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Self-forgiveness and Forgiveness-seeking in Response to Rumination: Cardiac and Emotional Responses of Transgressors

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Self-forgiveness and forgiveness-seeking in response to rumination:

Cardiac and emotional responses of transgressors

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Abstract

Self-forgiveness and forgiveness-seeking are important and understudied aspects of forgiveness. We examined the cardiac and emotional patterns of healthy young adults (40 women, 40 men) who recalled an unresolved offense they had caused another person. Participants engaged in four imagery conditions: ruminating about the offense, being humbly repentant and engaging in self-forgiveness, seeking forgiveness from the victim and receiving forgiveness, and seeking forgiveness from the victim and being begrudged. Being repentant and begrudged forgiveness by one's victim was associated with the same level of guilt as when ruminating, but significantly more negative emotion, less control, and less empathy than when ruminating, self-forgiving, and receiving forgiveness from the victim. Compared to ruminating about one's wrong-doing, self-forgiving alleviated guilt and negative emotion, increased perceived control, decreased heart rate, and increased parasympathetic activation. Imagery of receiving forgiveness from the victim resulted in these same patterns and was equivalent to self-forgiveness across variables.

Keywords: forgiveness-seeking, self-forgiveness, rumination, HR, RSA, PEP

Words = 149

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The psychology of forgiveness has been receiving increased attention, with nearly 2,356 peer-reviewed sources on forgiveness in PsycInfo. The granting of forgiveness has been a fruitful area receiving primary attention (for meta-analyses see Fehr et al., 2010; Riek & Mania, 2011). Research has demonstrated that granting forgiveness is associated with better health and well-being (Friedberg et al, 2007; Lawler et al., 2005), lower levels of stress (Friedberg et al., 2005; Harris et al., 2006), and increased relationship satisfaction, commitment, and trust between the victim and the transgressor (Gordon et al., 2009; McCullough et al., 1998). Questions remain about how the forgiveness process may impact perpetrators. Does seeking and/or receiving forgiveness offer benefits in a similar fashion that granting forgiveness does? Does self-forgiveness yield psychophysiological results that parallel those for granting of forgiveness? The purpose of this experiment is to begin to address these questions, specifically by testing the cardiac physiology and emotional reactions of perpetrators who are repentant and pursue self-forgiveness or forgiveness from the victim.

Granting Forgiveness

In one of the earliest studies to examine the effects of granting forgiveness on the victim, Witvliet et al. (2001) had participants recall a transgression that they had suffered. Next, participants imagined either forgiving responses (empathic perspective-taking, granting forgiveness) or unforgiving responses (ruminating about the offense, harboring a grudge). During these imagery sessions a number of physiological measures were taken and a distinct pattern emerged. During the forgiving imagery, participants showed lower sympathetic nervous system arousal (as measured by skin conductance level changes), smaller increases in heart rate

(HR), and lower mean arterial pressure change compared to the unforgiveness imagery. Participants also experienced reduced negative emotions during forgiving imagery conditions compared to unforgiving imagery. Subsequent experiments showed that victims' rumination about an offense inhibited their parasympathetic functioning, as measured by the high frequency (HF) component of the power spectrum for heart rate variability (HRV), whereas compassionate responses associated with forgiveness kept HF-HRV at baseline levels (Witvliet et al., 2010; Witvliet, De Young, et al. 2011). Because chronic increases in sympathetic arousal (Olafiranye et al., 2011) and impairment in parasympathetic functioning (Shenhar-Tsarfaty et al., 2014) are related to negative health effects this suggests that over the long term, if one is unforgiving toward others, cardiac health consequences could occur.

Other studies also supported a link between health and granting forgiveness. This is true for both self-perceptions of health (Wilson et al., 2008) and objective, physiological measures. For example, individuals higher in trait and state forgiveness were likely to have lower blood pressure compared to those low in forgiveness (Lawler et al, 2003). Friedberg et al. (2007) measured forgiveness and cardiovascular activity and found that higher levels of trait forgiveness were related to lower diastolic blood pressure. Worthington and Scherer (2004) suggested that forgiveness may be related to health due to the fact that forgiveness is associated with decreases in anger and stress, which in turn have a positive impact on health outcomes. This is supported by Lawler et al. (2005), who demonstrated that reductions in negative emotion are a mediating factor in the forgiveness and health relationship.

Receiving Forgiveness

While there seems to be a consensus that granting forgiveness is associated with positive physiological responses and better health, it is less clear what the physiological effects of

receiving forgiveness may be. To our knowledge, only one study has examined this. Witvliet et al. (2002) studied participants who recalled an incident in which they believed they had transgressed against another. Next, participants went through a series of conditions which included rumination about the transgression, and imagining that the victim forgave, reconciled, or held a grudge against the participants for the transgression. During these imagery conditions the investigators collected HR measured by electrocardiography (ECG), skin conductance (a measure of sympathetic activation), and facial muscle activity measured by electromyography. Participants also reported the emotions they experienced during each imagery trial. Results indicated that while there were some significant differences in facial electromyography between the receiving forgiveness and grudge conditions, participants' HR and skin conductance levels did not differ across imagery conditions. Subjective ratings showed that forgiveness-seeking, receiving forgiveness, and reconciliation elicited increased ratings of positive valence with decreased ratings of negative emotions, such as sadness, anger, and guilt, in comparison to rumination and being begrudged.

  While Witvliet et al. (2002) did not find effects of those forgiveness-seeking conditions on cardiac and sympathetic activity we believe that the inclusion of parasympathetic measures in a similar paradigm will provide a fuller understanding of autonomic response to rumination and forgiveness-seeking imagery. Specifically, recent studies demonstrated that rumination about one's offender and offense impaired parasympathetic nervous system activity evident in HF-HRV (Witvliet et al., 2010, 2011). We hypothesize that ruminating about oneself as the offender responsible for an offense will also impair parasympathetic functioning.

Self-Forgiveness

Just as forgiveness of others has been distinguished from excusing or condoning the event, self-forgiveness is more than simply a cessation of negative emotions toward oneself. Sandage et al. (2000) have placed the burden on perpetrators to accept personal moral responsibility for their culpable behavior while investing in efforts to make repairs of the relational damage they have done. Rather than a private, emotion-focused response to oneself by oneself and for oneself, studies are emphasizing the importance of responsibility-taking and reparative responses toward the victim as important prerequisites to self-forgiveness (Fisher & Exline, 2006; Griffin et al., 2015; Witvliet, Hinman et al., 2011). Cornish and Wade (2015) framed the steps of responsibility, remorse, and repair, as important on the path to renewal through self-forgiveness. Using an experimental paradigm, Exline et al. (2010) found that first focusing on personal responsibility and relational repair facilitated self-forgiveness. For those who first focused on self-forgiveness, however, relational repair was less likely. Research has shown that forgiving oneself is related to positive psychological outcomes such as less depressive emotion (Wohl et al., 2008), lowered anxiety (Maltby et al., 2001), increased self-esteem (Woodyatt & Wenzel, 2013), and increased physical health (Krause & Hayward, 2013). A meta-analytical review by Davis et al. (2015) confirmed the robustness of the relationship between self-forgiveness and self-reported physical and psychological health. Responsible self-forgiveness has also been tested clinically as a cognitive strategy to cope with guilt by restoring self-worth through self-concept transformation, which was also accompanied by decreased self-condemnation and negative emotions (Griffin et al., 2015).

In their meta-analysis, Davis et al. (2015) concluded that, although the self-reported evidence for the relationship between self-forgiveness and physical and mental health is compelling, some limitations need to be addressed. Davis et al. (2015) observed that most

studies focused on trait self-forgiveness, recommending that state self-forgiveness studies should be conducted using repeated-measures experimental designs. They also recommended the use of more precise state measures, such as physiological measures rather than relying only on self-reports.

The Current Study

To address these recommendations, we designed a repeated measures study that partially replicated Witvliet et al.'s (2002) experiment in order to test both self-forgiveness and forgiveness-seeking as responses to rumination. We instructed our participants to recall an event in which they offended someone, and then ruminate about it and imagine of seeking forgiveness for their offense. We were specifically interested in the cardiac and emotional implications of forgiveness-seeking and self-forgiveness as responses to rumination about one's wrongdoing. In one of the forgiveness-seeking conditions, participants imagined that the victim denied forgiveness, and in another, participants imagined that the victim granted it. This study included one condition Witvliet et al. (2002) did not include, in which we asked our participants to imagine that they forgave themselves. Another difference between this study and Witvliet et al.'s, is that they measured responses during short periods (16 s) of imagery, whereas we measured cardiac responses during longer epochs (2 min) of imagery (e.g., Witvliet et al., 2010). In this way we were able to obtain enough data points to calculate cardiac measures of autonomic arousal, parasympathetic functioning and sympathetic activity.

Hypotheses. Anticipating that psychological stress and anxiety would occur in our paradigm (Friedberg et al. 2005; Maltby et al. 2001), we predicted that ruminating about one's transgression would elicit guilt (Riek et al., 2014) and negative emotions (Griffin et al., 2015;

Witvliet et al. 2002), and would prompt cardiac arousal (Baumeister et al., 1995; Ottaviani et al, 2009).

Imagining that forgiveness was begrudged, on the other hand, may be upsetting if it is experienced as an act of hostility or rejection. In this study, we predicted that imagery of being begrudged—compared to rumination about one's wrongdoing—would elicit cardiac arousal (Iffland et al., 2012) and more negative ratings of valence, anger, anxiety, and sadness, along with lower subjective ratings of guilt, perceived control, and empathy for the victim (Witvliet et al., 2002). We also predicted that imagery of being begrudged forgiveness would elicit cardiac arousal associated with parasympathetic withdrawal and sympathetic activation (Brindle et al., 2014; Delaney & Brodie, 2000).

Finally, we predicted that imagery of receiving forgiveness from a victim or forgiving oneself would elicit smaller HR increases, less sympathetic activation, and less parasympathetic withdrawal than when ruminating about an offense, echoing research findings on granting forgiveness (e.g., Witvliet et al., 2001, 2010, 2011, 2015) in combination with research on seeking forgiveness and being begrudged forgiveness (Witvliet et al., 2002). Receiving forgiveness from another person or oneself would also elicit more positive valence, higher control, and lower subjective ratings of anger, anxiety, sadness, and guilt, with moderate levels of empathy consistent with that work.

Method

Participants

We collected data from 83 consenting college students, who received course credit for their participation in this repeated measures design. We excluded data from three participants because of use of medication or physical conditions that affected heart functioning. We analyzed

data from 80 participants, (40 women, 40 men), mean age=19.44 years, *SD*=1.12. Participants

were 71% Caucasian, 21% Asian, 3% African-American, 1% Native-American, 1% Hispanic,

and 3% other ethnicities.

Materials and Procedure

We used the National Systems' MW 2000 Impedance Cardiograph to collect ECG and

impedance cardiography (ICG) bio-signals recorded at 1,000 Hz. We followed the guidelines

from Berntson et al. (1997) to record and analyze the values that correspond to the high

frequency HF component of the HRV power spectral density that Berntson et al. (1997) refers to

as respiratory sinus arrhythmia (RSA), where higher values indicate stronger parasympathetic

engagement. We also followed the guidelines from Sherwood et al. (1990) to record and analyze

impedance cardiography, using four Ag/AgCl spot electrodes located over C4 (first current

electrode), on the front of the neck, 4 cm above the clavicle (first voltage electrode), over the

sternum (second voltage electrode), and over T9 (second current electrode). We used Mindware

software ACQ 1.3 to collect bio-signals, and Mindware software (HRV 2.51 and ICG 2.51) to

correct the data manually for artifact and movement in 120 s epochs. We obtained R-R inter-beat

intervals to compute HR (in beats per minute) and to calculate RSA, using the .12-.40 Hz high

frequency band of the power spectrum, as an estimate of parasympathetic activation (Lewis,

Furman, McCool, & Porges, 2012). We also used Pre-Ejection Period (PEP) as an estimate of

sympathetic activity, with shorter periods corresponding to greater sympathetic activity. PEP was

obtained by averaging the ECG and the dZ/dt waveforms for each 120 s epoch, and measuring

the distance between the ECG Q-wave and the B-point of the dZ/dt wave (Sherwood et al.,

1990).

Each participant completed testing individually in a two-hour session focused on a real-life transgression so that all aspects of the transgression were held constant across conditions. After reading and signing an informed consent form, each participant received a questionnaire with demographic and health items. Then, we asked them to recall and write a description of an event in which they had "hurt, offended, wronged, or mistreated someone else," and had "not resolved, fixed, or worked it out yet" and to identify the type of relationship they currently had with the person or persons who they had previously "hurt, offended, wronged, or mistreated." Participants rated how long ago the event had happened, and answered the questions in Table 1, including Fisher and Exline's (2006) questions of feeling responsible, remorseful, and self-condemning.

[Table 1 near here]

From this point on, we left the participants alone in the experimental room, and communicated with them via a PA system. We used a computer monitor to give written instructions and an alphanumeric computer keyboard to collect ratings. We used the procedures described by Witvliet et al. (2010) for each block of physiological data collection. For the first bio-signals baseline collection, we instructed the participants to relax for 2 min, repeating the word "one" quietly as they exhaled. After this first baseline block we collected one block comprising 2 min of relaxation followed by 2 min of rumination about their offense, followed by a rating of their emotional states.[1] Next, we proceeded to a series of three data-collection blocks, each comprising 2 min of relaxation, 2 min of one of the forgiveness-seeking imagery conditions, in counterbalanced order to assess responses to rumination. After each imagery block

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[1] After the first forgiveness-seeking block, we introduced a rumination block to refocus participants on their transgression. The first rumination period prior to the repentant forgiveness-seeking conditions was used as the comparison in Table 1. Research by Witvliet et al. (2015) found that responses before forgiveness-related responding provide the purest indication of rumination responses.

the participants rated their emotional valence, anger, anxiety, sadness, guilt, control, and empathy, using a seven-point Likert scale.

Each of the four imagery tasks represented one condition related to offending and seeking forgiveness, as follows: (1) Rumination: we instructed the participants to think about the person they had offended or hurt and how the offense harmed this person, with particular focus on the negative feelings and thoughts associated with the offensive event. (2) Begrudged: we instructed the participants to imagine that they asked the offended person to forgive them, but the offended person responded with anger and a refusal to forgive. (3) Other-forgiven: we instructed the participants to imagine that they asked the offended person to forgive them, and the offended person responded with kindness and forgiveness. (4) Self-forgiven: we instructed the participants to imagine that they felt responsible for the offense, were sorry for it, committed to do what is right, and embraced self-forgiveness for committing that transgression. The full imagery instructions can be found in the Appendix.

Results

Of the offenses participants reported, 56% involved either a friend or other relationship from school, 21% an immediate family member, 19% a romantic partner, and four percent involved other relationships. The mean time elapsed since the reported event was 1.62 years, ranging from one day to 8.96 years. Table 1 summarizes measures of self-reported attitudes about the offense and of the relationship between the participants and their victims.

We lost 1.2% of all data cells due to data collection error (three of HR, 15 of RSA, and 13 of PEP). Before conducting analyses we deleted extreme values based on an SPSS outlier analysis (1.6%, 41 outliers out of all data cells). Huynh-Feldt ε is reported for repeated-measures

ANOVAs in which the sphericity assumption was violated. The Šidák correction was used for alpha inflation in post-hoc *t*-tests.

Cardiac Measures

We used repeated-measures ANOVAs to analyze the differences between physiological means (HR, RSA, and PEP) across the four imagery conditions, with planned contrasts comparing the rumination condition to the begrudged, other-forgiven, and self-forgiven conditions. Figure 1 shows the means for HR, RSA, and PEP.

[Figure 1 near here]

Table 2a shows an overall significant effect of imagery only for HR. Planned contrasts demonstrated that mean HR during the rumination condition was significantly higher than when begrudged, $F(1,73)=6.24$, $p=.015$, partial $\eta^2=.08$, other-forgiven, $F(1,73)=5.80$, $p=.019$, partial $\eta^2=.07$, and self-forgiven, $F(1,73)=10.64$, $p=.002$, partial $\eta^2=.13$. Post-hoc comparisons did not show any HR differences between the three forgiveness-seeking conditions. Mean HR in the rumination condition was significantly higher than baseline, $t(78)=-6.34$, $p<.001$, $d=0.71$, 99% CI [1.16, 2.70].

The planned contrasts showed that mean RSA for the rumination condition was significantly lower than for other-forgiven, $F(1,73)=4.56$, $p=.036$, partial $\eta^2=.06$, and self-forgiven conditions, $F(1,73)=5.34$, $p=.024$, partial $\eta^2=.07$. Mean RSA during the three forgiveness-seeking conditions did not differ from each other. Consistent with findings about victims' HF HRV (Witvliet et al., 2010, Witvliet, DeYoung, et al., 2011), RSA decreased significantly from baseline only for rumination, $t(76)=-4.64$, $p<.001$, $d=0.48$, 99% CI [-0.54, -0.16].

We did not observe any significant effects between conditions or changes from baseline in PEP.

[Table 2 near here]

Ratings of Emotion

We conducted repeated-measures ANOVAs for each subjective emotional state, as reported on Table 2b. Figure 2 shows the means for each emotion rating across each imagery condition. Compared to rumination, valence was significantly more unpleasant during the begrudged condition, $F(1,77)=31.66$, $p<.001$, partial $\eta^2=.29$, but was significantly more pleasant in the other-forgiven, $F(1,77)=122.20$, $p<.001$, partial $\eta^2=.61$, self-forgiven conditions, $F(1,77)=117.38$, $p<.001$, partial $\eta^2=.60$. Compared to the rumination condition, anger increased significantly in the begrudged condition, $F(1,77)=9.84$, $p=.002$, partial $\eta^2=.11$, but dropped significantly during the other-forgiven, $F(1,77)=47.86$, $p<.001$, partial $\eta^2=.38$, and self-forgiven conditions, $F(1,77)=55.16$, $p<.001$, partial $\eta^2=.42$. For anxiety ratings, the begrudged condition did not differ from rumination, but anxiety dropped significantly from rumination levels during the other-forgiven, $F(1,77)=43.12$, $p<.001$, partial $\eta^2=.36$, and the self-forgiven conditions, $F(1,77)=31.75$, $p<.001$, partial $\eta^2=.29$. Sadness increased significantly from rumination levels in the begrudged condition, $F(1,77)=5.00$, $p=.028$, partial $\eta^2=.06$, but decreased in the other-forgiven, $F(1,77)=67.13$, $p<.001$, partial $\eta^2=.47$, and self-forgiven conditions, $F(1,77)=54.45$, $p<.001$, partial $\eta^2=.41$. Guilt was similar during the rumination and begrudged conditions, but decreased significantly from rumination levels during the other-forgiven, $F(1,78)=62.18$, $p<.001$, partial $\eta^2=.44$, and the self-forgiven conditions, $F(1,78)=51.05$, $p<.001$, partial $\eta^2=.40$. Mean ratings of control decreased significantly in the begrudged condition, in relation to rumination, $F(1,77)=19.40$, $p<.001$, partial $\eta^2=.20$, but increased in the other-forgiven, $F(1,77)=6.23$, $p=.015$,

partial η^2=.08, and self-forgiven conditions, $F(1,77)$=8.61, p=.004, partial η^2=.10. The highest

mean rating of empathy occurred during the condition of rumination about one's wrongdoing, in

which empathy was higher than during the begrudged, $F(1,78)$=41.30, p<.001, partial η^2=.35, the

other-forgiven, $F(1,78)$=8.55, p=.005, partial η^2=.10, and the self-forgiven conditions,

$F(1,78)$=4.82, p=.031, partial η^2=.06.

[Figure 2 near here]

Post-hoc tests showed that imagining that the victim denied forgiveness and instead held

a grudge elicited significantly higher ratings on negative emotions (anger, anxiety, sadness, and

guilt) than imagining that one was forgiven by the victim or self-forgiven, all $ts(78) \geq 5.76$, all

ps<.001, all $ds \geq 0.65$. The other-forgiven and self-forgiven conditions elicited significantly more

positive valence, higher sense of control, and empathy for the victim than the begrudged

condition, all $ts(78) \geq 3.13$, all $ps \leq .002$, all $ds \geq 0.35$. After correcting for alpha inflation, the other-

forgiven and self-forgiven mean ratings did not differ significantly from each other.

Discussion

In this study we investigated forgiveness-related responses to an interpersonal offense from the understudied transgressor's perspective. Rumination about the offense and its effects on the victim were compared to three forgiveness-seeking conditions, each of which involved the transgressor's focus on his or her responsibility, regret about one's role in committing the offense, and a humbled and repentant response of relational repair. These three conditions of forgiveness-seeking included imagining being begrudged by the victim, being forgiven by the victim, and forgiving oneself.

The Effects of Ruminating

We hypothesized that ruminating about one's offense would elicit cardiac changes, with overall increased autonomic arousal and impaired parasympathetic activity, as has been found in victims who ruminated about their offender and offense (Witvliet et al., 2010, 2011). This hypothesis was supported by a significant acceleration of heart rate along with significant parasympathetic withdrawal evident in RSA decreases compared to baseline, and compared to forgiveness by the victim and oneself. These cardiac responses were not associated with a change in sympathetic activation, consistent with Witvliet et al. (2002).

Our hypothesis predicted that ruminating about one's transgression would elicit reciprocal sympathetic activation and parasympathetic inhibition, a pattern observed in tasks involving engagement of central processing resources (Backs et al., 2005), mild psychological stress, such as those using the Stroop Word Color Conflict Test with monetary inducement (Delaney & Brodie, 2000), and tasks eliciting acute psychological stress, such as those involving speech, mental arithmetic, or reaction time (Brindle et al., 2014). However, we observed a different autonomic mode of control, known as uncoupled parasympathetic inhibition (no

sympathetic changes with parasympathetic inhibition—Berntson et al., 1993). This mode of control has been found in tasks involving perceptual-manual response without engagement of central processing resources (Backs et al., 2005). Our findings suggest that ruminating about one's transgression involved a certain degree of attention without a pronounced engagement of central resources. However, vagal deregulation has been associated with disruption in several measures of biopsychosocial well-being, such as positive emotions, social connectedness (Kok et al., 2013), satisfaction with life, depression, and global functioning (Kogan et al., 2013). Some studies also suggest that parasympathetic deregulation may contribute to physical disorders such as hypertension due to an increase in cardiac output (Brindle et al., 2014), and a number of disorders associated with inflammatory processes (Shenhar-Tsarfaty et al., 2014). These observations suggest that ruminating about one's wrongdoing may also negatively impact emotional and physical well-being.

Several of our hypotheses about emotional states and rumination were supported (Figure 2). Rumination was characterized by negative valence with moderate levels of anxiety, sadness, guilt, anger, and sense of control. Rumination about one's wrongdoing and its impact on the victim also prompted the highest level of empathy for the victim in comparison to all the other conditions. These results are consistent with the findings on ruminating about an offense for which the participant was responsible (Witvliet et al., 2002), and understandably opposite to research showing low levels of empathy for participants ruminating about being the victim of another's offense (Witvliet et al., 2010).

Although rumination has been observed as a naturally-occurring and frequent response to receiving an offense (Suchday et al., 2006), naturally-occurring rumination about one's own wrongdoing is not yet well understood. Rumination is a predictor of forgiveness-seeking, but it is

mediated by guilt (Riek, 2010; Riek et al., 2014). Interestingly, when asked to choose an event in which they were at fault, our participants generally selected offenses for which they reported feeling highly responsible and moderately remorseful, but they also indicated that they generally ruminated very little about them. Their mean ratings for guilt after ruminating were identical to their mean ratings of guilt about the offense measured before ruminating. These observations could be understood in the framework of self-serving bias. Baumeister et al. (1990), and Zechmeister and Romero (2002), found that offenders tend to perceive their offenses as a one-time event, which is limited to the past, has very little or no lasting consequences, and will cause minimal impact on the interpersonal relationship. These findings suggest that rumination about one's own offenses is less likely to occur naturally than rumination about offenses one suffers. Therefore, the emotional effects we observed in our study can more likely apply to situations in which an offender is prompted to think about their offense, such as in the context of psychotherapy, a reminder of one's offense, or a confrontation with a frustrated victim.

The Effects of Being Begrudged

When participants imagined that their victims withheld forgiveness, their heart rate accelerated significantly less compared to when they ruminated about their offense (Figure 1). Contrary to our hypothesis, parasympathetic inhibition during the begrudged condition reached half of the mean level of RSA during the rumination condition, but this difference was not statistically significant. However, RSA during the begrudged condition reached a level statistically at par with its pre-trial baseline. This response suggests that seeking forgiveness and having it begrudged exerted a calming effect. Because this condition actually involved two different processes (imagining that one sought forgiveness and that the victim denied it) it is plausible that forgiveness-seeking is the component of imagery which effectively blunted the

arousal elicited by ruminating about the offense, and it seems to have occurred independently

from the outcome of the apology. Witvliet et al. (2002) did not test the same cardiac response,

and to date we have not found another study that could help to clarify this observation

specifically. However, the similarity between the autonomic responses during the begrudged

condition and the autonomic responses to receiving forgiveness of other and self (Figure 1)

reinforces the plausibility of this hypothesis. Perhaps participants felt that if they had sought

forgiveness at all they had met their responsibility as a transgressor and the victim's response

was less relevant. Therefore, seeking forgiveness as a humbly repentant process—independent

from receiving forgiveness or not—could improve well-being and physical health by promoting

vagal upregulation (Kogan et al, 2013; Kok et al., 2013; Shenhar-Tsarfaty et al. 2014).

Emotionally, valence during rumination was negative, and it became even more negative

during the begrudged condition. This decrease in valence in the begrudged condition was not

accompanied by a significant decrease in guilt, as predicted, but was associated with an increase

in anger and sadness, and a decrease in control and empathy, as predicted. The sharp drop in

empathy suggests a negative reappraisal of the victim. If in fact offenders perceive their offenses

as an event circumscribed to the past, and with minimal repercussions for the victim (Baumeister

et al., 1990; Zechmeister & Romero, 2002), a refusal to forgive could be perceived as a counter-

offense, and the victim could be reappraised, with a reversal of the roles of victim and offender.

This hypothesis could explain the drop in empathy for the victim and the diminished sense of

control over the situation, with increased anger for the counter-offense (grudge) by the former

victim. However, if such victim reappraisal occurred, it was not sufficient to avert the offender's

guilt and anxiety, and this ambivalence may be associated with the perception of being

begrudged as more unpleasant than ruminating. Negative affect has been found to mediate

forgiveness traits and physical health (Lawler et al., 2005), and so seeking forgiveness may be a

moral response that carries the risk of being denied forgiveness and feeling worse.

The Effects of Receiving Forgiveness and Self-Forgiveness

Supporting our hypotheses, receiving forgiveness from the victim and self-forgiving had

statistically equivalent effects to each other, and differed from one's offense rumination.

Specifically, in comparison to ruminating about the offense, forgiveness—by the victim and by

oneself—prompted lower HR, associated with a reduction in parasympathetic withdrawal (RSA)

(Figure 1). Witvliet et al. (2002) did not observe this effect for HR, which suggests that

recording cardiac responses over a longer period of time may be a more sensitive method to

observe effects of forgiveness-seeking imagery.

The two forgiveness-receiving conditions also showed similar emotional responses

(Figure 2), and both differed significantly from the rumination and begrudged conditions for

every subjective rating of emotional state. Specifically, in comparison to the two negative

conditions, our participants' ratings showed that imagery of receiving forgiveness—whether

from the victim or oneself—was more pleasant and elicited an increased sense of being in

control. As predicted, the negative emotions of sadness, guilt and anger were also significantly

lower for both conditions of receiving forgiveness—from the victim and oneself—than for the

conditions of ruminating or being begrudged. After imagery of receiving forgiveness, however,

participants reported lower levels of empathy for their victims in relation to rumination, but

higher empathy than in the begrudged condition. Such differences from the rumination condition

are consistent with the view that vagal stability interacts with emotional positivity in receiving

forgiveness (Kok et al., 2013), which may contribute to emotional and physical well-being.

Although mean responses to all variables measured during the other-forgiven and self-forgiven conditions were nearly the same, self-forgiveness seems to be more complex than receiving forgiveness from the victim. Self-forgiving represents at the same time repentant forgiveness-seeking and self-referential forgiveness-granting. It is likely to be affected by self-serving bias between other factors. For example, Hall and Fincham (2008) observed that the predictors of self-forgiveness were guilt, perceived forgiveness (of the victim and of a higher power), conciliatory behavior (of the victim and of a higher power), and the severity of the transgression. Dixon et al. (2014) found that the predictors of self-forgiveness were self-evaluative perfectionism through the mediation of self-acceptance and rumination. Wohl and McLaughlin (2014) presented a multilayered model of self-forgiveness which flows from an offensive behavior, to recognition, attribution (internal vs. external), acceptance of responsibility, and ends in five possible outcomes, ranging from no self-forgiveness to genuine self-forgiveness with behavior cessation. This model predicts that self-forgiveness may be genuine or not, in which the perpetrator lets him or herself "off the hook" by accepting less responsibility than warranted by the infraction. In keeping with this model, the imagery instructions we used in our experiment are consistent with genuine self-forgiveness for a behavior that occurred in the past and is not likely to occur again, for which one takes responsibility, experiences remorse, and is humbly repentant in seeking forgiveness, features consistent with Griffin et al.'s (2015) intervention for responsible self-forgiveness. The current study's results suggest that the emotional and autonomic effects of this type of self-forgiveness are very similar to the effects of receiving forgiveness from the victim. Subsequent studies could investigate the current approach to humbly responsible self-forgiveness compared to self-condoning and self-forgiveness for an ongoing infraction.

Limitations

One of the limitations of our study is its restricted ecological validity due to the experimental paradigm. Our conditions bypassed naturally-occurring motivations to ruminate and to seek forgiveness by instructing our participants to imagine they were engaging in these behaviors that the literature has emphasized. This paradigm excluded the decision-making process involved in forgiveness-seeking, and also may have blunted the effects of real-life risks and unpredictability involved in facing a real victim. Because research has demonstrated that imagery of forgiveness can change offense rumination (Witvliet et al., 2015), pure rumination data was recorded after the participant had become acclimated to the lab by completing baseline physiology testing and questionnaires, and prior to forgiveness-seeking. We recommend a cautious interpretation of our results, recognizing that the rumination patterns here reflect what occurred before humble repentance with forgiveness-seeking.

Conclusion and Future Directions

Our findings suggest that ruminating about an offense committed by oneself may carry cardiac and emotional costs by increasing parasympathetic withdrawal and eliciting negative emotionality. Seeking forgiveness (with responsibility-taking, remorse, and relational repair) by itself seems to contribute to improve the autonomic effects of the offense on the offender, but it is only when forgiveness-seeking is followed by forgiveness-receiving—from the victim or oneself—that the offender fully experiences a positive shift in his or her emotional and cardiac HR and RSA responses. Imagery of receiving forgiveness from the victim and forgiving oneself may contribute to psychological and physical well-being by inhibiting parasympathetic withdrawal and improving self-regulation.

Although we did not observe physiological and emotional differences between self-forgiveness and receiving forgiveness from others, future studies could investigate whether these two conditions elicit different behavioral outcomes. For example, is pro-social behavior toward the victim more likely when the forgiveness comes from the victim rather than from oneself? Does the source of forgiveness impact that likelihood of reconciliation? In short, while we have found similarities between self-forgiveness and forgiveness from others, there may remain some substantial differences between the two.

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Appendix

Imagery Prompts

<u>Rumination</u>

For the next two minutes, think of the person you hurt, offended, or wronged. Think of the ways in which your offense harmed this person when it happened, and how it continued to negatively affect this person. During your imagery, actively focus on the negative thoughts, feelings, and physical responses you have as you think about the negative ways in which you offended this person and how your offense harmed him or her.

<u>Begrudged</u>

For the next two minutes, try to imagine that you felt responsible for and regret about your role in committing the offense. Imagine that you felt so humbled and repentant that you asked for forgiveness and tried to make things right. Imagine that you talked to this person who you offended, asked for forgiveness, and he or she responded by showing anger at you. He or she said that it would be impossible to forgive you, and then continued to nurse a grudge against you. During your imagery, actively focus on the thoughts, feelings, and physical responses you have as you think about having your apology completely rejected by this person.

<u>Forgiveness From the Victim</u>

For the next two minutes, try to imagine that you felt responsible for and regret about your role in committing the offense. Imagine that you felt so humbled and repentant that you asked for forgiveness and tried to make things right. Imagine that you talked to this person who you

offended, asked for forgiveness, and he or she responded by forgiving and showing kindness to you. He or she said that you were completely forgiven, and then went on acting as if you had never offended him or her. During your imagery, actively focus on the thoughts, feelings, and physical responses you have as you think about having your apology completely accepted by this person.

Self-Forgiveness

For the next two minutes, try to imagine that you felt responsible for and regret about your role in committing the offense. Imagine that you felt so humbled and repentant that you wanted to be forgiven, confessed, repented, and committed to do what is right. Imagine that as you look at your own actions of causing hurt and of humbly repenting, that you embrace mercy and forgiveness for yourself. Imagine that you embrace this kindness and compassion for yourself as you commit to do what you believe is right. During your imagery, actively focus on the thoughts, feelings, and physical responses you have as you think about fully embracing forgiveness of yourself.

Table 1

Means and SDs for measures of self-reported attitudes about the offense and the relationship

with the victim.

Variables	Mean	SD
How good do you feel about yourself? (1=extremely negative; 7=extremely positive)	2.57	0.98
How much do you ruminate about it? (1=not at all; 7=all the time)	3.11	1.57
How much do you condemn yourself for it? (1=not at all; 7=very much	3.36	1.50
How severe was the offense? (1=not at all severe; 7=extremely severe)	3.75	1.51
How remorseful do you feel about it? (1=don't feel remorse; 7=feel remorse very much)	4.38	1.38
How responsible do you feel about it? (1=don't feel responsible; 7=feel very responsible)	5.28	1.13
How well did you know the person you hurt? (1=not at all; 7=very well)	5.78	1.63

Note. N = 80.

Table 2

Results of the repeated-measures ANOVAs for each dependent variable across the four imagery conditions.

Measure	n	Means [95% C.I.]				F	df	Partial η^2	ε
		Rumination	Begrudged	Other-Forgiven	Self-Forgiven				
a) Physiological Measures									
HR (bpm)	74	**1.82** [1.20, 2.43]	0.73^{R*} [0.08, 1.39]	$0.80^{R*,Bns}$ [0.12, 1.48]	$0.50^{R**,Bns,OFns}$ [-0.15, 1.14]	3.79^*	3,219	.05	
RSA (ln[ms^2])	74	**-0.29** [-0.43, -0.15]	-0.14^{Rns} [-0.30, 0.02]	$-0.09^{R*,Bns}$ [-0.24, 0.08]	$-0.05^{R*,Bns,OFns}$ [-0.23, 0.12]	2.10	3,219	.03	
PEP (ms)	65	0.82 [-0.41, 2.04]	0.31^{Rns} [-1.16, 1.22]	$0.35^{Rns,Bns}$ [-0.62, 1.33]	$0.19^{Rns,Bns,OFns}$ [-0.92, 1.29]	0.34	3,192	.01	.84
b) Subjective Measures of Discrete Emotions									
Valence	78	3.46 [3.23, 3.70]	$2.82^{R†}$ [2.60, 3.04]	$5.23^{R†,B†}$ [5.00, 5.47]	$5.03^{R†,B†,OFns}$ [4.79, 5.26]	$127.41^†$	3,231	.62	.67
Anger	78	3.19 [2.81, 3.57]	3.86^{R**} [3.46, 4.26]	$1.89^{R†,B†}$ [1.63, 2.14]	$2.01^{R†,B†,OFns}$ [1.77, 2.25]	$55.03^†$	3,231	.42	.83
Anxiety	78	3.68 [3.37, 4.00]	3.90^{Rns} [3.54, 4.25]	$2.60^{R†,B†}$ [2.32, 2.89]	$2.72^{R†,B†,OFns}$ [2.43, 3.00]	$31.77^†$	3,231	.29	.94
Sadness	78	3.85 [3.53, 4.17]	4.27^{R*} [3.93, 4.61]	$2.30^{R†,B†}$ [2.03, 2.57]	$2.54^{R†,B†,OFns}$ [2.28, 2.80]	$56.36^†$	3,231	.42	.92
Guilt	79	4.37 [4.04, 4.69]	4.24^{Rns} [3.91, 4.57]	$2.90^{R†,B†}$ [2.58, 3.22]	$3.10^{R†,B†,OFns}$ [2.78, 3.42]	$35.10^†$	3,234	.31	.93
Control	78	4.60 [4.24, 4.97]	$3.87^{R†}$ [3.52, 4.22]	$5.04^{R*,B†}$ [4.71, 5.36]	$5.12^{R**,B†,OFns}$ [4.84, 5.39]	$24.59^†$	3,231	.24	.93
Empathy	79	4.98 [4.67, 5.28]	$3.96^{R†}$ [3.60, 4.32]	$4.48^{R**,B**}$ [4.18, 4.78]	$4.61^{R*,B†,OFns}$ [4.28, 4.94]	$13.61^†$	3,234	.15	.90

Note. Cardiac measures were corrected to each condition's pre-trial baseline. HR = (Heart Rate), RSA = (Respiratory Sinus Arrhythmia) parasympathetic activation, PEP = (Pre-Ejection Period) sympathetic withdrawal. We reported the Huynh-Feldt ε for the cases in which the sphericity assumption of the repeated measures ANOVA was violated (missing ε-values indicate analyses in which the sphericity assumption was not violated). Means in boldface are significantly different from each condition pre-trial baseline (HR and RSA), after Šidák correction for alpha-inflation. Superscripts for the means indicate the significance of the comparison between that mean and rumination (R), begrudged (B), or other-forgiven (OF) conditions. SPSS includes between person variance in the CIs for the repeated measures means. Therefore, we evaluated the 95% CIs for the mean difference of pairs compared. Superscripts for the means indicate that the 95% CI around the mean difference did not cross zero, indicating a reliable difference between those means. ^p=.07, *p<.05, **p<.01, †p<.001.

Figure Captions

Figure 1. Means for (a) heart rate (HR), and (b) parasympathetic activation (RSA, Respiratory Sinus Arrhythmia), corrected to baseline. Error bars represent 95% CIs. Note that the 95% CIs in SPSS include between person variance for repeated measures means.
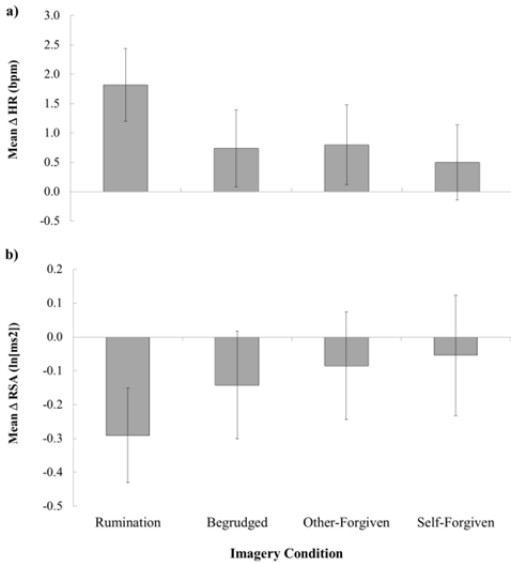

Figure 2. Mean subjective ratings of emotions states across the four imagery conditions. The dotted line marks the central score of the Likert scale. Error bars represent 95% CIs. Note that the 95% CIs in SPSS include between person variance for repeated measures means.