and revenge indicating more forgiveness), or what McCullough et al. (2003) called "trend forgiveness". Consider the hypothetical longitudinal trajectories for Alan and Bill in Figure 1 (we focus on changes in revenge for illustrative purposes, but we could also have focused on changes in avoidance). On Day 0 (i.e., immediately after the transgression), Alan had a high level of revenge motivation that declined steadily until Day 35. However, on Day 0, Bill had less revenge motivation, which did not decline over the 35 days. Thus, Alan was more vengeful initially but had more trend forgiveness, whereas Bill was less vengeful at the outset but also less forgiving.

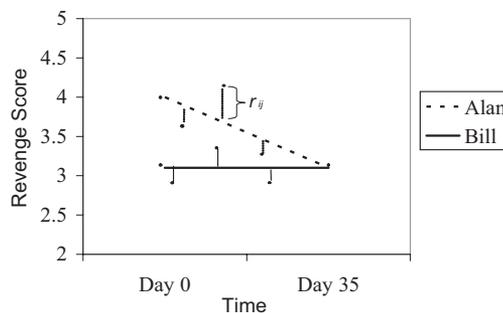


Figure 1. Hypothetical longitudinal trajectories of revenge motivation for two individuals—Alan and Bill—during the 35 days following a transgression. Alan had more revenge motivation initially following the transgression (i.e., on Day 0) than did Bill. Alan's revenge motivations declined over the 35-day period, so we can say that he has experienced a degree of *trend forgiveness*. Bill's revenge motivations did not decline, so he does not exhibit evidence of trend forgiveness. The residual r_{ij} represents the deviation of Alan's (i.e., person j 's) revenge score on Day i from what would have been expected for him on the basis of his initial level of revenge motivation and his degree of trend forgiveness. On Day i , Bill has become more vengeful than is to be expected on the basis of his initial status and degree of trend forgiveness, and therefore, temporarily less forgiving.

Trend Forgiveness, Temporary Forgiveness, and the Epistemic Value of Within-Subjects Research

Discovering that people's rates of change in rumination are associated with their rates of change in avoidance and revenge motivation, or *trend forgiveness*, would essentially be a replication of McCullough et al.'s (2001) previous findings, and, thus, would be unsurprising. But note in Figure 1 that neither Alan's nor Bill's revenge scores fall perfectly on their linear regression lines: On some days, Alan and Bill had more or less revenge motivation regarding their transgressors than would be expected given their initial levels of those motivations and the rates of change in their motivations over the 35 days (i.e., trend forgiveness). McCullough et al. (2003) named such temporary deviations in people's TRIMs "temporary forgiveness," with people being temporarily more forgiving when their avoidance and revenge motivations were lower than would be expected on the basis of their initial status and trend forgiveness estimates. Of course, these residuals also contain measurement error, but insofar as the residuals are correlated with intraindividual differences in other psychological processes, the residuals themselves may reveal important insights about why people are more forgiving toward a transgressor on some occasions than they might be on others (McCullough et al., 2003). In light of McCullough et al.'s (2001) findings that people whose rumination decreases over time are the people who experience reductions in avoidance and revenge over time, it is important to discover whether people become temporarily more forgiving (i.e., temporarily less avoidant and less vengeful than would be expected on the basis of their initial status and trend forgiveness estimates) on occasions when they are also less ruminative about the transgression than is typical for them.

The difference between these two questions is subtle but not trivial. A conclusion generated from a between-persons research study (e.g., the conclusion that people who experience a reduction in rumination over a finite period of time also tend to experience reductions in revenge and avoidance motivation) cannot be generalized to within-persons relationships. That is, we cannot extrapolate to the conclusion that when a specific individual becomes less ruminative than is typical for him or her, that individual will also tend to become less avoidant and vengeful than is typical for him or her (Borsboom, Mellenbergh, & van Heerden, 2003). This is because the psychological processes of individuals that create between-persons covariation in two constructs (e.g., the finding that people who stop ruminating over time about a transgression are more likely to forgive the transgression than are people who do not stop ruminating over time) may not be the same psychological processes that generate within-persons covariation in the two constructs.

Fortunately, it is possible to evaluate whether a between-persons relationship between two variables obtains at the within-persons level, but to do so, one must use a research design that explicitly represents within-persons changes (Borsboom et al., 2003). An additional advantage to hypothesis tests that explicitly incorporate within-persons changes is that they permit investigators to evaluate how well a theoretically expected association (e.g., a negative association between rumination and forgiveness) generalizes across persons. In other words, it becomes possible to estimate the percentage of individuals within a population for whom an expected association obtains. Our longitudinal model of forgiveness

(McCullough et al., 2003), which decomposes forgiveness into between-persons components and within-persons components, is perfectly suited to addressing such issues. Thus, a major goal of the present article was to determine whether the previously established between-persons association of rumination and forgiveness obtains within persons also.

Anger and Fear: Two Possible Mediators of the Rumination–Forgiveness Relationship

Assuming that a rumination–forgiveness association did exist at the within-persons level, it would still be unclear what psychological mechanisms were responsible for this association. We think that rumination's ability to elicit negative emotions is one of the strongest candidates for a link by which rumination might be associated with forgiveness. Our thinking in this regard is influenced heavily by the CNA model linking negative affect and aggression (Berkowitz, 1990). The CNA model gives pride of place to negative emotion as a mediator of the link between rumination and aggressive responses (Berkowitz, 1990; Miller et al., 2003). Specifically, the CNA model posits that people ruminate about a transgression, which leads to negative affects like anger or fear that, in turn, activate other nodes in an aggression-relevant cognitive network. This proposition implies that negative emotions, such as anger and fear, may mediate the relationship between rumination and forgiveness.

However, forgiveness is often conceptualized not only as a cessation of vindictive, vengeful motivation (i.e., the sort that would seemingly be motivated by anger) but also as a reduction in the motivation to avoid contact with the offender (McCullough et al., 1998; 1997). In previous work, we assumed that a vengeful stance is associated with an angry, approach-related desire to harm one's transgressor in kind, whereas an avoidant stance is associated with a fearful desire to maintain a safe distance from the transgressor (McCullough et al., 1998, 1997). This latter motivation would seem less strongly linked to anger toward a transgressor and more strongly linked to fear of the transgressor.

If this is the case, then one should expect (a) that transient increases in rumination would be associated with increases in avoidance motivation only insofar as rumination led to transient increases in fear of the transgressor and (b) that transient increases in rumination would be associated with increases in revenge motivation only insofar as rumination led to transient increases in anger toward the transgressor (McCullough et al., 1998, 1997). Other investigators recently proposed a similar "matching hypotheses" regarding the relations among rumination, forgiveness, and affect (Berry, Worthington, O'Connor, et al., 2005), and it comports well with other evidence that anger is associated with approach motivation (Harmon-Jones, Vaughn-Scott, Mohr, Sigelman, & Harmon-Jones, 2004) and optimistic appraisals of risk, whereas fear leads to pessimistic appraisals of risk (Lerner & Keltner, 2000, 2001).

The Present Investigation

We conducted three studies to examine whether ruminating about a real-life transgression is associated with reduced forgiveness, operationalized as transient fluctuations in avoidance and revenge motivation (McCullough et al., 2003). To do so, we used multilevel

random coefficient models (Bryk & Raudenbush, 1992; Hedeker, 2004) to represent within-persons changes in people's TRIMs during the weeks following the interpersonal transgressions they incurred. We also examined whether within-persons fluctuations in fear and anger toward the transgressor could be considered mediators of the associations between rumination and forgiveness. In addition, we investigated the possible confounding effects of fluctuations in positive and negative affect and the potential moderating effects of trait positive and negative affectivity.

Study 1

Method

Participants

Participants were 89 students in undergraduate psychology courses (69 women, 20 men; M age = 20.44, SD = 3.09) at Southern Methodist University. All participants, who had incurred a transgression in the last 7 days (M = 4.66 days, SD = 1.86), received extra course credit for participating. Students who completed all five repeated assessments received \$10. Analyses of different aspects of this data set were reported in McCullough et al. (2003).

Measures

TRIMs. On up to five occasions, we measured participants' avoidance and revenge motivations toward their transgressors with McCullough et al.'s (1998) TRIM Inventory. For this measure, participants completed 5-point Likert-type scales to indicate how much they agreed or disagreed with items related to their current motivation to avoid and to seek revenge against their transgressors (e.g., "I avoid him/her"; "I'll make him/her pay"). These subscales had adequate internal consistency estimates (i.e., $\alpha \geq .85$ for all measurement occasions) and test-retest stability estimates (i.e., r s ranging from .41 to .90 across all measurement occasions). The TRIM Inventory has shown good convergent and discriminant validity (McCullough et al., 2001; McCullough et al., 2003; McCullough & Hoyt, 2002; McCullough et al., 1998).

Rumination. We measured rumination about the transgression with an eight-item scale that was inspired by the Intrusiveness subscale of the Impact of Event Scale (Horowitz, Wilner, & Alvarez, 1979). Participants rated on a 6-point scale ranging from 0 (*not at all true of me*) to 5 (*extremely true of me*) how much they had the following experiences in the last 24 hours: "I couldn't stop thinking about what he/she did to me"; "Thoughts and feelings about how he/she hurt me kept running through my head"; "Strong feelings about what this person did to me kept bubbling up"; "Images of the offense kept coming back to me"; "I brooded about how he/she hurt me"; "I found it difficult not to think about the hurt that he/she caused me"; "I found myself playing the offense over and over in my mind"; "Even when I was engaged in other tasks, I thought about how he/she hurt me." The linear combination of these eight items had high internal consistency ($\alpha \geq .94$ for all measurement occasions) and moderate test-retest stability (i.e., r s ranging from .24 to .82 across all five measurement occasions).¹

Anger and fear regarding the transgressor. Participants rated how much they felt *angry, mad, enraged, afraid, and fearful*

toward their transgressors on a 6-point scale ranging from 0 (*not at all*) to 5 (*extremely*). The means of these adjectives were used to measure anger and fear, respectively, toward transgressors. Internal consistency reliabilities ranged from $\alpha = .85$ to .95. Test-retest correlations ranged from .32 to .82 across the five measurement occasions.

Trait positive and negative affect. The Positive and Negative Affect Schedule (Watson, Clark, & Tellegen, 1988) was administered in the initial survey to measure positive and negative trait affectivity. The measure consists of 20 emotion words (e.g., *interested, distressed*) that participants rated on 5-point scales to indicate the degree to which they "generally feel this way; that is, how you feel on average" for each emotion. Internal consistency estimates for the Positive and Negative subscales were high (α s = .85 and .87, respectively).

Painfulness of the transgression. To indicate how painful they experienced the transgression to be upon enrollment, participants completed an item that read "How painful is the offense to you right now?" to which they responded using a 7-point Likert-type scale ranging from 0 (*not very painful at all*) to 6 (*worst pain I ever felt*).

Procedure

We announced in several undergraduate psychology courses our interest in surveying people who had incurred a serious interpersonal hurt within the previous 7 days. Throughout the semester, we revisited these courses to enroll qualified participants and supply them with initial packets that included the measures described above. After they completed the initial survey, we tried to collect follow-up data on four other occasions by contacting them in class via announcements at the end of professors' lectures. These follow-up sessions were spaced roughly 2 weeks apart. Thus, for every participant, we aimed to collect data 1, 3, 5, 7, and 9 weeks after the transgression. Of our 89 participants, 43 provided data for five time points, 8 for four time points, 11 for three time points, 14 for two time points, and 13 for only one time point. Thus, about 28% of the data were missing. This rate of missingness is not considered too problematic because maximum likelihood estimation is used in hierarchical linear modeling (HLM) to yield fixed and random effects that remain unbiased by missing data if the

¹ To confirm that the Rumination scale was distinct from the measures of avoidance and revenge motivation, we conducted a maximum likelihood factor analysis on the 12 TRIM items and the eight rumination items using data from the first assessment for participants in Study 1 and Study 2. We used oblimin rotation ($\Delta = 0$). Three clear factors emerged after five iterations. The first factor, accounting for 30.6% of total item variance, consisted of the seven TRIM-Avoidance subscale items with pattern loadings $> .5$. The second factor, accounting for 21.7% of the total item variance, consisted of the eight Rumination scale items with pattern loadings $> .69$. The third factor, accounting for 9.6% of the variance, consisted of the five TRIM-Revenge subscale items with pattern loadings $> .5$. None of the items loaded on their nontarget factors with pattern loadings of .3 or greater. The TRIM-Avoidance factor was correlated with the TRIM-Revenge and Rumination factors at $r(187) = .43$ and .16, respectively. The TRIM-Revenge factor was correlated with the Rumination factor at $r(N = 189) = .12$.

data can be assumed to be missing at random (Raudenbush & Bryk, 2002; Schafer & Graham, 2002).²

Statistical Models and Analyses

Within-persons models. Because our data conformed to a two-level hierarchical structure (repeated measures nested within individuals), we ran two-level models with the HLM 6.2 statistical software package (Raudenbush, Bryk, Cheong, & Congdon, 2000). HLM is especially useful for this application because it accommodates repeated measures designs with missing data. This program enabled us to conduct longitudinal analyses that simultaneously fit within-person models and between-person models that can account for individual differences in the parameters of the within-person models. The within-persons (or Level 1) models were of the form:

$$TRIM_{ij} = \beta_{0j} + \beta_{1j}(Time)_{ij} + \beta_{2j}(Rumination)_{ij} + r_{ij} \quad (2)$$

where $TRIM_{ij}$ = Person j 's score on one of the TRIMs (i.e., avoidance or revenge motivation) at Time i ; β_{0j} = Person j 's initial status on the TRIM when the time scale is set to zero; $\beta_{1j}(Time)$ = the rate of change in the TRIM scores as a linear function of time (i.e., number of weeks to the nearest 1/7th of a week since each individual's transgression occurred); and $\beta_{2j}(Rumination)$ = the extent to which fluctuations above and below the regression line in Person j 's TRIMs—based on their initial status and degree of linear change (trend forgiveness)—are associated with within-person fluctuations in Person j 's rumination about the transgression.

The r_{ij} represents the residual in the observed TRIM score that cannot be accounted for by the initial status, linear change, and rumination parameters. In other words, r_{ij} in Equation 2 represents the residual in $TRIM_{ij}$ after controlling for intraindividual variability in rumination, whereas the r_{ij} in Equation 1 represents the residual in $TRIM_{ij}$ before controlling for intraindividual variability in rumination. By decomposing individuals' instantaneous TRIM scores into components representing initial status and linear change, the coefficient for rumination (with scores centered around each person's mean) represents the association between fluctuations in people's TRIMs (above and below the values we would expect on the basis of their initial status and linear change parameters) and fluctuations in how much they ruminated about the transgression. In other words, by interpreting the coefficients for rumination derived from these within-person models, one can evaluate whether people tend to be more avoidant or vengeful, respectively, toward their transgressors on occasions when they are more ruminative toward their transgressors than would be expected on the basis of (a) how avoidant or vengeful, respectively, they were immediately after the transgression occurred and (b) how much their avoidance (or revenge) motivation changed as a linear function of time during the measured interval. Controlling for initial levels and rates of linear change in this fashion enabled us to control for similarities in initial status and rates of linear change in the predictor and outcome variables when we evaluated the within-persons hypotheses (McCullough et al., 2003).³

Between-persons models. The between-persons (or Level 2) models accounted for individual differences in the Level 1 β coefficients (i.e., initial status, linear change, and the within-person association of rumination and the outcome variable). To control

individual differences in perceived transgression painfulness and trait positive and negative affectivity, the between-persons equations that modeled these interindividual differences included covariates for these variables (centered around their grand means). The between-person equations were of the form:

$$\beta_{0j} = \gamma_{00} + \gamma_{01}(Painful)_j + \gamma_{02}(Trait\ Neg\ Affect)_j + \gamma_{03}(Trait\ Pos\ Affect)_j + u_{0j} \quad (3)$$

$$\beta_{1j} = \gamma_{10} + \gamma_{11}(Painful)_j + \gamma_{12}(Trait\ Neg\ Affect)_j + \gamma_{13}(Trait\ Pos\ Affect)_j + u_{1j} \quad (4)$$

$$\beta_{2j} = \gamma_{20} + \gamma_{21}(Painful)_j + \gamma_{22}(Trait\ Neg\ Affect)_j + \gamma_{23}(Trait\ Pos\ Affect)_j + u_{2j} \quad (5)$$

By evaluating the significance of the effects of trait negative affect and trait positive affect upon the β_{2j} parameters, we were able to evaluate whether the strength of the within-persons association between rumination and the two TRIM variables differed as a function of trait positive and trait negative affect.

Mediational analyses. According to Baron and Kenny (1986), to examine whether a variable, such as anger or fear toward a transgressor, mediates the rumination–forgiveness association, several conditions must be evaluated. First, the predictor variable (in this case, rumination) must be associated with both (a) the outcome variable (i.e., avoidance or revenge motivation) and (b) the presumed mediator variable (i.e., fear of or anger toward the transgression) in bivariate regressions. Second, the presumed mediator must maintain its significant association with the outcome variable when the outcome variable is regressed simultaneously on the predictor and the presumed mediator. These conditions can be evaluated jointly with Sobel's (1982) test for mediation.

Krull and MacKinnon (2001) showed that these criteria can be used for testing mediation in multilevel models as well. The

² "Missing at random" is a surprisingly complex concept. Within the context of this study, missingness at random occurs when missingness for a given variable y on a given measurement occasion i is not uniquely related to the unobserved measurements of y on occasion i , even though missingness can be related to other variables that are included in the model. In other words, as long as the missing values of y on occasion i are not unique predictors of missingness for y on occasion i after controlling for observed values of y from previous time points or other predictors in the model (e.g., other within-subjects or between-subjects covariates), then the missingness is ignorable under maximum likelihood estimation, which will yield unbiased parameter estimates and standard errors (Schafer & Graham, 2002). Moreover, Collins, Schafer, and Kam (2001) recently demonstrated that in a variety of realistic missingness scenarios, the persistence of a unique relationship between scores on y and missingness on y can have a rather minor impact on parameter estimates and their standard errors.

³ We controlled for initial status and linear change in these models and equivalent models in Studies 2 and 3 because multivariate models that we ran with these data (Raudenbush, Brennan, & Barnett, 1995) indicated that linear changes in rumination were correlated with linear changes in avoidance and revenge ($r_s [N = 89] = .65$ and $.19$, respectively, in Study 1; $r_s [N = 115] = .87$ and $.87$, respectively, in Study 2; and $r_s [N = 162] = .39$ and $.59$, respectively, in Study 3). These findings show that people who experienced reductions in rumination tended also to experience reductions in avoidance and revenge motivation, or trend forgiveness. This replicates previous findings from McCullough et al., 2001.

Table 1
Means and Standard Deviations for Major Variables in Studies 1–2

Measure	Time 1		Time 2		Time 3		Time 4		Time 5	
	<i>M</i>	<i>SD</i>								
Study 1										
Avoidance	2.57	1.10	2.46	1.09	2.39	1.05	2.32	1.12	2.46	1.12
Revenge	1.84	0.85	1.71	0.91	1.65	0.75	1.57	0.69	1.55	0.73
Rumination	3.18	1.14	1.71	1.57	1.19	1.39	0.97	1.29	0.80	1.25
Study 2										
Avoidance	3.11	1.08	2.96	1.10	2.82	1.13	2.74	1.10	2.70	1.15
Revenge	1.83	0.83	1.61	0.80	1.53	0.77	1.52	0.79	1.48	0.87
Rumination	3.55	0.96	2.01	1.21	1.24	1.13	0.90	1.00	0.80	1.05

within-person equations for evaluating simultaneously the association of anger or fear (the presumed mediators) and rumination (the predictor variable) with the TRIM variables (the outcomes) were of the form:

$$TRIM_{ij} = \beta_{0j} + \beta_{1j}(Time)_{1j} + \beta_{2j}(Rumination)_{ij} + \beta_{3j}(Anger)_{ij} + r_{ij} \quad (6)$$

and we again included between-persons equations as in Equations 3–5 above.

Results

Descriptive Statistics

As described in McCullough et al. (2003; Study 2), the types of relationship partners who had committed transgressions against our participants were diverse. Most transgressions were committed by girlfriends or boyfriends (42%), friends of the same gender (23%), and friends of the other gender (15%). Smaller numbers reported on transgressions by relatives (10%), husbands and wives (3%), and “others” (8%). Participants described several types of transgressions, including betrayals of a confidence or insults by a friend (36%); neglect by a romantic partner, spouse, or ex-romantic partner (25%); infidelity by a romantic partner or spouse (13%); rejection, neglect, or insult by a family member (10%); termination of romantic relationship (7%); insults by people other than family or friends (3%); and rejection or abandonment by friend or prospective relationship partner (3%). Two participants declined to describe the specific transgression. Mean level of pain reported by participants was 3.81 (*SD* = 1.39). Means and standard deviations for the major variables in Study 1 appear in Table 1.

Fluctuations in Rumination as Predictors of Temporary Forgiveness

We first examined whether people are temporarily more forgiving (i.e., whether they have less avoidance and revenge motivation than would be expected on the basis of their initial status and linear change estimates) when they are less ruminative about the transgression than is typical for them, per Equation 2. Table 2 lists

statistics associated with the parameter estimates of initial status and linear change (trend forgiveness) in avoidance and revenge as well as the average within-persons association of rumination and each of the TRIMs.

Table 2 shows that the average participant had an initial status of 2.46 and a linear change of (essentially) zero units per week on the avoidance metric, and an initial status of 1.79 and a linear decrease of .02 units per week on the revenge metric. For the average person, every one-unit increase in rumination (above his or her mean) was associated with a .16-unit increase in avoidance. Similarly, every one-unit increase in rumination above the average person's typical degree of rumination was associated with a .07 increase in revenge. Therefore, rumination covaried considerably and uniquely with people's TRIMs, effect size $r_s(85) = .39$ and .29 for the avoidance and revenge coefficients, respectively (Hunter & Schmidt, 1990). On occasions when people reported more rumination about their transgression than was typical for them, they also reported higher levels of avoidance and revenge motivations than would have been expected on the basis of their initial status and linear change (trend forgiveness) estimates. In other words, on days when people ruminated more about the transgression than was typical for them, they also tended to be less forgiving.⁴

The standard deviations for the within-persons associations of rumination with avoidance and revenge motivation, respectively, were 0.24 and 0.02, respectively. By dividing the coefficients for the associations of rumination with avoidance and revenge motivation by their standard deviations, we can determine the percentage of individuals in the population who would be expected to have positive associations of rumination with avoidance and revenge motivation. In the case of the rumination–avoidance association, people who scored more than $.16/.24 = .67$ standard deviations below the mean would be expected to have rumination–avoidance associations that were not positive. In other words, about 75% of the population would be expected to have positive within-persons associations of rumination and avoidance. In the case of the rumination–revenge association, people who scored

⁴ Gender differences in the within-persons associations of rumination with avoidance and revenge motivation were consistently nonsignificant.

Table 2
Parameter Estimates for Linear Models of Longitudinal Change in TRIMs in Studies 1–2

Measure (Parameter)	<i>M</i>	<i>SD</i>	<i>SE</i>	<i>t</i>	% VAF ^a	χ^2 (1, <i>N</i> = 50)
Study 1						
Avoidance						
Initial status	2.46	1.03	.12		80.95	275.83***
Linear change (forgiveness)	0.00	0.10	.02	0.03	0.02	128.18***
Rumination	0.16	0.24	.04	3.98**	4.34	99.37**
Revenge						
Initial status	1.79	0.80	.09		79.82	238.47***
Linear change (forgiveness)	-0.02	0.07	.01	-2.08*	0.01	107.18***
Rumination	0.07	0.02	.03	2.78**	0.05	57.89
Study 2						
Avoidance						
Initial status	2.96	1.09	.12		82.64	360.21***
Linear change (forgiveness)	-0.02	0.11	.02	-0.97	0.90	186.27***
Rumination	0.12	0.26	.04	2.84**	4.72	177.49***
Revenge						
Initial status	1.61	0.65	.07		79.30	292.04***
Linear change (forgiveness)	0.00	0.06	.01	0.20	0.67	156.46**
Rumination	0.14	0.13	.02	5.44***	3.19	131.00*

Note. All models included Level 2 covariates representing perceived transgression painfulness, trait positive affect, and trait negative affect, all centered around their grand means (coefficients not shown). TRIMs = transgression-related interpersonal motivations; VAF = variance accounted for.

^a % VAF = percentage of variance accounted for by the initial status, linear change, and rumination parameters.

* $p < .05$. ** $p < .01$. *** $p < .001$.

more than $.07/.02 = 3.5$ standard deviations below the mean would be expected to have rumination–avoidance associations that were not positive. In other words, more than 99% of the population would be expected to have positive within-persons associations of rumination and revenge.

The values in the “%VAF” (% variance accounted for) column of Table 2 indicate that the initial status, trend forgiveness, and rumination parameters did a good job of accounting for variance in people’s avoidance and revenge scores (i.e., 85.31% and 79.88% of the variance, respectively).

Is the Within-Persons Association of Rumination and Temporary Forgiveness Moderated by Trait Positive or Negative Affectivity?

We proceeded to examine whether individual differences in the association of rumination with temporary forgiveness were moderated by individual differences in positive and negative affectivity, per Equation 5. Neither trait positive affectivity nor trait negative affectivity appeared to moderate the associations of rumination with revenge and avoidance ($ps > .10$).

Is the Association of Rumination and Forgiveness Mediated by Anger or Fear Toward the Transgressor?

Because fluctuations in rumination were associated with temporary forgiveness, we then examined whether people also experienced changes in anger and/or fear vis à vis the transgressor when they ruminated about the transgression more than was typical for them and, if so, whether those emotional changes appeared to mediate the associations of rumination and temporary forgiveness.

The first two columns of data in Table 3, labeled $\beta(yx)$ and $\beta(mx)$, contain the coefficients resulting from regressing the presumed outcomes y (i.e., avoidance or revenge motivation) and the presumed mediators m (i.e., fear of and anger toward the transgressor) upon the predictor variable x (i.e., rumination). These coefficients show that rumination was significantly related to the presumed outcome variables (avoidance and revenge) as well as the presumed mediators (fear of and anger toward the transgressor). The third column of data, labeled $\beta(ym.x)$ demonstrates that when anger was used as a potential mediator, it maintained a significant association with the TRIM variables, with rumination simultaneously controlled. The same was not the case when fear was used as a potential mediator. The coefficients in the column of data labeled $\beta(yx.m)$, which displays the associations of the predictor x (rumination) with the presumed outcomes y (i.e., avoidance or revenge motivation) with the presumed mediator m (fear or anger) simultaneously controlled, were nonsignificant when anger was examined as a potential mediator. These results are consistent with the hypothesis that anger (but not fear) toward the transgressor functioned as a mediator of the associations of rumination with avoidance and revenge. The Sobel tests, whose t values appear in Table 3, also support this interpretation.

The traditional Sobel test for mediation ignores the so-called ab covariance (Kenny, Korchmaros, & Bolger, 2003), which is covariance between the random effects for the association of the predictor with the mediator (the a path) and the random effects for the unique association of the mediator with the outcome while controlling for the direct effect of the predictor (the b path). Failure to consider this ab covariance when testing mediational hypotheses in multilevel models can lead to underestimates or overestimates of mediated effects. Using Korchmaros and Kenny’s (2003)

Table 3
Mediational Analyses for Rumination–TRIM Associations in Studies 1–3^a

Variable	$\beta(yx)$	$\beta(mx)$	$\beta(y_{m.x})$	$\beta(y_{x.m})$	Sobel's <i>t</i>
Study 1					
x-m-y ^b					
Rum-Anger-Avo	0.16**	0.47***	0.33***	−0.00	5.22***
Rum-Fear-Avo	0.16**	0.20**	0.02	0.14**	0.43
Rum-Anger-Rev	0.07*	0.47***	0.20***	−0.02	4.06***
Rum-Fear-Rev	0.07*	0.20**	0.06	0.07*	1.66
Study 2					
x-m-y					
Rum-Anger-Avo	0.12**	0.46***	0.24***	0.01	5.41***
Rum-Fear-Avo	0.12**	0.23***	−0.00	0.12*	0.07
Rum-Anger-Rev	0.14***	0.46***	0.11***	0.08**	3.93***
Rum-Fear-Rev	0.14***	0.23***	−0.02	0.12***	0.49
Study 3 ^c					
x-m-y					
Rum-Anger-Avo	0.03*	0.13**	0.13***	0.02	3.99***
Rum-Fear-Avo ^d	0.03*	0.01			
Rum-Anger-Rev	0.03*	0.13***	0.12***	0.01	3.89***
Rum-Fear-Rev ^d	0.03*	0.02			

Note. In the regressions for Study 3, scores on Day *i* − 1 for anger, fear, and the TRIM (transgression-related interpersonal motivation) being modeled as a dependent variable are statistically controlled. Rum = Rumination; Avo = Avoidance; Rev = Revenge.

^a All models included Level 2 covariates representing perceived transgression painfulness, trait positive affectivity, and trait negative affectivity, all centered around the grand means (coefficients not shown). ^b *x* = presumed predictor variable; *m* = presumed mediator variable; *y* = presumed outcome variable. ^c Study 3 coefficients reflect mediational analyses involving rumination on Day *i* − 1 as the *x* variable and anger, fear, avoidance motivation, and revenge motivation on Day *i* as the presumed mediator and outcome variables.

^d Missing cells indicate that mediational analyses were not performed because the preliminary conditions for assessing mediation were not fulfilled.

* $p < .05$. ** $p < .01$. *** $p < .001$.

approach for incorporating the *ab* covariance, we calculated the percentage of the association of rumination on avoidance that appeared to be mediated by anger (100%) and fear (2.71%), respectively, and the percentage of the association of rumination and revenge that appeared to be mediated by anger (100%) and fear (14.70%), respectively. (Because of sampling error, estimates can exceed 100% or fall below 0%. Here and elsewhere in the present article, we constrain these estimates to their upper bounds of 100% and lower bounds of 0%.)

Summary of Study 1

Study 1 revealed that rumination was negatively associated with temporary forgiveness (transient fluctuations in people's avoidance and revenge motivations). When people were more ruminative than was typical for them, they also tended to be more avoidant and vengeful toward their transgressors than was typical for them. These associations obtained even though we controlled for initial perceptions of transgression painfulness as well as trait positive and negative affectivity, and there was no evidence that these person-level variables moderated the within-persons associations of rumination with avoidance and revenge motivation. Mediational analyses were consistent with the idea that the associations of rumination with avoidance and revenge motivation were mediated by anger toward the transgressor.

To examine the rumination–forgiveness association with greater statistical power and control, we conducted a second study. In Study 2, we examined whether the associations of transient fluctuations in rumination were associated with temporary forgiveness while simultaneously controlling for transient fluctuations in positive and negative mood. Rumination and negative affect are dependably related (Mor & Winquist, 2002), so people may engage in more rumination when they are in negative moods. Insofar as negative mood states are associated with more rumination and less forgiveness, any apparent correlation between rumination and forgiveness might be spurious. Therefore, it is prudent to rule out the possibility that the rumination–forgiveness relationship is a byproduct of intraindividual fluctuations in positive and negative mood. Moreover, Berkowitz (1990) suggested that it was negative affect generally, rather than any specific negative affect such as anger or fear, that elicits aggressive responding, so in the context of forgiveness, it is useful to examine its associations with discrete affects such as anger or fear while controlling for negative affect more generally.

Study 2

Method

Participants and Procedure

Participants were 115 students in undergraduate psychology courses (91 women, 24 men; *M* age = 19.76, *SD* = 2.61) at

Southern Methodist University. As in Study 1, all participants had incurred a transgression within the last 7 days ($M = 4.04$ days, $SD = 1.82$); they received extra course credit for participating and \$10 for completing all five assessments. Other analyses based on this data set are reported in McCullough, Orsulak, Brandon, and Akers (2007). We used the same procedure as in Study 1, except that the five measurement occasions were spaced approximately 2 weeks apart (on the same day of the week and time of day), and they occurred in Michael E. McCullough's laboratory. Of the 115 participants, 96 completed all five visits, 5 completed 4 visits, 5 completed 3 visits, 5 completed 2 visits, and 4 completed only one visit. With only 8% missing data, attrition was much lower than in Study 1.

Measures

We used the same instruments as in Study 1 to measure people's TRIMs, rumination, fear and anger toward the transgressor, trait positive and negative affect, and painfulness of the transgression. All of the measures had comparable internal consistency and test-retest reliability estimates as in Study 1. In addition, we measured the moodlike manifestations of positive and negative affect by having participants also complete the PANAS on repeated occasions. On this form of the PANAS, participants were instructed to indicate how much they experienced 20 different emotions "in the last two weeks." Internal consistency and test-retest stability estimates across all measurement occasions were acceptable (i.e., α s ranged from .85 to .95, and r s ranged from .54 to .93).

Statistical Models and Data Analyses

We used the same statistical modeling approach as in Study 1. That is, we decomposed people's five repeated TRIM scores into a within-person model, with parameters representing initial levels of the variable, trend forgiveness, rumination (with values centered around each person's mean), and residual variance, per Equation 2. We simultaneously included between-persons covariates representing perceived transgression painfulness and trait positive and negative affectivity, per Equations 3–5.

To determine whether temporal fluctuations in positive and negative mood could account for the association of fluctuations in rumination with temporary forgiveness, we ran HLMs, with positive and negative state affect included as time-varying predictors of the TRIMs. Because we only had a maximum of five observations per individual, degrees of freedom within persons were inadequate for introducing positive mood and negative mood as simultaneous predictors, so we had to evaluate their associations with the outcome variables in separate models. This resulted in two new Level 1 equations:

$$TRIM_{ij} = \beta_{0j} + \beta_{1j}(Time)_{ij} + \beta_{2j}(Positive\ mood)_{ij} + \beta_{3j}(Rumination)_{ij} + r_{ij} \quad (7)$$

$$TRIM_{ij} = \beta_{0j} + \beta_{1j}(Time)_{ij} + \beta_{2j}(Negative\ mood)_{ij} + \beta_{3j}(Rumination)_{ij} + r_{ij} \quad (8)$$

As in Study 1, we controlled for perceived transgression painfulness and positive and negative trait affectivity by including these variables in the between-persons equations, per Equations 3–5.

To evaluate whether anger or fear toward the transgressor mediated the links between rumination and temporary forgiveness, we conducted mediational analyses, as in Study 1. To do so, we tested within-person models in the form of Equation 6.

Results

Descriptive Statistics

As in Study 1, most participants described transgressions committed by girlfriends or boyfriends (59%), friends of the same gender (19%), or friends of the other gender (11%). A few participants reported transgressions by relatives (10%), husbands or wives (3%), and "others" (9%). One person did not report the type of relationship involved. Participants experienced insults by a friend or betrayals of a confidence (28%); neglect by a romantic partner, spouse, or ex-romantic partner (22%); infidelity by a romantic partner or spouse (19%); rejection, neglect, or insult by a family member (10%); termination of romantic relationship (11%); insults by people other than family or friends (3%); and rejection or abandonment by a friend or prospective relationship partner (2%). Five participants did not describe the transgression. Participants in Study 2 reported that their transgressions were more painful ($M = 4.78$, $SD = 0.81$) compared with participants in Study 1 ($M = 3.81$, $SD = 1.39$). Table 1 displays the means and standard deviations for the major variables in Study 2.

Fluctuations in Rumination as Determinants of Temporary Forgiveness

To replicate Study 1's finding that people are temporarily more forgiving when they ruminate about the transgression less than is typical for them, we examined the within-persons associations of rumination with TRIM-avoidance and TRIM-revenge scores. Table 2 displays the statistics associated with the parameter estimates for initial status and linear change in the TRIMs and for time-varying fluctuations in rumination.

As in Study 1, time-varying fluctuations in rumination covaried significantly and uniquely with avoidance and revenge motivation. On occasions when people ruminated more about the transgression than was typical for them, they also tended to have higher levels of avoidance and revenge motivation than would have been expected on the basis of their initial status and linear change (trend forgiveness) parameter estimates over the measured interval, effect size $r_s(111) = .26$ and $.46$ for the avoidance and revenge coefficients, respectively.

The standard deviations for the within-persons associations of rumination with avoidance and revenge motivation, respectively, were 0.26 and 0.13, respectively. By dividing the coefficients by their standard deviations, we can determine the percentage of individuals in the population who would be expected to have positive associations of rumination with avoidance and revenge motivation. In the case of the rumination-avoidance association, people who scored more than $.12/.26 = .46$ standard deviations below the mean would be expected to have rumination-avoidance associations that were not positive. In other words, about 68% of the population would be expected to have positive within-persons associations of rumination and avoidance. In the case of the rumination-revenge association, people who scored more than

.14/.13 = 1.08 standard deviations below the mean would be expected to have rumination–avoidance associations that were not positive. In other words, about 86% of the population would be expected to have positive within-persons associations of rumination and revenge.

The values in the “%VAF” column of Table 2 indicate that the initial status, trend forgiveness, and rumination parameters accounted for most of the variance in people’s avoidance and revenge scores (i.e., 88.26% and 83.16%).

Is the Association of Rumination With Temporary Forgiveness Moderated by Trait Affectivity?

As in Study 1, neither trait positive affect nor trait negative affect significantly moderated the within-persons associations of rumination and TRIM-avoidance and TRIM-revenge scores in Study 2 ($p > .15$).

Is the Association of Rumination With Temporary Forgiveness Confounded by Mood?

To examine whether the associations of day-to-day fluctuations in rumination with temporary forgiveness could be attributed to fluctuations in positive and negative mood (i.e., whether rumination’s negative association with temporary forgiveness could be explained by the fact that people who were in bad moods were both more ruminative and less forgiving), we examined the within-persons associations of rumination with avoidance and revenge motivation while controlling for within-persons fluctuations in positive and negative mood, per Equations 7–8.

Fluctuations in positive mood and negative mood were not significantly associated with fluctuations in avoidance and revenge motivation. As expected, therefore, the within-persons associations of rumination with avoidance and revenge motivation, respectively, while controlling for positive mood were 0.13, $t(111) = 2.85$, $p < .01$ (effect size $r = .26$), and 0.14, $t(111) = 5.72$, $p < .001$ (effect size $r = .47$). Thus, controlling for state positive affect did not change the within-persons associations of rumination with avoidance and revenge motivation.

When simultaneously controlling for negative mood, rumination maintained its unique significant associations with avoidance and revenge motivation. The coefficients for the associations of rumination with avoidance and revenge, respectively, while controlling for negative mood were 0.13, $t(111) = 2.96$, $p < .01$ (effect size $r = .27$), and 0.11, $t(111) = 4.70$, $p < .001$ (effect size $r = .40$). Therefore, the within-persons association of rumination with avoidance and revenge motivation could not be attributed to the influence of negative mood.

Is the Association of Rumination and Forgiveness Mediated by Anger or Fear Toward the Transgressor?

As in Study 1, we proceeded to examine whether people also experienced changes in anger and/or fear vis à vis the transgressor on occasions when they ruminated about the transgression more than was typical for them and, if so, whether those emotional changes appeared to mediate the associations between rumination and temporary forgiveness.

The first two columns of data in the second part of Table 3, labeled $\beta(yx)$ and $\beta(mx)$, contain the coefficients that resulted from regressing the outcomes y (i.e., avoidance and revenge motivation) and presumed mediators m (i.e., fear and anger) upon the predictor variable x (i.e., rumination). These coefficients demonstrate that rumination was significantly related to the presumed outcome variables (avoidance and revenge) as well as the presumed mediators (fear of and anger toward the transgressor). The third column of coefficients, labeled $\beta(ym.x)$, shows that anger toward the transgressor (m) maintained a significant association with the TRIM variables (y), with rumination (x) simultaneously controlled. This is consistent with the proposition that anger mediated the association of rumination with avoidance and revenge motivation. The same was not true when we examined fear as a potential mediator of the rumination–TRIM relationships: Because the coefficients in the third column were not significant when fear was the presumed mediator, we can conclude that fear did not mediate the associations of rumination with avoidance and revenge motivation. The coefficients in the column of data labeled $\beta(yx.m)$, demonstrating the unique relationships between the outcomes y (avoidance and revenge motivation) and the predictor x (rumination) when controlling for the presumed mediators m (i.e., avoidance and fear motivation), were nonsignificant when anger was the mediator. The Sobel tests, whose t values appear in Table 3, also support the conclusion that anger (but not fear) toward the transgressor mediated the associations of rumination with avoidance and revenge.

Kenny et al. (2003) wrote that incorporating the ab covariance for multilevel mediational models is only necessary when the random effects variance for the a path (i.e., the coefficient representing the regression of the putative mediator on the putative x variable) and the random effects variance for the b path (i.e., the coefficient representing the association of the outcome variable y with the putative mediator variable when then putative x variable is simultaneously controlled) are significantly different from zero. These conditions were not fulfilled in our data—that is, for all mediational models, the a path, the b path, or both lacked significant random effects variance—so Kenny et al.’s calculations were not necessary to accurately estimate mediation. Using the traditional approach to estimating the percentage of an association of a relation between two variables that can be explained by a putative mediator (i.e., multiplying the a path and the b path, and dividing their product by the total association of the predictor and the outcome variable), we calculated the percentage of the association of rumination on avoidance that appeared to be mediated by anger (90.0%) and fear (0%), respectively, and the percentage of the association of rumination and revenge that appeared to be mediated by anger (37.4%) and fear (0%), respectively.

Summary of Study 2

Study 2 replicated the main findings from Study 1 with better statistical power and control. On occasions when people ruminated to a greater extent than was typical for them about the transgressions they had incurred, they also tended to have higher levels of avoidance and revenge motivation than was typical for them. These associations between temporal fluctuations in rumination and “temporary forgiveness” were not moderated by perceived painfulness of the transgression, trait positive affect, or trait neg-

ative affect. These associations were also independent of positive and negative mood. In addition, we found that when people ruminated more about a transgression than was typical for them, they also tended to experience transient increases in anger toward their transgressors, and these increases in anger appeared to mediate the within-persons associations of rumination with avoidance and revenge motivation.

The results of Studies 1 and 2 merely document that rumination is correlated within measurement occasions with higher levels of anger, avoidance motivation, and revenge motivation. Causal conclusions are certainly not justifiable on the basis of such findings. However, when the number of observations per person provides adequate degrees of freedom, it becomes possible to specify more rigorous models that enable one to evaluate whether rumination on a given day is associated with avoidance and revenge motivation on the next day, even after controlling for previous levels of avoidance and revenge motivation. Establishing that changes in a putative x variable (e.g., rumination) precede changes in a putative y variable (i.e., forgiveness) would provide stronger (although by no means definitive) support for the proposition that the rumination–forgiveness association is a causal one (Finkel, 1995; West & Hepworth, 1991). Therefore, we conducted a third study using data from a 21-day diary study that allowed us to evaluate the temporal nature of the relations among our variables.

Study 3

Method

Participants and Procedure

Participants were 163 students in undergraduate psychology courses (112 women, 51 men) at the University of Miami. As in Studies 1 and 2, all participants had incurred a transgression within the last 7 days ($M = 4.37$ days, $SD = 1.85$) at the time of enrollment. They received extra course credit for participating and, if they completed the tasks described here and a separate laboratory session not described here, \$20.

As in Studies 1 and 2, participants were recruited via their undergraduate psychology courses. Throughout the semester, we visited these courses, enrolled qualified participants in the study, and provided them with initial screening packets. After they completed the initial survey, we gave them a packet of 21 questionnaires; participants were to complete one questionnaire per day. We instructed participants to complete each entry honestly and advised them that it was better to leave a day's entry blank than to falsify their responses. In addition, we contacted participants periodically during the 21-day diary period to encourage compliance and timely completion of their diary entries. Participants dated each entry and returned the packets to Michael E. McCullough's laboratory approximately 21 days after beginning the study. As the histogram in Figure 2 shows, completion rates were very high, with 109 participants (66.9%) completing 21 diary entries, and only 9 participants (5.5%) failing to complete at least 10 diary entries.⁵

Measures

We used the same instruments as in Studies 1 and 2 to measure people's TRIMs, rumination, fear and anger toward their trans-

gressions, trait positive and negative affect, and painfulness of the transgression (the only difference being that participants were asked to report on their daily experience for all measures because the measures were administered daily). All of the measures' reliabilities were comparable to those in Studies 1 and 2.

Statistical Models and Data Analyses

The goal of Study 3 was to evaluate whether ruminating about a transgression on a given day predicts one's avoidance and revenge motivation on the successive day. In other words, we wished to determine whether the extent to which a person was ruminating about a transgression on any given day (while controlling for their revenge or avoidance motivations on that day, as well as their fear and anger toward the transgressor on that day) was associated with their revenge and avoidance motivations toward the transgressor on the next day. Insofar as this turned out to be the case, we wanted to determine whether the prospective association of rumination with the TRIM scores could be explained by the fact that ruminating on a given day, even after controlling for anger toward or fear of the transgressor on that day, was associated with participants' anger toward or fear of their transgressor on the next day (Cole & Maxwell, 2003; West & Hepworth, 1991). Therefore, we estimated two sets (one set for avoidance motivation and one for revenge motivation) of two-level regression models of the form:

$$TRIM_{ij} = \beta_0j + \beta_1j(Time)_{ij} + \beta_2j(TRIM)_{i-1,j} + \beta_3j(Rumination)_{i-1,j} + \beta_4j(Anger)_{i-1,j} + \beta_5j(Fear)_{i-1,j} + r_{ij} \quad (9)$$

In Equation 9, Person j 's TRIM score on Day i is modeled as a function of Person j 's intercept (i.e., expected TRIM score when other predictors obtain a value of 0), a linear function of time for Person j , and Person j 's TRIM rumination, anger, and fear scores from the previous day (thus the use of the subscript $i-1, j$). To evaluate the hypothesis that increases in rumination precede reductions in forgiveness, we evaluated the statistical significance of the β_{3j} coefficient for rumination. To examine whether anger toward or fear of the transgressor on a given day was associated uniquely with rumination on the previous day, we estimated models in the form of Equation 9, but which used anger and fear vis à vis the transgressor on Day i for Person j as the criterion variables.

In two final models, we evaluated whether the association of the previous day's rumination with the TRIM variables on any given day could be explained by the effects of the previous day's rumination on the given day's levels of anger or fear toward the

⁵ A reviewer pointed out Stone, Shiffman, Schwartz, Broderick, and Hufford's (2003) findings that medical patients often complete their diary entries in an untimely fashion (e.g., completing entries hours or days later than they were supposed to). We had no way of checking whether participants did so in Study 3, but because we made it clear to our participants that we preferred for them to omit missed entries rather than to fake them (and because course credit and financial incentives were not contingent upon completion of all entries), it seems rather unlikely that such confabulation was very prevalent. Nevertheless, we acknowledge that other steps could have been taken to maximize compliance and timely completion of diary entries, particularly in Study 3 (Green, Rafaeli, Bolger, Shrout, & Reis, 2006).

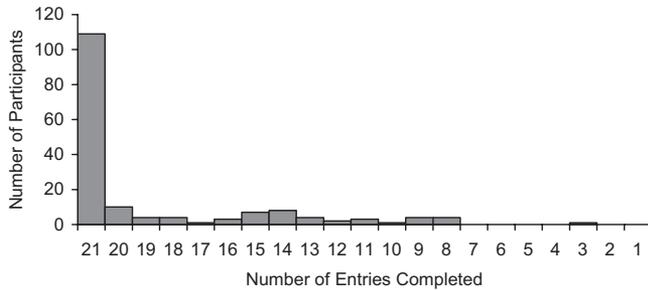


Figure 2. Daily questionnaire completion rates for participants in Study 3 ($N = 163$).

transgressor. To do so, we estimated models in the form of Equation 9 with one more predictor variable, which was Person j 's anger toward or fear of the transgressor, respectively, on Day i . These analyses allowed us to evaluate whether (a) rumination was associated with reduced forgiveness on the next day, (b) rumination was associated with increased anger or fear of the transgressor on the next day, and (c) insofar as (a) and (b) were true, whether the lagged association of rumination and forgiveness could be explained in terms of an intermediate association of rumination with anger or fear regarding the transgressor. As in Studies 1 and 2, each of the Level 1 β coefficients was modeled at Level 2 as a function of a grand mean, a person-specific residual, trait positive affectivity, trait negative affectivity, and perceived transgression painfulness so that we could examine the latter as possible moderator variables.

Through a series of analogous models, we also evaluated whether avoidance and revenge on a given day were uniquely associated with rumination on the next day and, if so, whether those associations appeared to be mediated by the associations of avoidance and revenge on a given day with anger and/or fear of the transgressor on the next day.

Results

Descriptive Statistics

As in Studies 1 and 2, the types of relationship partners who had committed transgressions against our participants were diverse. Most incurred transgressions committed by girlfriends or boyfriends (50%), friends of the same gender (19%), or relatives (13%). A smaller number of participants reported transgressions by friends of the other gender (9%), husbands or wives (1%), and "others" (8%). Participants described several types of transgressions, including infidelity by a romantic partner or spouse (29%); insults by a friend or betrayals of a confidence (20%); rejection, neglect, or insult by a family member (13%); termination of a romantic relationship (13%); neglect by a romantic partner, spouse, or ex-romantic partner (10%); rejection or abandonment by a friend or prospective relationship partner (10%); and insults by people other than family or friends (5%). At the beginning of the study, participants in Study 3 reported transgressions that were about as painful ($M = 4.84$, $SD = 0.88$) as did participants in Study 2 ($M = 4.78$, $SD = 0.81$).

Fluctuations in Rumination as Determinants of Temporary Forgiveness

Multilevel models revealed that on any given Day $i - 1$, if people had relatively high levels of rumination, then they were expected to have relatively high levels of avoidance motivation ($\beta = 0.035$, $SE = 0.015$), $t(160) = 2.31$, $p = .022$, effect size $r = .18$, on the following Day i , even after controlling for the covariation among rumination, avoidance motivation, anger toward the transgressor, and fear of the transgressor on Day $i - 1$. The standard deviation for this association was .094, implying that people who scored more than $.035/.094 = .37$ SDs below the mean had rumination-avoidance associations that were zero or less. In other words, about 64% of participants in this sample would be expected to have positive within-persons associations between rumination on Day $i - 1$ and avoidance motivation on Day i .

Similarly, on any given Day $i - 1$, if people had relatively high levels of rumination, then they were expected to have relatively high levels of revenge motivation ($\beta = 0.031$, $SE = 0.012$), $t(160) = 2.69$, $p = .008$, effect size $r = .21$, on the following Day i , even after controlling for the covariation among rumination, revenge motivation, anger toward the transgressor, and fear of the transgressor on Day $i - 1$.

The standard deviation for this association was .056, implying that people who scored more than $.031/.056 = .55$ SDs below the mean had rumination-avoidance associations that were not positive. In other words, about 71% of participants in this sample would be expected to have positive within-persons associations between rumination on Day $i - 1$ and revenge motivation on Day i .

The associations between rumination on Day $i - 1$ and the TRIMs on Day i were not moderated by trait negative affect, or perceived transgression painfulness, although the association of rumination on Day $i - 1$ and revenge on Day i was moderated by trait positive affect ($\beta = -0.033$, $SE = 0.013$), $t(160) = -2.54$, $p = .012$. For every unit increase in trait positive affect above the mean, the association between rumination on Day $i - 1$ and revenge motivation on Day i went down by .033 units. In other words, people with high levels of trait positive affect could apparently ruminate about a transgression that had occurred to them without experiencing a large increase in revenge motivation the following day.

Is the Association of Rumination and Forgiveness Mediated by Anger or Fear Toward the Transgressor?

Because increases in rumination on any given day appeared to be associated with increases in avoidance and revenge motivation on the next day, we proceeded to examine whether rumination on any given Day $i - 1$ predicted people's levels of anger toward, or fear of, the transgressor on the next Day i and, if so, whether those lagged associations of rumination with fear and anger mediated the associations of rumination on Day $i - 1$ and the TRIMs on Day i .

The first two columns of data in the bottom third of Table 3, labeled $\beta(yx)$ and $\beta(mx)$, contain the coefficients that resulted from regressing the outcomes y (i.e., avoidance and revenge motivation on any given Day i) and presumed mediators m (i.e., fear or anger on Day i) upon the predictor variable x (i.e., rumination on Day $i - 1$, controlling for levels of the outcome, fear, and anger on Day $i - 1$).

1). These coefficients show that rumination on Day $i - 1$ was associated with avoidance motivation, revenge motivation, and anger toward the transgressor (but not fear toward the transgressor) on Day i . The fourth column of coefficients, labeled $\beta(yx.m)$, demonstrate that the unique associations of the outcomes y (avoidance and revenge motivation on Day i) with the predictor x (rumination on Day $i - 1$) when controlling for the presumed mediator m were nonsignificant when anger was the presumed mediator variable. Because fear of the transgressor was not associated with rumination, we did not estimate equations in which fear of the transgressor was a presumed mediator. The Sobel tests, whose t values appear in the last column, are also consistent with the proposition that rumination on Day $i - 1$ preceded an increase in avoidance and revenge motivation the next Day i and that these increases in avoidance and revenge motivation may have been because rumination on Day $i - 1$ preceded increased anger toward the transgressor, which may have then led to increases in avoidance and revenge motivation.

Using Kenny et al.'s (2003) approach to estimating the percentage of an association between two variables that appears to be mediated by a third variable, we estimated that 41.09% of the association between rumination on Day $i - 1$ and avoidance motivation on Day i appeared to be mediated by anger toward the transgressor. Likewise, 56% of the association between rumination on Day $i - 1$ and revenge motivation on Day i appeared to be mediated by anger toward the transgressor.

Alternative Models

Through a series of analogous models to those above, we evaluated whether avoidance and revenge on a given day were uniquely associated with rumination on the next day and, if so, whether those associations appeared to be mediated by the associations of avoidance and revenge on a given day with anger and/or fear of the transgressor on the next day. While controlling for rumination, fear, and anger on Day $i - 1$, avoidance motivation on Day $i - 1$ was positively associated with rumination on Day i ($\beta = 0.09$, $SE = 0.03$), $t(160) = 2.65$, $p < .01$. While controlling for rumination, fear, and anger on Day $i - 1$, revenge motivation on Day $i - 1$ was not significantly associated with rumination on Day i ($\beta = 0.04$, $SE = 0.04$), $t(160) = 1.10$, $p = .27$. Thus, it appeared that avoidance motivation, but not revenge motivation, was uniquely associated with lagged changes in rumination.

To explore whether avoidance motivation on Day $i - 1$ obtained its association with rumination on Day i by predicting intermediate increases in anger or fear of the transgressor, we conducted mediational analyses. We found evidence that the association of avoidance motivation on Day $i - 1$ with rumination on Day i was mediated by anger on Day i (Sobel $t = 2.58$, $p < .01$). Avoidance motivation on Day $i - 1$ was not associated with fear on Day i , so we did not pursue further the possibility that avoidance on Day $i - 1$ obtains its association with rumination on Day i via its intermediate association with fear on Day i . Thus, we did find some evidence that avoidance motivation (but not revenge motivation) on a given day was associated with rumination on the next day and that this association was mediated by the association of avoidance motivation on a given day with anger toward the transgressor on the next day.

Summary of Study 3

In Study 3, we replicated the main findings of Studies 1 and 2 by using data from a 21-day diary study that allowed for an examination of the cross-lagged associations of rumination and forgiveness (Cole & Maxwell, 2003; Finkel, 1995; West & Hepworth, 1991). With these data, we were able to evaluate the possibility that rumination on any given day predicted how much avoidance and revenge motivation one would experience on the following day. Results were largely consistent with the hypothesis that ruminating about a transgression on any given day preceded increases in how motivated people felt to avoid and to seek revenge against their transgressors on the next day. Much of this lagged association between rumination and forgiveness could be attributed to the fact that rumination about the transgression on any given day preceded increases in how angry participants felt toward their transgressors on the following day, which may, in turn, have predicted increases in avoidance and revenge motivation.

In contrast, the evidence that forgiveness precedes changes in rumination was more mixed: We found evidence that increased avoidance motivation on a given day preceded increased rumination on the following day (and that this association was mediated by association of avoidance motivation with anger toward the transgressor on the next day), but revenge motivation was not related to increased rumination on the next day. Taken together, the results of Study 3 provide slightly better support to the notion that rumination precedes forgiveness than to the notion that forgiveness precedes rumination, although support for both hypotheses was uncovered.

General Discussion

Experimental research shows that rumination—whether about negative interpersonal events or one's own affective state—prolongs and exacerbates psychological and interpersonal distress. When people ruminate about their depressive symptoms or anger, they get more depressed or angry and stay that way longer (Mor & Winquist, 2002; Rusting & Nolen-Hoeksema, 1998). Moreover, when people ruminate about someone who has harmed them, they become more aggressive than when they distract themselves (Bushman, 2002).

Although nonexperimental studies can never prove definitively that the relationship between two variables is a causal one (Cole & Maxwell, 2003; West & Hepworth, 1991); the present results suggest that forgiveness can be added to the list of adaptive psychological processes that are negatively associated with rumination. Using short-term longitudinal methods and a statistical model for depicting forgiveness as a process of psychological change (McCullough et al., 2003), we found that rumination was related inversely to forgiveness in two ways. First, researchers in previous work (McCullough et al., 2001) have found that the extent to which people made progress in reducing their rumination over the course of days, weeks, and months after a transgression was strongly related to the extent to which they made progress in forgiving over time (see Footnote 2). In McCullough et al.'s (2003) longitudinal conceptualization of forgiveness, this means that reducing one's rumination about a transgression was related to trend forgiveness, or linear reductions in avoidance and revenge, over time.

We also found that on occasions when individuals ruminated about a transgression to a greater extent than was typical for them, they also became temporarily more avoidant and more vengeful toward their transgressors than was typical for them. In addition, the results of Study 3 suggest that changes in rumination precede the changes in forgiveness with which they are linked. As Borsboom et al. (2003) explained, between-subjects associations are distinct from within-subjects associations, and without evidence of within-subjects relations between variables, it is unwarranted to conceptualize their within-persons relationships between two variables as causal in nature. Therefore, the fact that we have demonstrated that the typical individual experiences increases in avoidance and revenge motivation following occasions when he or she has ruminated more about a transgression than is typical for him or her provides credence to the possibility that the rumination–forgiveness relationship is a causal one. In Study 3, evidence for this causal account was more consistent than for the reverse causal account—that is, forgiveness precedes reductions in rumination. Nevertheless, because third variables can always be invoked to explain associations derived from nonexperimental research, experimental studies of the rumination–forgiveness relationship will be indispensable for shedding any definitive light on the causal status of the rumination–forgiveness association.

The Role of Emotion in the Rumination–Forgiveness Association

Berkowitz's (1990) CNA model of aggression and Miller et al.'s (2003) extension of this model to triggered displaced aggression suggest that rumination about a transgression reactivates affects that organize people's thoughts, motivations, physiology, and motoric behavior so that they can coordinate effective fight-or-flight responses to provocation. As expected, we found that temporary increases in rumination were related to temporary changes in affect—anger most notably. Moreover, we found that these affective changes could be conceptualized as a psychological mediator through which rumination is associated with reduced forgiveness.

This account for our findings also fits well with an understanding of forgiveness as a motivational phenomenon (McCullough et al., 2003, 1998, 1997). Some researchers have proposed that rumination occurs when people perceive an important goal to be unfulfilled. In such cases, it is argued that ruminative thoughts serve as cues to redouble one's efforts to pursue the goal. In this light, when one ruminates about a transgression, the ruminative cognitions may signify that important psychological states (viz., safety and status) that were threatened by the transgression have not been fully restored to one's ideals. Ruminative cognitions therefore may emerge to energize people in their pursuits of safety and status, and it may be avoidance and revenge motivations specifically—two very old adaptations to group living (de Waal, 2000)—that rumination reenergizes to help people in their search for these important social-psychological goods.

It is also of interest that anger, but not fear, appeared to operate as a mediator of rumination's associations with avoidance and revenge motivation. This is inconsistent with what we presumed about the emotional specificity of avoidance and revenge motivations as well as with evidence that fear leads to risk aversion, whereas anger leads to risk seeking (Lerner & Keltner, 2000, 2001). In previous work, we have assumed that a vengeful stance

is associated with an angry, approach-related (i.e., risk seeking) desire to harm one's transgressor in kind, whereas an avoidant stance was associated with a fearful (i.e., risk averse) desire to maintain a safe distance from one's transgressor (McCullough et al., 1998, 1997). However, the present findings cast doubt on this interpretation: In all three studies, anger appeared to mediate the associations of rumination with revenge and avoidance motivation alike. The utility of anger, but not fear, as a potential mediator of the rumination–forgiveness association is also inconsistent with Berkowitz's (1990) neoassociationist model of the relations between affect and aggression, which proposes that negative affect of any sort should increase the accessibility of aggression-related constructs.

It may simply be the case that rumination does more to make people angry toward their transgressors than it does to make them fearful of their transgressors—especially when the ruminative thoughts are about the types of transgressions that our participants experienced (mostly violations of trust or faithfulness in close relationships). Thus, different mediational results may have occurred if we had examined the role of anger and fear as mediators in the context of more severe transgressions, in which participants had legitimate concerns for their safety or well-being that may have caused them to fear their transgressors (e.g., intimate partner violence, imbalanced power relationships, and the like) when they ruminated. Another possibility is that other negative emotions associated with the avoidance of aversive stimuli (disgust seems like a promising candidate) that we did not explore here would have been better mediators of the rumination–avoidance relationship than the rumination–revenge relationship. Yet a third possibility is that the emotions that elicit avoidance motivation and revenge motivation are in fact more similar than different (cf. McCullough et al., 2003; McCullough & Hoyt, 2002; McCullough et al., 1998, 1997).

Limitations and Directions for Future Work

Because the data we examined herein were nonexperimental, the causal status of the relationships among rumination, affect, and forgiveness cannot be established definitively without experimental research. This is especially noteworthy because earlier levels of avoidance motivation predicted later levels of rumination, suggesting that the relations between rumination and forgiveness may be reciprocal or even the result of unmeasured third variables. Future research on this topic could be improved also by directly measuring the supposed behavioral sequelae of rumination and forgiveness (viz., avoidance and revenge behavior) and by studying the possible motivational effects of revenge and avoidance through other channels (e.g., facial expressions, physiological functioning, and actual behavior). Finally, it would be a great boon to forgiveness theory to arrive at a more formal understanding of how specific emotions influence forgiveness. The present results suggest that anger precedes reduced forgiveness, and other research suggests that empathy facilitates forgiveness (McCullough et al., 1998, 1997). Evolutionary models of emotion and social behavior may be particularly useful in generating predictions regarding the role of specific emotions in forgiveness (Keltner & Haidt, 1999). Studies incorporating considerations such as these that we have listed could help to clarify how rumination obtains its negative

association with forgiveness, how emotion may be implicated, and the possible consequences of rumination and forgiveness for personal and interpersonal functioning.

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