UNDERSTANDING THE PROCESSES ASSOCIATED WITH FORGIVENESS

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UNDERSTANDING THE PROCESSES ASSOCIATED WITH FORGIVENESS

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EDITORIAL
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Editorial: Understanding the Processes Associated With Forgiveness

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Keywords: forgiveness, transgression, prosocial motivation, forgiving process, behavioral measurement

Editorial on the Research Topic

Understanding the Processes Associated With Forgiveness

INTRODUCTION

There has been a rapid growth in research on forgiveness over the past two decades. Although researchers have not reached a consensus on the definition of forgiveness (Worthington, 2020), there is general agreement that forgiveness is a changing process of prosocial motivation toward the transgressor, including changes in cognition, emotion, and motivation. Previous studies found that responding to offenses with forgiveness is associated with greater mental and physical health (Davis et al., 2015; Toussaint et al., 2015). Greater forgiveness is related to less neuroticism, depression, and rumination (Brown, 2003; Berry et al., 2005; McCullough et al., 2007), increased subjective well-being (Toussaint and Friedman, 2009), and improved interpersonal relationships (Riek and Mania, 2012). Individuals with lower levels of forgiveness also have higher levels of blood pressure, heart rate, and stress perception (Lawler-Row et al., 2011). Our understanding of forgiveness has increased remarkably with the breadth and depth of scientific research into many aspects of forgiveness. However, the process of forgiveness remains unclear. Due to the complexity of forgiveness, more research is needed to explore the process of forgiveness and the factors that affect the process. This current Frontiers Research Topic, brings together 10 articles that illustrate these questions, examining the process of forgiveness from different perspectives.

FACTORS AFFECTING THE FORGIVENESS PROCESS

Hong et al. examined the influence of cognitive factors (e.g., compromising thinking) and personality traits (e.g., self-esteem) on forgiveness among a large adolescent sample. They found that compromising thinking forecasted decisional forgiveness rather than emotional forgiveness, and that self-esteem moderates the influence of compromising thinking on decisional and emotional forgiveness. Kong et al. found that rumination and anger play a mediating role between self-control and forgiveness. Using a behavioral measure of forgiveness, Liu and Li found that individuals with high self-control, expressed greater prosocial responses toward people who previously offended them, which is consistent with forgiveness. Ho et al. examined the facilitating role of emotional regulation on forgiveness and found that both self-regulatory strength and emotion regulation can predict forgiveness, and cognitive reappraisal plays a mediating role between self-regulatory fatigue and forgiveness. Moreover, previous studies found that empathy

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plays a vital role in facilitating forgiveness (Kimmes and Durtschi, 2016; Cornish et al., 2018). Ma and Jiang found similar results from a sample of adolescents.

THE MODEL OF MOTIVATED INTERPERSONAL FORGIVENESS

To answer the questions of when, why, and how forgiveness occurs, Donovan and Priester (2017) proposed the Model of Motivated Interpersonal Forgiveness, in which they hypothesize that relationship closeness leads to a desire to maintain the relationship. This desire leads to motivated reasoning, which leads to interpersonal forgiveness. They found that motivated reasoning predicted forgiveness rather than empathy when controlling feelings for the other. In this new study, they replicated the abovementioned findings and excluded potential influences of the measures of motivated reasoning and the analytic estimation of hypothesis models (Donovan and Priester). The Model of Motivated Interpersonal Forgiveness suggests an explanation by which we can understand the psychological process of forgiveness.

FORGIVENESS OVER TIME AND FORGIVENESS INTERVENTIONS

To explore the association between forgiveness and health, Long et al. examined the relationship between self- and divine- forgiveness and subsequent health and well-being using longitudinal data. They found that self-forgiveness and divine forgiveness were positively related to psychosocial well-being and negatively related to psychological distress. However, they found little evidence of associations of self- and divine-forgiveness with physical health or health behavior outcomes. Toussaint et al. examined the effectiveness of the REACH forgiveness psychological education method in a sample of Indian college students, which was effective with people of different religious commitments. Perceiving the offender as sharing a similar spirituality was associated with increased empathy, positive affect, and emotional forgiveness and less growth of unforgiveness as a result of the forgiveness training.

THE REPAIRING EFFECT OF APOLOGY AND COMPENSATION

Apology and compensation are methods whereby an offender attempts to repair relationship damage from transgressions by acknowledging their accountability. Offender behaviors were thought to promote the victim's empathy and forgiveness. Witvliet et al. found that apology and restitution each independently increased forgiveness and positive emotions while reducing unforgiveness, negative emotion, and muscle activity above the brow. Interactions observed greater effects of restitution compared to an apology, decreasing unforgiveness and anger while elevating positivity and gratitude. Komiya et al. conducted four studies to examine a socio-ecological hypothesis on apology and compensation. They found that compensation was more effective in appeasing residentially mobile people than stable people, while apology showed an opposite effect.

OPEN ISSUES AND FUTURE DIRECTIONS

This Frontiers Research Topic on "Understanding the Processes Associated with Forgiveness" displays many approaches to the study of the process of forgiveness, emphasizing the diversity of this topic, and paving the way for future research. However, there still exist numerous issues concerning forgiveness that need to be investigated. First, a better understanding is needed of the processes that govern an individual's decision to forgive and their experiences of emotional transformation. It is still unclear what the many influences on the process of forgiveness are. We also need to understand exactly how forgiveness impacts physical and mental health. Second, more effective methods are needed to describe the process of forgiveness besides self-report. Notably, when measuring forgiveness using behavioral measurements, different experimental tasks may reflect the different psychological processes associated with forgiveness. Whether the results based on different experimental tasks are comparable and reproducible, and whether simple behavioral responses can reflect advanced psychological processes needs further study. Finally, more research is needed on the cognitive neural mechanisms of forgiveness-related processes and the neural basis of forgiveness. We look forward to seeing this Frontiers Research Topic inspire exciting new research on forgiveness in a multi-faceted and integrated manner.

AUTHOR CONTRIBUTIONS

HL, NW, and EW conceptualized the article. HL drafted the manuscript. NW and EW substantively revised the manuscript, and read and approved the submitted version. All authors contributed to the article and approved the submitted version.

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Self-Esteem Moderates the Effect of Compromising Thinking on Forgiveness Among Chinese Early Adolescents

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Forgiveness contributes to positive social relationships, which is critical for individual development, particularly for early adolescents. Most previous studies focused on the unique roles of cognitive factors (e.g., compromising thinking) and personality traits (e.g., self-esteem) in the process of developing forgiveness. However, sporadic research has examined their interactive effect on forgiveness from an integrated perspective. Given that forgiveness has been categorized into decisional and emotional forgiveness, this study aimed to examine the effects of compromising thinking on two types of forgiveness, and the moderating effects of self-esteem on the association between compromising thinking and forgiveness among early adolescents. A total of 1,009 Chinese primary and secondary school students (50.4% males; M_{age} = 11.75, SD = 1.27) were recruited to complete three self-reported questionnaires. The results showed that compromising thinking predicted decisional forgiveness but not emotional forgiveness. Furthermore, self-esteem was identified to moderate the conditional effects of compromising thinking on decisional and emotional forgiveness. These findings advance a better understanding of the construct and mechanism of forgiveness, which can provide insights for targeted forgiveness interventions among early adolescents, such as compromising thinking instructions and self-esteem enhancement programs.

Keywords: compromising thinking, decisional forgiveness, emotional forgiveness, self-esteem, early adolescents

INTRODUCTION

Early adolescence is a developmental period in which social relationships become increasingly important and complex (Parker et al., 2006), and interpersonal problems become frequent and intense (Karimova, 2015; Ma et al., 2019). A critical element in assisting in maintaining, developing, and re-establishing interpersonal relationships is forgiveness, which facilitates individual prosocial

development, especially for adolescents (McCullough, 2000; Karremans et al., 2011). Forgiveness refers to a prosocial change in emotions and behaviors after experiencing a transgression (McCullough, 2000). It is acknowledged as a principle within the ethical codes of various religious cultures, which has been substantiated to engender a variety of positive benefits, such as fewer health problems related to high blood pressure, elevated heart rate, and somatic symptoms (Karremans and Van Lange, 2008), lower levels of stress and depression (Lawler-Row and Piferi, 2006; Green et al., 2012), and higher levels of life satisfaction and psychological well-being (Worthington, 2005; Karremans and Van Lange, 2008). Thus, forgiveness is of great existential value and has gained increasing attention from researchers.

Forgiveness is known as a complex process that involves reducing negative motivation and increasing positive motivation after experiencing a transgression (Worthington, 2005). It can be categorized as *decisional forgiveness* and *emotional forgiveness*. The former refers to the behavioral intention to resist an unforgiving stance and to respond differently toward a transgressor; the latter refers to reduction of unforgiving-related negative emotions and replacement with positive prosocial emotions. These two processes have an essential distinction and interactively explain the process of forgiveness (Worthington et al., 2007b). Although numerous studies have recognized the importance of forgiveness, little research has focused on the subconstructs of forgiveness. Thus, this study focused on decisional and emotional forgiveness, instead of considering forgiveness as an integrated entity.

Most studies have focused almost exclusively on the unique roles of cognitive factors and individual traits in forgiveness (Zhang and Gu, 2009). For instance, adolescents with compromising thinking are more willing to forgive the experienced transgression (Lv et al., 2015). Also, adolescents with high self-esteem are more likely to grant forgiveness (Eaton et al., 2006; Yao et al., 2016). Recently, cognitive factors and personality traits have been proposed to interactively affect the process of forgiveness (Fehr et al., 2010). However, sporadic research provided empirical evidence, such that Miao et al. (2018) found that self-esteem moderated the effect of empathy on forgiveness among early adolescents. Importantly, empathy is associated with perspective-taking that may be related to dialectical thinking and compromise-focused thought (Lv et al., 2015); thus, the effects of compromising thinking on decisional and emotional forgiveness may be moderated by self-esteem. Taken together, this study aimed to examine the direct effect of compromising thinking and the moderating effect of self-esteem on decisional and emotional forgiveness among early adolescents.

Compromising Thinking and Forgiveness

Cognitive factors have been identified as critical contributing factors in explaining forgiveness in the stress and coping model of forgiveness (Worthington, 2006), and it is possible that compromising thinking may be a potential predictor. Compromising thinking refers to a general inclination to having a middle ground attitude rather than extreme propositions when confronting contradictions, which is identified as an important dimension subordinated to holistic thinking (Choi et al., 2007). That is, people with compromise-focused thought tend to exhibit high tolerance of contradictions, have high preferences for naïve dialecticism and constructive strategies, and pursue compromising solutions to problems (Nisbett et al., 2001; Spencer-Rodgers et al., 2010). This thinking style may be applicable to the context in which a person encounters a transgression. Adolescents with compromise-focused thought are oriented to avoid interpersonal conflicts, hold non-extreme attitudes, and try to maintain social harmony (Fu et al., 2004). During this process, they may inhibit impulsive revenge behaviors, which seems to increase decisional forgiveness (Lv et al., 2015).

Furthermore, adolescents with compromise-focused thought tend to think through a holistic perspective; also, they may dialectically reconsider the experienced transgression. This process may contribute to thoughts that there may be other contributing factors involved (e.g., It may be not totally caused by the offender), and/or there may be reciprocity (e.g., I may be forgiven in case I unintentionally offend others) (Lv et al., 2015). In this sense, those adolescents may try to reduce negative affection and grant emotional forgiveness (Donovan and Priester, 2017; Smith et al., 2019). In support of this, empirical research has found that adolescents who score high in compromising thinking are more likely to forgive the offender after being offended compared with those who score low in compromising thinking (Lv et al., 2015). Additionally, indirect experimental evidence showed that priming compromising thinking could reduce aggressive tendencies, state anger, and hostility that are associated with unforgiveness (Zhang et al., 2011; Fatfouta et al., 2015). Based on this review of the literature, the following hypotheses guided this study:

H1a: Compromising thinking is positively associated with decisional forgiveness.

H1b: Compromising thinking is positively associated with emotional forgiveness.

Self-Esteem as a Moderator

Despite the potential role compromising thinking plays in explaining the process of forgiveness, the extent of association may vary with individual differences, such as how an individual feels about and interprets a situation after experiencing a transgression (Lv et al., 2015). As stated earlier, self-esteem refers to the extent to which an individual identifies and values the self (Rosenberg, 1965). It has been regarded as a regulator of self-threat to influence the perceptions and interpretation of the self and the world (Trzesniewski et al., 2006; Sciangula and Morry, 2009). That is, high levels of self-esteem not only directly influences forgiveness, but also has a moderating effect during the process of forgiveness (Eaton et al., 2006; Yao et al., 2016; Miao et al., 2018).

Specific to transgression contexts, people with low self-esteem feel insecure and have low self-confidence and fragile self-worth; they also show high interpersonal sensitivity and possibly treat being offended as a threat to self-worth (Eaton et al., 2006). After

experiencing a transgression, adolescents with low self-esteem may automatically activate a psychological defense system. Thus, they are more likely to react with extreme behaviors (e.g., revenge) and feel as though they are not being respected even though they have compromise-focused thought (Fehr et al., 2010). That is, under the condition of low levels of self-esteem, compromising thinking may weakly affect decisional and emotional forgiveness.

In contrast, people with high self-esteem have stable self-cognition and are less influenced by the external environment (Deci and Ryan, 1995); they are less likely to overreact and to use striking-back strategies to enhance the self. In this sense, their inner cognitive thinking may determine how to cope with the transgression. Those high self-esteem adolescents with compromise-focused thought tend to hold non-extreme attitudes and are more willing to grant decisional and emotional forgiveness (Lv et al., 2015; Yao et al., 2016). In support of the moderating role of self-esteem, empirical studies have found that social-cognitive factors (e.g., empathy) have a stronger effect on forgiveness among early adolescents with high self-esteem compared with those with low self-esteem (Miao et al., 2018). Also, forgiveness interventions (i.e., instructing how to interpret transgressions) have a stronger effect on positive emotions toward the offender among women with high self-esteem compared with those with low self-esteem (Cardi et al., 2007). On the basis of the above findings, we proposed the following hypotheses:

H2a: Self-esteem moderates the effect of compromising thinking on decisional forgiveness. That is, compromising thinking has a stronger association with decisional forgiveness with high self-esteem compared with those with low self-esteem.

H2b: Self-esteem moderates the effect of compromising thinking on emotional forgiveness. That is, compromising thinking has a stronger association with emotional forgiveness with those who have high self-esteem compared with those with low self-esteem.

The Present Study

By reviewing the existing literature, cognitive factors and personality traits have been argued to interactively influence the process of forgiveness (Zhang and Gu, 2009; Fehr et al., 2010). Compromising thinking as an inclination to middle ground attitude may contribute to promoting decisional and emotional forgiveness after experiencing a transgression. Similarly, self-esteem as a regulator of self-threat influences the perceptions of transgressions, which may moderate the associations between compromising thinking and the two types of forgiveness. Considering that compromising thinking is a manifestation of Chinese culture characteristics, in which Chinese people have more compromise-focused thought compared with Westerners (as they are deeply influenced by the Confucian philosophy) (Fu et al., 2004; Spencer-Rodgers et al., 2010), this study focused on Chinese contexts and could contribute to a better understanding of forgiveness from a cultural perspective. Additionally, it is known that age is positively associated with forgiveness due to moral reasoning development and psychological maturity (Toussaint et al., 2001; Fehr et al., 2010). However, most of the previous studies were limited to adolescence and adult participants; the findings might be of somewhat limited value. To this end, the present study aimed to examine the direct effect of compromising thinking and the moderating effect of self-esteem on decisional and emotional forgiveness among early adolescents.

MATERIALS AND METHODS

Participants and Procedures

Participants were 1,009 students (509 males = 50.4%; 28 students did not report gender information) who were recruited from two ordinary primary and secondary schools in Beijing, China, with an age range from 10 to 15 years (M = 11.75, SD = 1.27). Participants consisted of 24.7% fourth graders, 33.0% fifth graders, 24.2% sixth graders, 13.1% seventh graders, and 5.0% eighth graders.

This research was approved by the Academic Ethics Committee of the Faculty of Psychology at Beijing Normal University and was implemented by research assistants in the fall semester of 2018. Prior to the formal investigation, six research assistants interviewed a total of 30 students randomly selected from primary and secondary schools (not including data collection participants). This process helped to clarify the words, statements, and instructions that were fit for students, especially for those in lower grades, which could avoid possible result bias (Fowler, 2002). Students voluntarily participated in this study. Written informed consent was obtained from participants' parents and legal guardians before the study. The informed consent and assent forms informed the participants that this investigation was anonymous and confidential, and the data would be used only for academic research. Compromising thinking, self-esteem, and decisional and emotional forgiveness were measured in sequence by the same pencil-and-paper questionnaires in the regular classrooms; the time estimated to complete the self-reported questionnaires was approximately 15 min.

Measures

Compromising Thinking

Compromising thinking style was assessed by a subscale of the Analysis-Holism Thinking Scale (Choi et al., 2007) and reflected a general middle ground attitude toward contradictions. The scale had five items with a single dimension (e.g., "It is more desirable to take the middle ground than go to extremes"). Participants rated to what extent they agreed with each item on a 7-point Likert scale, ranging from 1 (*strongly disagree*) to 7 (*strongly agree*). Higher scores indicated higher tendencies to engage in compromising thinking. The results of confirmatory factor analysis (CFA) supported the one-dimension construct validity, chi-square values, χ^2 (4) = 47.75, the comparative fit index (CFI) = 0.97, the Tucker-Lewis fit index (TLI) = 0.93, the root mean square error of approximation (RMSEA) = 0.10, and the standardized root-mean-square residual (SRMR) = 0.03. Validity

evidence showed moderate correlations with relevant measures such as the Global Style Scale and the Rahim Organizational Conflict Inventory–II (Choi et al., 2007). Additionally, the scale in this study had good internal consistency (Cronbach's α = 0.81).

Self-Esteem

The level of self-esteem was measured by a validated Chinese version of the Rosenberg Self-Esteem Scale (Yang and Wang, 2007). It had 10 items (e.g., "On the whole, I am satisfied with myself") and used a 5-point Likert scale (1 = *completely disagree*, 5 = *completely agree*), with higher scores indicating higher levels of self-esteem. The results of CFA showed that the validity of this scale was acceptable, χ^2 (28) = 114.88, CFI = 0.99, TLI = 0.98, RMSEA = 0.06, SRMR = 0.03. The scale was moderately correlated with the scale of assessing self-consistency and congruency (Yang and Wang, 2007). Additionally, the present sample revealed good internal consistency of the Rosenberg Self-Esteem Scale (Cronbach's α = 0.88).

Forgiveness

Two distinguishable forgiveness processes are decisional forgiveness and emotional forgiveness, which were assessed by the Decisional Forgiveness Scale and the Emotional Forgiveness Scale, respectively (Worthington et al., 2007a; Dorn et al., 2013), which has been validated in the Chinese context (Chi et al., 2011). The former scale contains eight items with a two-component structure, prosocial intention (e.g., "If I see him or her, I will act friendly"), and inhibition of harmful intention (e.g., "I will not seek revenge upon him/her"). The latter scale also has eight items with a two-component structure, reduction of negative emotion (e.g., "I no longer feel upset when I think of him or her"), and presence of positive emotion (e.g., "I feel sympathy toward him/her"). After participants were instructed "Think about someone who has hurt or offended you, and recall the details of the transgression," they responded to each item on a 5-point Likert scale (1 = *completely disagree*, 5 = *completely agree*), with higher scores indicating higher tendencies to engage in decisional and emotional forgiveness. The results of CFA supported the two-dimension construct validity of the Decisional Forgiveness Scale, χ^2 (17) = 137.48, CFI = 0.96, TLI = 0.93, RMSEA = 0.08, SRMR = 0.05, and the Emotional Forgiveness Scale, χ^2 (16) = 119.17, CFI = 0.96, TLI = 0.93, RMSEA = 0.08, SRMR = 0.06. The Decisional and Emotional Forgiveness Scales were both strongly correlated with other measures of interpersonal forgiveness, trait, and state forgiveness (Hook, 2007). The two scales had good construct validity and acceptable internal consistency (Cronbach's α = 0.77, 0.68, respectively).

Data Analysis

Descriptive analyses and correlations were conducted using SPSS 19.0. The direct effect of compromising thinking and the moderating role of self-esteem on forgiveness were examined using structural equation modeling (SEM) in Mplus 7.1. Moreover, the missing data were handled by maximum likelihood (ML) estimates in the analyses. The model fit was evaluated by χ^2, CFI, TLI, RMSEA, and SRMR. Notably, CFI and TLI values were larger than 0.9, and RMSEA and SRMR values were less than 0.08, indicating an acceptable model fit (Wen et al., 2004).

RESULTS

Descriptive Statistics

Means, standard deviations, and Pearson correlations for all variables are presented in **Table 1**. Age was not correlated with compromising thinking and self-esteem, but was negatively correlated with both decisional and emotional forgiveness, suggesting that it should be considered as a covariate. Compromising thinking, self-esteem, and decisional and emotional forgiveness were positively correlated with each other, except for the non-significant correlations between compromising thinking and emotional forgiveness, and between self-esteem and emotional forgiveness.

The Direct Effect of Compromising Thinking

Compromising thinking and self-esteem can be handled as manifest variables because they have a one-dimensional and homogeneous construct. Decisional and emotional forgiveness

TABLE 1 | Means, Standard Deviations and Correlations.

	M	*SD*	1	2	3	4	5	6	7	8	9
1 Age	11.75	1.27	–								
2 Compromising	26.01	6.79	0.03	–							
3 Self-esteem	36.80	8.55	−0.02	0.31***	–						
4 Decisional	28.03	6.69	−0.08*	0.16***	0.15***	–					
5 Prosocial	13.52	3.37	−0.08*	0.16***	0.10**	0.85***	–				
6 Inhibition	14.51	4.19	−0.07*	0.13***	0.17***	0.91***	0.55***	–			
7 Emotional	21.80	5.97	−0.13***	0.01	0.01	0.49***	0.44***	0.42***	–		
8 Positive	9.89	4.23	−0.09**	0.04	−0.04	0.31***	0.34***	0.23***	0.84***	–	
9 Negative	11.91	3.37	−0.12***	−0.04	0.08*	0.46***	0.34***	0.46***	0.72***	0.22***	–

Compromising = Compromising thinking, Decisional = Decisional forgiveness, Prosocial = Prosocial intention, Inhibition = Inhibition of harmful intention, Emotional = Emotional forgiveness, Positive = Presence of positive emotion, Negative = Reduction of negative emotion. Prosocial intention and inhibition of harmful intention as the subconstructs of decisional forgiveness; presence of positive emotion and reduction of negative emotion as the subconstructs of emotional forgiveness
**p < 0.05, **p < 0.01, ***p < 0.001.*

have multiple dimensions, they thus can be parceled as latent variables according to subordinated dimensions in SEM analyses (Wu and Wen, 2011). To test hypotheses H1a and H1b, a direct model was conducted and showed a satisfactory model fit, χ^2 (4) = 11.00, CFI = 0.99, TLI = 0.97, RMSEA = 0.04, SRMR = 0.02. The model indicated that compromising thinking positively predicted decisional forgiveness (β = 0.18, $p < 0.001$) but failed to predict emotional forgiveness ($p = 0.89 > 0.05$) after controlling for the effect of age. The finding indicated compromising thinking was associated with decisional forgiveness but not with emotional forgiveness, supporting H1a, but not supporting H1b.

The Moderating Effect of Self-Esteem

In regard to the hypotheses of self-esteem (H2a, H2b), the moderating model had a good model fit, χ^2 (8) = 23.93, CFI = 0.98, TLI = 0.94, RMSEA = 0.05, SRMR = 0.02. As shown in **Figure 1**, the results suggested that the interaction term (i.e., a product of compromising thinking and self-esteem) predicted both decisional and emotional forgiveness after controlling for the effect of age. In addition, bias-corrected bootstrap tests with 1000 deriving samples were adopted. Neither the confidence interval (CI) of the interaction term on decisional (90% CI [0.001, 0.15]) and emotional forgiveness (95% CI [0.03, 0.13]) included zero, indicating the significant moderating effects of self-esteem.

To further clarify the essence of the interaction effect, a simple slope analysis was conducted. Specifically, participants were divided into two counterparts (i.e., High = $M + SD$; Low = $M-SD$) on the basis of the levels of the moderator. As shown in **Figure 2A**, among early adolescents with low levels of self-esteem, compromising thinking did not predict decisional forgiveness (β = 0.08, 95% CI [−0.04, 0.17]), while the prediction became significant among early adolescents with high levels of self-esteem (β = 0.26, 95% CI [0.11, 0.35]). Importantly, further examination of the slopes under different levels of self-esteem demonstrated marginal significance (90% CI [0.02, 0.30]), which suggested that self-esteem moderated the effect of compromising thinking on decisional forgiveness, supporting H2a.

Similarly, as shown in **Figure 2B**, among early adolescents with low levels of self-esteem, compromising thinking negatively predicted emotional forgiveness (β = −0.23, 95% CI [−0.14, −0.03]). In contrast, among early adolescents with high levels of self-esteem, compromising thinking positively predicted emotional forgiveness (β = 0.22, 95% CI [0.01, 0.15]). Additional examination of slopes demonstrated statistical significance (95% CI [0.07, 0.26]), which indicated self-esteem moderated the effect of compromising thinking on emotional forgiveness, supporting H2b.

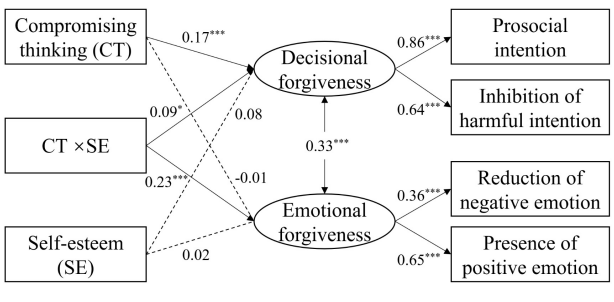

FIGURE 1 | A moderating model of self-esteem in the associations between compromising thinking and forgiveness. The effect of age was controlled. All coefficient estimates are completely standardized. *$p < 0.05$, ***$p < 0.001$.

DISCUSSION

This study was one of a few studies that simultaneously examined the effects of cognitive factors (e.g., compromising thinking) and personality traits (e.g., self-esteem) on decisional and emotional forgiveness among primary and secondary school students. Based on a large sample of early adolescents, the results revealed slightly negative correlations between age and two types of forgiveness. Furthermore, compromising thinking positively predicted decisional forgiveness, but it did not directly predict emotional forgiveness. More importantly, the conditional predictions were moderated by individual difference in self-esteem. In sum, these findings contribute to further understanding of the construct and mechanism of forgiveness within Chinese contexts, which can lend credence to prosocial development interventions among young people.

The Relation Between Age and Forgiveness

This study showed weak and negative correlations between age and decisional forgiveness/emotional forgiveness among primary and secondary school students. The negative relation was consistent with the findings among fourth, seventh, and ninth grader samples (Goss, 2007). Although the previous study found that age was positively associated with forgiveness (Toussaint et al., 2001), the discrepancy may be due to the age span of the sample. That is, Toussaint's study investigated participants aged from 18 to over 65 years, whereas this study focused on early adolescence aged 10–15 years. As earlier, turning from late childhood to early adolescence, interpersonal conflicts become more frequent and intense (Karimova, 2015; Ma et al., 2019). Thus, early adolescents seem to show a slight decline in decisional and emotional forgiveness, although they may be becoming psychologically mature. Taken together, these findings partially supported the notion that prosocial behaviors show an initial decline during early adolescence and a subsequent increase during adulthood (Luengo Kanacri et al., 2013). For another thing, the weak correlations coincided with the meta-analysis results in which relationship between age and forgiveness ($r = 0.06$) was so small that it can be nearly negligible (Fehr et al., 2010). Future studies (e.g., expanding age span, using longitudinal research) are warranted in order to further reveal the association between age and forgiveness.

Compromising Thinking, Self-Esteem, and Decisional Forgiveness

The results showed that compromising thinking positively predicted decisional forgiveness after the effect of age was controlled, consistent with the previous research (Lv et al., 2015).

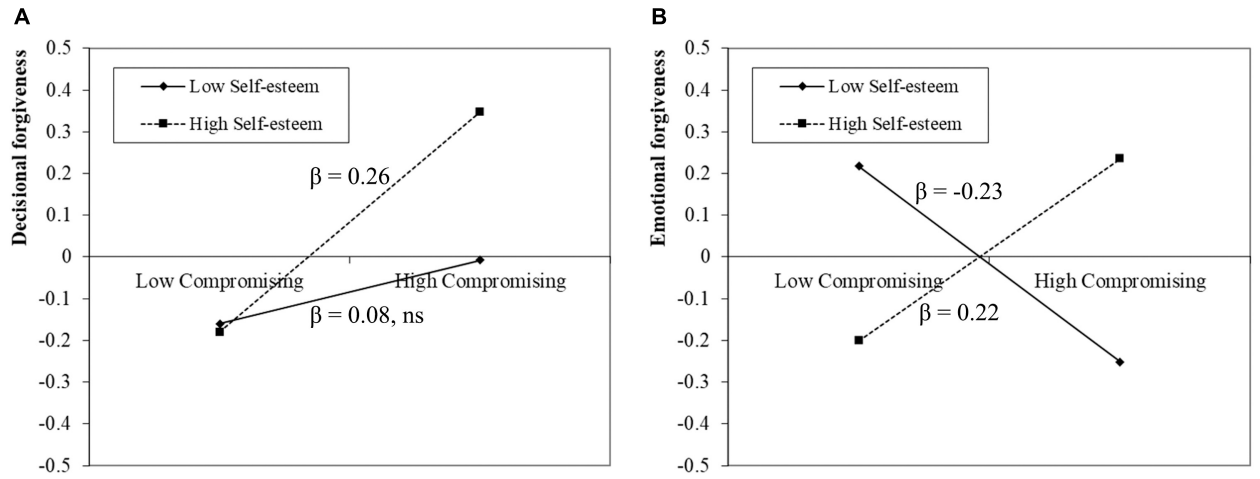

FIGURE 2 | Self-esteem moderated the effects of compromising thinking on decisional and emotional forgiveness. **(A)** indicates the interactive effect on decisional forgiveness. **(B)** indicates the interactive effect on emotional forgiveness. ns, non-significant.

Influenced by the doctrine of the mean of the Confucian philosophy, such as the proverb "a bad compromise is better than a good lawsuit," Chinese people are prone to adopt a middle ground attitude and find compromising solutions when they are confronted with contradictions (Nisbett et al., 2001). Specific to a transgression context, when being offended by someone, Chinese early adolescents with compromise-focused thought may be less likely to react with extreme behaviors as they are oriented against interpersonal conflict and toward social harmony (Fu et al., 2004). Thus, they may not seek revenge upon the offender, and even try to treat him/her as usual to maintain harmonious relationships (Lv et al., 2015). It seemed possible that compromising thinking was positively associated with decisional forgiveness among early adolescents.

Furthermore, self-esteem moderated the effect of compromising thinking on decisional forgiveness. That is, compromising thinking did not predict decisional forgiveness among early adolescents with low self-esteem, but it positively predicted decisional forgiveness among early adolescents with high self-esteem. Consistent with the previous research, the role of social-cognitive factors in predicting forgiveness strengthened with increased self-esteem (Miao et al., 2018). Early adolescents with low self-esteem feel insecure and have low self-worth; they may give priority to protecting their threatened self-esteem (Eaton et al., 2006). Those with compromise-focused thought seem not to resist seeking revenge and not to express a forgiving attitude to the transgressor, because they tend to self-protect even though they have compromise-focused thought toward the transgression. In contrast, early adolescents with high self-esteem have relatively secure and stable self-cognition; they may attenuate negative value of the offense and not treat it as a threat to the self (Eaton et al., 2006). Their compromise-focused thought may encourage them to hold a middle ground attitude and to find harmonious resolutions after experiencing a transgression (Lv et al., 2015). In short, it was plausible that compromising thinking was not associated with decisional forgiveness among early adolescents with low self-esteem, but it was positively associated with decisional forgiveness among early adolescents with high self-esteem.

Compromising Thinking, Self-Esteem, and Emotional Forgiveness

Although compromising thinking did not directly predict emotional forgiveness after the effect of age was controlled, self-esteem moderated the association between compromising thinking and emotional forgiveness. That is, compromising thinking negatively predicted decisional forgiveness among early adolescents with low self-esteem, whereas it positively predicted decisional forgiveness among early adolescents with high self-esteem. As stated earlier, self-esteem to some extent influences the perceptions of external and subsequent behaviors (Trzesniewski et al., 2006; Sciangula and Morry, 2009). In turn, these perceptions and thoughts may regulate how to interpret and appraise transgressions, as described in the stress and coping model of forgiveness (Strelan and Covic, 2006; Worthington, 2006). For instance, after suffering from being offended, early adolescents with low self-esteem may experience emotional shifts and exhibit high hostility (Zeigler-Hill et al., 2011). Those people may appraise the offense as an act of provocation and regard emotional inaction as a manifestation of weakness (Fehr et al., 2010). Afterward, they may feel angry and resentful toward the transgression (e.g., emotional unforgiveness), although they have compromise-focused thought.

In contrast, early adolescents with high self-esteem have sufficient psychological resources; they may appraise the incident as a challenge for self-enhancement and believe in prosocial changes as a way of spirituality-shaping and personal growth (Lawler-Row and Piferi, 2006; Strelan and Covic, 2006). In this sense, those people with compromise-focused thought are more likely to exhibit positive emotions and be more willing to grant emotional forgiveness. By and large, it was plausible that

compromising thinking was negatively associated with emotional forgiveness among early adolescents with low self-esteem, but it was positively associated with emotional forgiveness among early adolescents with high self-esteem.

Limitations, Implications and Future Directions

Several limitations of this study should be noted. First, a cross-sectional design cannot make causal inferences; thus, future researchers might use an experimental design to further examine its effect on forgiveness. For example, compromising thinking can be primed by relevant materials (Zhang et al., 2011), and forgiveness can be measured by the Forgiveness Implicit Association Test (Goldring and Strelan, 2017). Second, compromising thinking, to a large extent, is a characteristic of East Asians relative to Westerners (Nisbett et al., 2001); thus, future research could focus on cultural differences of thinking styles and its effects on forgiveness after transgressions. Third, although the Decisional and Emotional Scales have adequate reliability and validity, there is a possibility that participants may consider different types of transgressions, which might potentially influence the final results. Thus, the measures should be further improved and enhanced in any future research. Fourth, age appears to be positively related to forgiveness due to psychological maturity (Toussaint et al., 2001), but it was found to have weak and negative correlations in this study. Future studies could investigate people in a larger age span, which might contribute to validating the correlation and advancing a better understanding of the developmental process of forgiveness. Finally, given that forgiveness involves a transgressor, a victim, and sometimes observers and other social elements (Worthington, 2005), forgiveness processes may vary with situational characteristics (Fehr et al., 2010). Future researchers could consider other moderating mechanisms to enhance and integrate the models of forgiveness.

Despite these limitations, several theoretical and practical implications of this study should be noted. This study found a slightly negative relationship between age and forgiveness, which complements the previous research that mainly focused on adolescence and adulthood. Moreover, this study was, to date, the first piece of research to examine the effects of compromising thinking on decisional and emotional forgiveness, and the moderating effects of self-esteem on the association. On the one hand, these findings supported the unique and distinct constructs of forgiveness (Worthington et al., 2007b). On the other hand, this study provided empirical evidence to substantiate that cognitive factors and personal traits interact on the process of forgiveness (Zhang and Gu, 2009; Fehr et al., 2010).

In regards to targeted forgiveness interventions for early adolescents, compromising thinking can be improved by naïve dialecticism training, which may be instrumental in reconciling non-constructive cognitions and alleviate non-adaptive emotions, thereby further avoiding social conflicts, fostering forgiveness, reducing somatic symptoms, and increasing psychological well-being (Karremans and Van Lange, 2008). To be specific, parents, teachers, and mental health workers can guide students to think in a dialectical way, instruct them to hold a holistic perspective, and educate them to seek constructive solutions (Zhang et al., 2011). These processes may be conducive to reconciliating negative experiences (e.g., betrayal traumas) and facilitate adaptive coping strategies (Boyraz et al., 2019). For another thing, self-esteem was found not only as a contributing factor of forgiveness, but also as a potential moderator to increase the effects of cognitive factors on forgiveness. Families and schools could implement self-esteem enhancement programs, which are beneficial to ameliorate how students perceive and react after experiencing a transgression, and then promote the occurrence of decisional and emotional forgiveness, especially true among early adolescents with compromise-focused thought.

DATA AVAILABILITY STATEMENT

The datasets generated for this study are available on request to the corresponding author.

ETHICS STATEMENT

The studies involving human participants were reviewed and approved by the Academic Ethics Committee of the Faculty of Psychology at Beijing Normal University. Written informed consent to participate in this study was provided by the participants' legal guardian/next of kin.

AUTHOR CONTRIBUTIONS

WH and R-DL designed the study, analyzed the data, and drafted the manuscript. WH, YD, and TO revised the manuscript. XF, RJ, and SJ collected the data. All co-authors participated in the discussion of the results.

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Why Do People With Self-Control Forgive Others Easily? The Role of Rumination and Anger

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Previous research shows that self-control predicts forgiveness, but few studies have investigated the internal mechanism of this link. The current study explored the effects of rumination and anger on the relationship between self-control and forgiveness. A total of 580 college students recruited from three universities in Wuhan completed the self-control, rumination, anger, and trait forgiveness scales. Results showed that self-control was positively correlated with forgiveness ($r = 0.34$, $p < 0.001$). Rumination ($\beta = 0.08$, $p < 0.05$) and anger ($\beta = 0.13$, $p < 0.05$) mediate the relationship between self-control and forgiveness. Moreover, a serial mediation effect of rumination and anger was observed between self-control and trait forgiveness ($\beta = 0.02$, $p < 0.05$). These findings suggest that self-control may impair individuals' rumination. Moreover, less rumination may restrain anger and consequently increase forgiveness.

Keywords: self-control, rumination, anger, trait forgiveness, serial mediation effect

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INTRODUCTION

Connecting with others and maintaining harmonious interpersonal relationships is necessary within society. However, interpersonal relationships are often disturbed by certain offenses, which may result in the breakdown of relationships between the victim and the offender; opportunities for downstream gains from such relationships may also be lost (McCullough et al., 2013). The drawbacks of ending a relationship normally motivate victims to choose forgiveness to maintain the original state of the relationship (McCullough et al., 2010). At the dispositional level, individuals differ much in their willingness to forgive, and trait forgiveness has been conceptualized as a basis for responses to specific transgressions (Roberts, 1995). According to the interpersonal variable model, personalities are important factors of trait forgiveness (Koutsos et al., 2008). People with a high level of agreeableness or empathy often show forgiveness in a specific relationship (McCullough and Hoyt, 2002; Giammarco and Vernon, 2014).

Self-control is the ability to monitor and regulate behavior to achieve long-term goals (Balliet, 2010; Pronk et al., 2010). People who have poor self-control may perform unconstrained impulsive actions to serve immediate urges, desires, and emotions (Hagger et al., 2010). Moreover, self-control plays a role in social relationships (McCullough et al., 2013).

Relationship Between Self-Control and Trait Forgiveness

McCullough et al. (1998) have argued that individuals undergo complex motivation in the case of an offense. On the one hand, offense behavior, as a stress factor, instinctively triggers

victims' negative interpersonal motivations (e.g., avoidance or revenge) toward offenders (Finkel and Campbell, 2001). On the other hand, unforgiveness means losing the possibility to gain potential benefits from these relationships; victims may regain the prosocial motivation to get along with offenders (McCullough et al., 2010). Prosocial motivation and negative interpersonal motivation are tightly related; forgiveness occurs when prosocial motivation is stronger than negative interpersonal motivation (McCullough et al., 1998). According to interdependence theory, self-control plays a role in motivation transformation when individuals are in mixed motivation states; a person with a high level of self-control can easily transfer negative interpersonal motivation into prosocial motivation (Righetti et al., 2013). According to the compensation model, trait self-control is positively related to forgiveness even in the absence of concern for the well-being of others (Balliet et al., 2011). Beyond these observations, the result of a mate analysis shows that individuals with a high level of self-control often have a high tendency to forgive others (Burnette et al., 2014). In other words, self-control can positively predict trait forgiveness (Balliet et al., 2011; Yin, 2016). On the basis of previous findings, we suggest the following hypothesis: *Self-control positively predicts trait forgiveness* (H1).

Mediation Effect of Rumination Between Self-Control and Trait Forgiveness

Rumination, as a negative cognition process, is a strategy used when dealing with a negative experience; this process involves repetitive and passive focus on one's negative experiences (Denson et al., 2011). Rumination often makes people feel uncomfortable, thus increasing their tendency toward aggression (Denson et al., 2011). When people experience an offense, they recall details repeatedly and think about the negative consequences of the offense. Rumination involves central executive functions (Smith and Alloy, 2009), and self-control is closely related to the advanced cognitive activity and can therefore suppress rumination through central executive functions (Hofmann et al., 2012). Meanwhile, a study has shown that self-control is negatively related to rumination (Denson et al., 2011), thus indicating that self-control may predict one's rumination.

The relationship between rumination and forgiveness has been investigated several times. Lucas et al. (2010) has found that rumination is negatively related with forgiveness. Furthermore, Berkowitz (2012) has reported that rumination makes victims experience offended feelings repeatedly, which ultimately hampers forgiveness. Moreover, researchers have indicated that rumination can negatively predict forgiveness, and the possibility of forgiveness can be increased by reducing rumination (Fatfouta, 2015; Witvliet et al., 2015). In other words, rumination may predict trait forgiveness negatively. Meanwhile, rumination is considered one of the most important factors in interpersonal forgiveness among college students (Zhang et al., 2017). A review study has noted that cognitive factors, such as rumination, may be a considerable predictor for forgiveness (Ma and Zheng, 2012). Furthermore, a recent study has shown that rumination partly mediates the relationship between self-control and trait forgiveness, suggesting that self-control may increase forgiveness by decreasing the level of rumination (Xia et al., 2017). On the basis of previous findings, we formulate the following hypothesis: *Self-control positively predicts trait forgiveness through rumination* (H2).

Mediation Effect of Anger Between Self-Control and Trait Forgiveness

Except for cognitive processes, self-control may also influence emotional regulation (Hofmann et al., 2012; Watkins et al., 2013). Watkins et al. (2013) have found that a high level of self-control can help individuals perform effective emotional management and ensure that emotions can be expressed appropriately. Empirical studies have suggested that self-control can effectively reduce anger (Chapman et al., 2006). Another study has shown that high school students with a high level of self-control tend to express less anger (Hamarta et al., 2015). In sum, self-control may predict anger negatively.

Moreover, anger is a key factor that prevents trait forgiveness. Numerous offenses often trigger fierce anger within victims, thus making forgiveness difficult. First, anger reduction from the event that triggered anger to the current state is positively related to forgiveness (Konstam et al., 2001). Then, a cross-cultural investigation has found a negative association between anger and forgiveness in both U.S. and Chinese culture (Zhang et al., 2015). Furthermore, a meta-analysis has suggested that people with a high level of anger are less likely to grant forgiveness than those with a low level of anger (Fehr et al., 2010). In other words, anger and forgiveness are negatively correlated. To explore the causal relationship between anger and forgiveness, a longitudinal study has found that the level of anger can negatively predict the level of forgiveness (McCullough et al., 2007). Therefore, we formulate the following hypothesis: *Self-control positively predicts trait forgiveness through the mediation of anger* (H3).

Multiple Mediation Effect of Rumination and Anger Between Self-Control and Trait Forgiveness

Rumination is an important risk factor for anger. The ABC theory of emotion demonstrates that cognition is the direct cause of emotion (Ziegler, 2001). We have deduced that rumination can predict anger, and numerous empirical studies have investigated the link between them. Berkowitz (2012) has stated that rumination, which is conceptualized as the repeated recall of aggressive behaviors, can activate the feelings of being offended and eventually trigger anger. Bushman (2002) has also found that rumination can instigate anger. Runions (2013) has shown that the anger of victims toward offenders can be effectively reduced by decreasing rumination. Thus, rumination may be a negative predictor of anger. Furthermore, a recent study among Chinese college students has shown that rumination and anger are positively correlated with each other, and anger and rumination are both negatively associated with forgiveness (Wu et al., 2019). However, no study has examined the role of anger and rumination simultaneously in the relationship between self-control and forgiveness. To explore the underlying

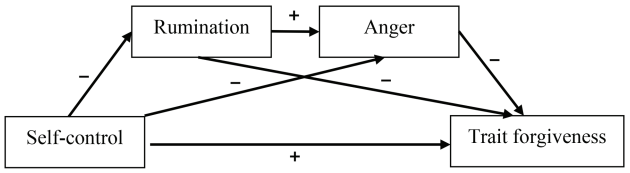

FIGURE 1 | Conceptual model.

mechanism of the influence of self-control on forgiveness clearly, we propose the following hypothesis: *Self-control positively predicts trait forgiveness through the multiple mediations of rumination and anger* (H4).

The present study explores how self-control influences trait forgiveness by building multiple mediation models (**Figure 1**). This study will provide new evidence to determine how self-control influences forgiveness and to guide the intervention and treatment of forgiveness behaviors.

METHOD

Participants

A total of 580 students were randomly recruited from three universities in Wuhan, Hubei province. The final valid sample size was 573, which comprised 284 females, 276 males, and 13 unreported students. Seven participants were excluded because the completion of their questionnaire was lower than two-thirds of the total items. The participants' age ranged from 16 to 36, and the mean age was 22.26 years (SD = 4.01).

Measures

Self-Control Scale

Self-control was measured with the 19-item self-control scale, which was revised from the Chinese samples by Tan and Guo (2008). The items were rated by a five-point scale ranging from 1 (*totally disagree*) to 5 (*totally agree*). One example was the statement, "I can resist the temptation easily." The total score ranged from 19 to 95. High scores indicated great self-control. The scale was a reliable and valid measurement of self-control (Tan and Guo, 2008). In this study, the Cronbach's α was 0.86, and the fit indices of confirmatory factor analysis were shown as follows: χ^2/df = 2.35, NFI = 0.90, CFI = 0.94, RMSEA = 0.05.

Rumination Scale

The Chinese version of the seven-item rumination scale was developed by Wang (2006), which included items such as "Sad things in the past always come to my mind, which makes it hard to fall asleep." The items were rated by a 5-point scale ranging from 1 (*totally disagree*) to 5 (*totally agree*). The total score ranged from 7 to 35. Higher scores indicated more rumination. The scale showed excellent reliability and validity (Wang, 2006). In the present research, the Cronbach's α was 0.87, and the fit indices of confirmatory factor analysis were shown as follows: χ^2/df = 3.77, NFI = 0.98, CFI = 0.98, RMSEA = 0.07.

Anger Scale

This scale was the sub-scale of the State-Trait Anger Expression Inventory (STAXI) (Spielberger, 1999), which was used to measure an individual's level of anger after an offense. The Chinese version of the sub-scale was revised by Liu and Gao (2012), which included six items. Each item was rated by a five-point scale ranging from 1 (*totally disagree*) to 5 (*totally agree*). The total score ranged from 6 to 30. Higher scores indicated more anger. An example of the questions included "I will feel angry if I am behind schedule because of others' mistakes." In this study, the Cronbach's α was 0.81, and the fit indices of confirmatory factor analysis were shown as follows: χ^2/df = 3.50, NFI = 0.96, CFI = 0.97, RMSEA = 0.07.

Trait Forgiveness Scale

The scale included the Heartland Forgiveness Scale (HFS)-Self sub-scale with items such as "I always feel regretful about my mistakes" and HFS-Other sub-scale with items like "In most cases, I can forgive others for their faults" (Thompson et al., 2005). The two sub-scales had 12 items each, but only the HFS-Other was employed for studying individuals' forgiveness tendency toward others. The items were rated by a five-point scale ranging from 1 (*totally disagree*) to 5 (*totally agree*). The total score ranged from 12 to 60. Higher scores indicated higher trait forgiveness. In the current study, the Cronbach's α was 0.80. The fit indices of confirmatory factor analysis were shown as follows: χ^2/df = 4.26, NFI = 0.90, CFI = 0.92, RMSEA = 0.07.

Procedure and Data Processing

This study was approved by the Human Research Ethics Committee, School of Psychology in XXX University and all participants signed an informed consent form before their inclusion in the formal research. The participants were students recruited randomly from three universities in Wuhan, China. These participants were supposed to read the instructions carefully before completing the scale. The data were collected in person, and each participant was given a large pack of tissue worth 10 RMB after the investigation. The missing data were replaced by the population mean value because less than 0.1% of the total data were missing. We conducted descriptive analysis, correlation analysis, and multiple mediation analysis on self-control, rumination, anger, and trait forgiveness.

RESULTS

Control and Test of Common Method Bias

Using self-report to collect data might result in common method bias, so certain actions were taken (Zhou and Long, 2004). Participants answered the questions completely and anonymously, and some items were reverse coded. Furthermore, Harman's single-factor test was used to test the common method bias when the data were collected. The results showed that 11 factors had an eigenvalue that was more than 1. The first factor accounted for 20.25% of the total variance, which was less

than the critical standard 40% (Zhou and Long, 2004). Therefore, no significant common method bias was observed.

Descriptive Statistics and Correlations

After controlling the effects of age and sex, the results showed significant correlations between every two variables. The absolute values of the correlation coefficients were between 0.30 and 0.55 (**Table 1**).

Multiple Mediation of Rumination and Anger

Bias-corrected percentile bootstrap method was used to test the mediation effect of rumination and anger (Hayes, 2013). The number of bootstrap samples was 5,000. The level of confidence for all confidence intervals in the output was 95%. Given that the CI did not contain 0, the mediation effect was significant. The results showed that after controlling gender and age, all the paths were significant in the overall model (**Figure 2**).

On the direct effect, trait forgiveness was predicted by self-control significantly. On the indirect effects, the total indirect effect was significant (**Table 2**). Specifically, rumination was the meditator [β = 0.08, $p < 0.05$, CI (0.05, 0.13)] in the path of self-control → rumination → trait forgiveness (Indirect effect 1). Anger was the meditator variable [β = 0.13, $p < 0.05$, CI (0.09, 0.18)] in the path of self-control → anger → trait forgiveness (Indirect effect 2). A serial mediation effect of rumination and anger was observed [β = 0.02, $p < 0.05$, CI (0.01, 0.04)] in the path of self-control → rumination → anger → trait forgiveness (Indirect effect 3).

DISCUSSION

Relationship Between Self-Control and Trait Forgiveness

The study finds that self-control can positively predict trait forgiveness, which supports H1. This finding is consistent with that of previous research (Balliet et al., 2011; Yin, 2016; Xia et al., 2017). According to interdependence theory, a low level of self-control makes individuals susceptible to negative interpersonal motivation and causes them to act impulsively (Righetti et al., 2013). Another explanation is that enhancing self-control will help improve problem-solving strategies, such as negotiation instead of revenge, and, eventually, the act of forgiveness.

Mediation Effects of Rumination and Anger in the Relationship of Self-Control and Trait Forgiveness

The results show that self-control can positively predict trait forgiveness through rumination, which supports H2. This finding has also been proven by Xia et al. (2017), indicating that rumination mediates the relationship between self-control and forgiveness. Self-control, as a type of basic human ability, has a broad influence on cognition processes (Ma and Zheng, 2012). People with high level of self-control can efficiently decrease rumination to improve the tendency of forgiveness.

Moreover, the results show that self-control can predict trait forgiveness through anger, which supports H3. This finding is also consistent with Ma and Zheng's (2012) view that emotional factor plays a role in the relationship between self-control and trait forgiveness. Previous research has found that anger is a negative factor for forgiveness (Fehr et al., 2010; Zhang et al., 2015), and reducing anger promotes forgiveness (Konstam et al., 2001). The present study explores the role of anger in the relationship between self-control and forgiveness.

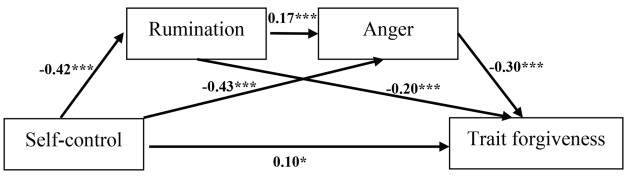

FIGURE 2 | Multiple mediation model.

TABLE 2 | Indirect effects of self-control and trait forgiveness.

	β	Boot SE	Boot LLCI	Boot ULCI	Ratio of total effects
Total indirect effect	0.23	0.03	0.18	0.29	69.70%
Indirect effect 1	0.08	0.02	0.05	0.13	24.24%
Indirect effect 2	0.13	0.02	0.09	0.18	39.40%
Indirect effect 3	0.02	0.01	0.01	0.04	6.06%

β refers to standardization effect size.

TABLE 1 | Descriptive statistics and correlations among variables.

	M ± SD	1	2	3	4
1. Self-control	59.01 ± 10.30	—			
2. Rumination	18.69 ± 5.96	–0.43***	—		
3. Anger	22.21 ± 4.79	–0.51***	0.36***	—	
4. Trait forgiveness	39.67 ± 6.77	0.34***	–0.35***	–0.43***	—

****p < 0.001 (all two-tailed test).*

In addition, self-control influences trait forgiveness through the multiple mediation effect of rumination and anger, which supports H4. Berkowitz (2012) has shown that rumination allows individuals to experience high levels of anger and found that the act of forgiveness is challenged by activating negative information about offenses. Meanwhile, individuals with high level of self-control are likely to restrain rumination (Denson et al., 2011; Xia et al., 2017), have less anger, and can eventually forgive others. As mentioned above, rumination is a kind of cognition process, and anger is a specific emotion. Therefore, according to the ABC theory, we can speculate that rumination may be a cognition process that can lead to anger. Self-control subsequently predicts trait forgiveness through the mediators of rumination and anger in the current study. Moreover, these findings elaborate the theory of Ma and Zheng (2012) and enrich our understanding of mediators of rumination and anger in the relationship between self-control and trait forgiveness among Chinese college students. However, the perspectives about the direction from rumination to anger vary. Some studies have suggested that rumination is indirectly associated with forgiveness through anger (Bushman, 2002; Ray et al., 2008). Other studies have suggested that anger may improve the level of rumination, particularly anger rumination, which is a kind of rumination that recall past anger experiences. Thus, future studies should further examine the relationship, mainly the direction, of rumination and anger through a longitudinal design. The present study is the first to investigate the inner mechanism underlying self-control and forgiveness in the Chinese context. A serial meditation model has been conducted to enrich the theory of forgiveness behaviors and provide important suggestions for practice in the intervention of forgiveness. In practice, victims can reduce rumination by improving the level of self-control. Then, they may feel fewer negative emotions and eventually increase their willingness to forgive offenders.

Limitations

This study has a few limitations. First, the causal relationship of self-control and forgiveness has not been tested due to the cross-sectional research design. Future research should use longitudinal design or a three-wave cross-lagged design to examine the causal relationship of self-control and trait forgiveness. Second, the act of forgiveness varies in different backgrounds and events in which offense is inflicted. Thus, these factors should be considered in future studies to investigate the relationship between self-control and trait forgiveness. Third, this study has focused only on dispositional states of self-control, anger, rumination, and forgiveness. Finally, the participants of this study are mainly college students. Therefore, the results are not extensively representative. In the future, replicating the present study with a large sample group can address the issue of generalizability.

CONCLUSION

Self-control positively predicts trait forgiveness directly and through the chain mediation of rumination and anger indirectly.

DATA AVAILABILITY STATEMENT

The raw data supporting the conclusions of this manuscript will be made available by the authors, without undue reservation, to any qualified researcher.

ETHICS STATEMENT

The studies involving human participants were reviewed and approved by Central China Normal University Human Ethics Committee. The patients/participants provided their written informed consent to participate in this study.

AUTHOR CONTRIBUTIONS

FK designed the research and revised the paper. HZ and HX collected and analyzed the data and wrote the paper. BH and JQ recruited participants and collected data. XS, ZZ, and YZ revised the paper. All authors agreed on the final version of the manuscript.

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ORIGINAL RESEARCH
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Apology and Restitution: The Psychophysiology of Forgiveness After Accountable Relational Repair Responses

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Apology and restitution each represents wrongdoers' accountable repair responses that have promoted victims' self-reported empathy and forgiveness in crime scenario research. The current study measured emotional and stress-related dependent variables including physiological measures, to illuminate the links between predictors of forgiveness and health-relevant side effects. Specifically, we tested the independent and interactive effects of apology and restitution on forgiveness, emotion self-reports, and facial responses, as well as cardiac measures associated with stress in 32 males and 29 females. Apology and restitution each independently increased empathy, forgiveness, gratitude, and positive emotions, while reducing unforgiveness, negative emotion, and muscle activity above the brow (corrugator supercilii, CS). The presence of a thorough apology—regardless of whether restitution was present—also calmed heart rate, reduced rate pressure products indicative of cardiac stress, and decreased muscle activity under the eye (orbicularis oculi, OO). Interactions pointed to the more potent effects of restitution compared to apology for reducing unforgiveness and anger, while elevating positivity and gratitude. The findings point to distinctive impacts of apology and restitution as factors that foster forgiveness, along with emotional and embodied changes relevant to health.

Keywords: forgiveness, accountability, apology, restitution, heart rate, rate pressure product, facial electromyography, emotion

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INTRODUCTION

An emerging literature provides evidence that victims are more forgiving if they receive an apology (see Fehr et al., 2010) or restitution (Carlisle et al., 2012; Witvliet et al., 2020) or both in combination (Kiefer et al., 2020). The present investigation extends this work by also examining emotional and embodied responses to apology and restitution, with implications for the growing literature on forgiveness and its physiological side effects as health pathways (Witvliet et al., in press)[1].

[1]Witvliet, C. V. O., Cheadle, A. D., and Root Luna, L. M. (in press). "Forgiveness: Psychophysiological side-effects and pathways to health," in *Handbook of Forgiveness in Philosophy and Psychology*, eds B. Enright, and G. Pettigrove (New York, NY: Routledge).

We conceptualize interpersonal offenses as relational injustices for which transgressors are accountable to those harmed through their actions or failures to act (Witvliet, 2020). Whereastransgressions are violations of expectations for responsible interpersonal behavior (e.g., that a person will not cause harm), apology may signal the offender's accountable responsibility-taking for wrongdoing against the victim, and restitution may represent tangible and quantifiable recompense for the injustice (Witvliet et al., 2020). In this way, apology and restitution may represent relational and restorative responses that reduce the gap a victim perceives between injustice experienced and the justice desired (see Witvliet et al., 2008b). Reducing this injustice gap is associated with reductions in negative and aroused affect such as fear, sadness, and anger that are part of unforgiveness (Exline et al., 2003; Worthington, 2006; Witvliet et al., 2008b; Davis et al., 2016)—while also elevating positive and prosocial responses of gratitude, empathy, and forgiveness with associated emotional and physiological change (e.g., Witvliet et al., 2010, 2019).

Prior research has found that apology and restitution can each foster forgiveness. In experiments using a burglary scenario with both students and a community sample, Witvliet et al. (2020) found that experimental manipulations of apology and restitution independently prompted greater self-reported empathy and forgiveness while decreasing unforgiving motivations such as avoidance and revenge. Carlisle et al. (2012) found self-reported and behavioral evidence that apology and restitution each prompted forgiveness-consistent responses for a lab study offense of unfair raffle ticket distribution. Specifically, receiving an apology note prompted higher self-reported forgiveness, and receiving restitution prompted a behavioral forgiveness-oriented response (i.e., higher distribution of raffle tickets). Lab-based apology research showed that including restitution-oriented information—communicating that a lab offense was fake—promoted more forgiving responses (Zechmeister et al., 2004) and lower judgments of irresponsibility (Ohbuchi et al., 1989). In addition, Jeter and Brannon (2018) found that apologies that included an expressed desire to engage in restitution were particularly effective for inducing forgiveness.

Although no known studies have assessed the affective physiology associated with receiving restitution, three studies have addressed apology and stress-related cardiovascular responses (Anderson et al., 2006; Whited et al., 2010; Kubo et al., 2012). Both Anderson et al. (2006) and Whited et al. (2010) verbally harassed participants in the lab while they completed challenging arithmetic exercises. Anderson et al. (2006) found that the absence of an apology was associated with poor recovery from systolic blood pressure elevations in highly hostile participants. Specifically, 5 min into a recovery period, participants high in hostility who received no apology showed impaired systolic blood pressure recovery, moderate recovery for a pseudo-apology lacking remorse, and best recovery for a good apology. After 10 min of recovery, hostile participants who received no apology still had higher systolic blood pressure than those who received a pseudo-apology or a good apology (Anderson et al., 2006).

In the laboratory of Whited et al. (2010), receiving an apology versus no apology improved heart rate (HR) variability, indicative of improved parasympathetic nervous system engagement and self-regulation during the recovery period. Receiving an apology was also associated with diastolic and mean arterial blood pressure recovery, but an interaction with sex revealed that this pattern occurred only in women. Men showed the opposite blood pressure responses to receiving an apology for lab-based harassment. Sex did not predict responses to apology for self-reported hostility or positive affect.

In a study by Kubo et al. (2012), Japanese students received insulting written feedback on an essay, followed by either a simple written apology for the negative feedback or no apology. Apology groups did not differ in negative or positive emotion or in their skin conductance patterns, suggesting that sympathetic nervous system engagement did not differ across groups. However, the participants in the no-apology condition showed more anger and asymmetry in frontal brain activity indicative of approach motivation. By contrast, participants in the simple apology condition did not show this asymmetry in central nervous system functioning, did not show an increase in anger, and were buffered against HR reactivity.

Increasingly, forgiveness has been conceptualized within a multidimensional emotion framework that includes verbal–cognitive, behavioral, and physiological responses (see Witvliet and McCullough, 2007; Witvliet, 2020). Forgiving and unforgiving conditions have produced differentiated physiological reactivity and recovery patterns (e.g., Witvliet et al., 2001; Lawler et al., 2003). Worthington (2006) has further described emotional forgiveness as a process in which positive other-oriented affective responses (e.g., compassion or love) supplant the negative affective responses that characterize unforgiveness (e.g., vengeful or avoidant motives, anger, and fear) and are associated with stress. Whereas emotionally forgiving a loved one would restore more positive affect, the emotional change involved in forgiving a stranger may move toward affective neutrality (Worthington, 2006; Witvliet and Root Luna, 2018).

These emotional responses are important because variations in *valence* (negative–positive hedonic tone) and *arousal* (activation level) have been identified as pivotal axes for organizing physiological reactivity patterns. Using a 2 Valence (negative, positive) × 2 Arousal (low, high) emotional imagery design that assessed physiological reactivity from pretrial relaxations baselines to emotional imagery periods, Witvliet and Vrana (1995) found main effects of valence and arousal on specific measures. Specifically, they found that negatively valent emotional imagery conditions prompted greater activation of the brow muscle (corrugator supercilii, CS), compared to positively valent emotional imagery conditions. In the same study, the more arousing emotional imagery conditions prompted greater activation of the muscle under the eye (orbicularis oculi, OO) and greater increases in HR, compared to the less arousing emotional imagery conditions. In other research, rate pressure product scores (i.e., HR and systolic blood pressure multiplied)—considered indicative of myocardial oxygen demand—have been found to become elevated when people experience stress (Kitamura et al., 1972). Stress is high arousal and negative. Using a crime scenario as a stressor, Witvliet et al. (2008b) found that in the absence of either justice or forgiveness, rate pressure product

scores were significantly elevated, whereas retributive justice had a calming effect (Witvliet et al., 2008b). Forgiveness, whether measured as a trait (Lawler-Row et al., 2008) or as a state (Lawler et al., 2003), showed expected inverse relationships with rate pressure product scores. Collectively, the physiological measures have been shown to vary with emotion during imagery (Witvliet and Vrana, 1995), to be indicative of stress (Kitamura et al., 1972), and to be responsive in paradigms that assess emotion in contexts of unforgiveness, forgiveness (Witvliet et al., 2001), and justice (Witvliet et al., 2008b).

In the current experiment, we measured physiology and affective self-reports to test whether apology or restitution (or both) would have reliable effects, an approach vital to theorizing about unforgiveness and forgiveness as emotional processes. Using a psychophysiological paradigm, we tested apology and restitution in a 2 Apology (absent and present) × 2 Restitution (absent and present) design within participants. Because physiological baselines and reactivity patterns differ between people and require very large samples to test between-group manipulations, repeated-measures designs within people have been used in research on justice, forgiveness, and emotion (e.g., Witvliet et al., 2008b). The within-participant design allows each person to serve as his or her own control, yielding a stronger test of condition effects on physiology. Measuring physiology continuously shows how each condition type affects physiology, allowing us to create a difference from the pretrial baseline metric for each trial's imagery and recovery periods. By measuring multiple trials within each condition (e.g., Apology), participants can focus exclusively on one type of condition at a time, minimizing interference across conditions. Finally, condition orders can be counterbalanced across participants using a Latin square design to control for order effects.

This experiment incorporated affective self-reports used in basic emotion research (e.g., Witvliet and Vrana, 1995) and research examining forgiveness through the lens of emotion (Witvliet et al., 2001). These included ratings of valence and arousal, as well as perceived control, which has shown increases as emotion becomes more positive in valence and lower in arousal (Witvliet and Vrana, 1995). We measured self-reported fear, sadness, and anger, consistent with theorizing about unforgiveness (Worthington, 2006). We also used single-item measures of empathic perspective-taking, forgiveness, and gratitude as prosocial responses relevant to the affective experience of receiving an apology and restitution (Witvliet et al., 2001, 2008b).

We hypothesized the following, anticipating additive effects of apology and restitution based on other research (Witvliet et al., 2020):

(A) Apology and restitution would each decrease unforgiveness and associated negative and aroused emotion, as evident in
   (1) Lower self-reported unforgiveness scale scores and ratings of negative valence, arousal, anger, fear, and sadness.
   (2) Lower CS and OO reactivity.
   (3) Lower HR and rate pressure product reactivity.

(B) Apology and restitution would increase forgiveness and positive, prosocial emotions toward the offender, as evident in
   (1) Higher empathy and Positive Responses to the Offender (PRO) scale scores.
   (2) Higher ratings of empathy, forgiveness, and gratitude.

MATERIALS AND METHODS[2]

Participants

Undergraduate students (32 males, 29 females) in the midwestern region of the United States completed written informed consent and participated in this Human Subjects Review Board–approved experiment as one way to satisfy a requirement to learn about research. All participants were 18 years or older (M = 18.9, SD = 0.8). Of the participants, 54 were white, 6 were Asian or Asian-American, and 1 was African-American. Data collection was completed prior to any data analysis. Regarding sample size, a previous study using repeated measures and psychophysiology in a justice-oriented paradigm found effects in 56 participants (27 males, Witvliet et al., 2008b). Given the potential for data loss in physiological studies and challenges with undergraduate sign-ups, we aimed for a sample size of 60. Data collection notes about equipment failure or movement artifacts (e.g., coughing) were cross-checked with visual inspection of the data. In actuality, minimal missing data occurred: one missing for anger, sadness, and gratitude ratings, and OO electromyogram (EMG); two missing fear ratings and CS EMG; three missing valence and arousal ratings; and six missing blood pressure data due to equipment failure. In conducting a *post hoc* power analysis, we determined that with $\alpha = 0.05$ and a power of 0.80, we would be able to detect a repeated-measures effect size as small as an SPSS-generated $\eta_p^2 = 0.06$ ($f = 0.25$) given our total collected sample size (Faul et al., 2009). Thus, we report how we determined our sample size, all data exclusions, all manipulations, and all measures in the study.

Stimulus Materials

As shown in **Figure 1**, participants were presented with a burglary scenario and four possible apology and restitution outcome scenarios (Apology-Only, Restitution-Only, Both, and Neither), which were adopted from Witvliet et al. (2020) and are described in detail below. In this within-subjects design, each participant imagined all conditions, with orders systematically counterbalanced, within males and within females. Participants were instructed to "try to vividly imagine these events as if they were actually happening to you right now" and to "focus on the thoughts, feelings, and physical reactions you would be having if this really happened to you." This method has been used in both autobiographical (Witvliet et al., 2001) and scenario-based (Witvliet et al., 2008b) research paradigms.

[2]A separate project analyzed religious commitment correlations in a subset of the sample who self-identified as Christian, focusing on traits of forgivingness, empathy, rumination, and anger, as well as states associated with the crime incident and control condition that lacked a perpetrator repair response (Witvliet et al., 2008a).

Stimulus Materials of Crime Description

In the burglary incident scenario, participants imagined that they had returned to their residence and discovered that it had been broken into. Personal items had been stolen, including $50 in cash, loose change, a watch, a treasured keepsake from a loved one, and their credit cards. Police investigated but did not apprehend anyone for the crime.

Stimulus Materials of Post-burglary Outcomes

Participants were randomly assigned to one of the Latin square condition sequences of the four possible outcomes: receiving an apology, restitution, both, or neither. The scenarios were designed to bear similarity in structure. Each script began: "You have not had the chance to replace all your stolen cards and IDs due to your busy schedule. . ."

Apology-only

". . .The day after hearing from the detective, you receive a small, white envelope in the mail with no return address. Curious, you open the envelope. Inside is a folded piece of paper that you take out and open up. It is a note to you. The note says, '. . .I want to apologize to you. It was wrong of me to break into your apartment and take your things. Ever since, I have felt terrible. My conscience is really eating at me. I just wanted to tell you how bad I feel and how sorry I am that I probably have inconvenienced you to no end. If I had to do it over, I would ask for help instead of stealing. I wish I had never done it, and I know I never will do anything like this again. I am so sorry."'

Restitution-only

". . .The day after hearing from the detective, you receive a small, brown package in the mail with no return address. Curious, you open the package. Inside, you find your wallet, your watch, and a small envelope. You first check your wallet and find that the contents are all intact, including IDs, credit cards, pictures, and cash. Next you open the small envelope and find sixty dollars in cash and a note. The note says, 'Here is your stuff and some money to make up for any trouble I caused you."'

Both (apology and restitution)

The script for this condition began with the wording of the restitution condition, and then the wording of the note matched the apology condition.

Neither apology nor restitution

". . .The day after hearing from the detective, you decide that you finally need to follow up with replacing your missing things. You travel to a local department store and purchase another watch. You go back to school and replace your ID card. Then, you drive back to the motor vehicle administration to get a new driver's license. Finally, you call your credit card companies and ask them how long it will take for your new cards to be sent to you. Running these errands takes you the whole day."

Dependent Measures

Participants completed the scales (**Table 1**) in the first portion of the study, and they provided physiology measures followed by ratings (**Table 2**) in the second portion of the study (see the **Figure 1** note).

Self-Report Measures

Participants completed the Transgression-Related Interpersonal Motivations Inventory (TRIM; McCullough et al., 1998) as a measure of unforgiveness, the Empathy Adjectives Scale as a measure of empathy (Batson et al., 1986), and Positive Responses to an Offender (PRO), which is appropriate for non-close relationships (Witvliet et al., 2008b, 2020), as a measure of forgiveness. Participants rated their level of emotional valence (negative–positive), arousal (low–high), and perceived control by using a joystick to manipulate an androgynous line drawing of a person to display the affect they felt (see Hodes et al., 1985). Then, they used the joystick to register along a continuous line (labeled from not at all to moderately to completely) their own levels of fear, sadness, anger, gratitude, empathy for the perpetrator, and forgiveness for the perpetrator. All ratings were converted to a scale ranging from 0 to 20. The order of questions was systematically varied within and across participants.

Physiology

We continuously measured participants' second-by-second facial EMG activity above the brow at the CS muscle and under the eye at the OO muscle. On a beat-to-beat basis, we measured HR and systolic blood pressure, multiplying them to derive rate pressure products, which are indicative of cardiac stress (see Kitamura et al., 1972; Lawler et al., 2003; Lawler-Row et al., 2008; Witvliet et al., in press[3]).

Apparatus

Participants sat in a recliner in a private room. To time the presentation of tones and collect on-line physiological data, we used a Dell 486 computer and VPM software (Cook et al., 1987). To measure participant ratings after imagery, we used a joystick and a second Dell 486 with VPM software in the participant room. Imagery and relaxation trials were signaled by auditory tones at two frequencies—high (1,350 Hz) and low (620 Hz), respectively. The tones were 500 ms long and 73 dB[A]. Before the physiological data collection portion of the experiment, participants heard the tones to ensure they could distinguish between them.

Facial EMG was recorded at the CS (i.e., brow) and OO (i.e., under the eye) muscle regions using sensor placements suggested by Fridlund and Cacioppo (1986). Miniature Ag-AgCl electrodes filled with electrode gel were applied. EMG signals were amplified (50,000×) by a Hi Gain V75-01 bioamplifier, using 90 Hz high-pass and 1 kHz low-pass filters. Signals were rectified and integrated by a Coulbourn multifunction V76-23 integrator (nominal time constant = 10 ms).

For HR, electrocardiogram data were collected using two standard electrodes, one on each forearm. A Hi Gain V75-01 bioamplifier amplified and filtered the signals. The signals were then sent to a digital input on the computer that detected R

[3]Witvliet, C. V. O., Cheadle, A. D., and Root Luna, L. M. (in press). "Forgiveness: Psychophysiological side-effects and pathways to health," in *Handbook of Forgiveness in Philosophy and Psychology*, eds B. Enright, and G. Pettigrove (New York, NY: Routledge).

TABLE 1 | Means, standard deviations, and η_p^2 estimates of effect sizes (ES) for the scales assessing dependent variables.

	Neither	Apology-only	Restitution-only	Both	Apology		Restitution		A × R	
	M (SD)	*M (SD)*	*M (SD)*		*F (df)*	*ES*	*F (df)*	*ES*	*F (df)*	*ES*
Unforgiveness (12–60)	40.0[a]	33.1[b]	28.1[c]	24.5[d]	83.0***	0.58	104.5***	0.64	9.7**	0.14
	(8.8)	(10.0)	(9.9)	(9.5)	(1,60)		(1,60)		(1,60)	
Empathy (8–48)	12.7	20.2	23.8	30.5	116.1***	0.66	111.2***	0.65	0.67[n.s.]	0.01
	(5.2)	(9.0)	(10.1)	(11.2)	(1,60)		(1,60)		(1,60)	
Forgiveness (6–30)	10.7	14.0	16.7	19.7	78.1***	0.57	130.7***	0.69	0.22[n.s.]	0.00
	(4.4)	(4.9)	(5.6)	(5.9)	(1,60)		(1,60)		(1,60)	

*Unforgiveness was measured with the Transgressions-Related Interpersonal Motivations Inventory, empathy was assessed with the Empathy Adjectives Scale, and forgiveness was measured with the Positive Responses to the Offender scale. [a,b,c,d]Within each dependent variable for which the Apology × Restitution × Time interaction was significant, superscripts that differ indicate that the means significantly differ at $p \leq 0.008$ (Bonferroni-corrected α). All 0.95 CIs around the mean differences did not cross zero where traditional significance testing indicated differences. **$p < 0.01$, ***$p < 0.001$, [n.s.]$p > 0.42$.*

TABLE 2 | Means, standard deviations, and η_p^2 estimates of effect sizes for the single-item ratings associated with dependent variables.

Single-item ratings (0–20 scale)	Neither	Apology-only	Restitution-only	Both	Apology		Restitution		A × R	
	M (SD)	*M (SD)*	*M (SD)*	*M (SD)*	*F (df)*	*ES*	*F (df)*	*ES*	*F (df)*	*ES*
Dimensional ratings										
Valence	3.62[a]	8.53[b]	15.22[c]	16.60[c]	62.29***	0.52	221.33***	0.80	21.66***	0.28
	(3.95)	(4.17)	(3.18)	(3.83)	(1,57)		(1,57)		(1,57)	
Arousal	14.34	11.57	10.05	9.03	11.88***	0.17	19.82***	0.26	3.29[n.s.]	0.06
	(5.62)	(5.17)	(5.70)	(6.32)	(1,57)		(1,57)		(1,57)	
Control	7.07	8.90	11.51	13.44	17.62***	0.23	53.74***	0.47	0.01[n.s.]	0.00
	(5.49)	(4.87)	(3.91)	(5.01)	(1,60)		(1,60)		(1,60)	
Negative emotions										
Anger	16.20[a]	12.78[b]	7.23[c]	5.40[c]	25.82***	0.30	136.64***	0.70	3.92*	0.06
	(4.09)	(5.26)	(5.03)	(5.03)	(1,59)		(1,59)		(1,59)	
Sadness	11.13	9.47	5.30	4.22	8.64**	0.13	61.52***	0.51	0.28[n.s.]	0.01
	(5.62)	(4.82)	(4.59)	(4.01)	(1,59)		(1,59)		(1,59)	
Fear	8.05	5.76	4.83	3.17	22.57***	0.28	31.68***	0.35	0.57[n.s.]	0.01
	(5.32)	(4.63)	(4.53)	(3.17)	(1,58)		(1,58)		(1,58)	
Positive emotions										
Gratitude	3.00[a]	6.97[b]	15.10[c]	16.40[d]	30.78***	0.34	264.71***	0.82	10.63**	0.15
	(3.99)	(5.58)	(3.82)	(4.42)	(1,59)		(1,59)		(1,59)	
Empathy	3.52	7.80	9.43	12.54	59.71***	0.50	64.73***	0.52	2.23[n.s.]	0.04
	(3.75)	(4.96)	(5.29)	(5.10)	(1,60)		(1,60)		(1,60)	
Forgiveness	5.28	9.08	12.58	15.10	47.13***	0.44	110.78***	0.65	2.79[n.s.]	0.05
	(5.00)	(5.65)	(4.78)	(4.64)	(1,59)		(1,59)		(1,59)	

*[a,b,c,d]Within each dependent variable that has a significant Apology × Restitution interaction, superscripts that differ indicate that the means significantly differ at $p \leq 0.008$ (Bonferroni-corrected α). Where differences are noted, the 0.95 CIs around mean differences also did not cross zero. The comparisons of ratings values for Restitution-Only and Both were marginally different for both anger and valence (both ps = 0.01). *$p < 0.05$, **$p < 0.01$, ***$p < 0.004$.*

waves and measured interbeat intervals in milliseconds. Data were converted off-line to beats per minute. To derive rate pressure product data, we used the HR data and the systolic blood pressure data measured by a Colin 7000 continuous non-invasive blood pressure monitor with a solid-state pressure transducer array attached to the wrist. This provided continuous, beat-to-beat blood pressure values. An oscillometric cuff was used to provide calibration for the wrist transducer array during a 10 min initial calibration period preceding the physiology section of each experimental session.

Procedure

Participants attended a 2 h testing session (**Figure 1**). In the first portion of the study, participants provided individual difference information including demographic data and scales to assess religious commitment, forgivingness, anger, and rumination (see Witvliet et al., 2008a). State scales measuring unforgiveness, empathy, and forgiveness followed the burglary incident scenario and the possible outcomes. To control for effects related to the order of conditions, we used a Latin square design, with participants randomly assigned to one of four orders:

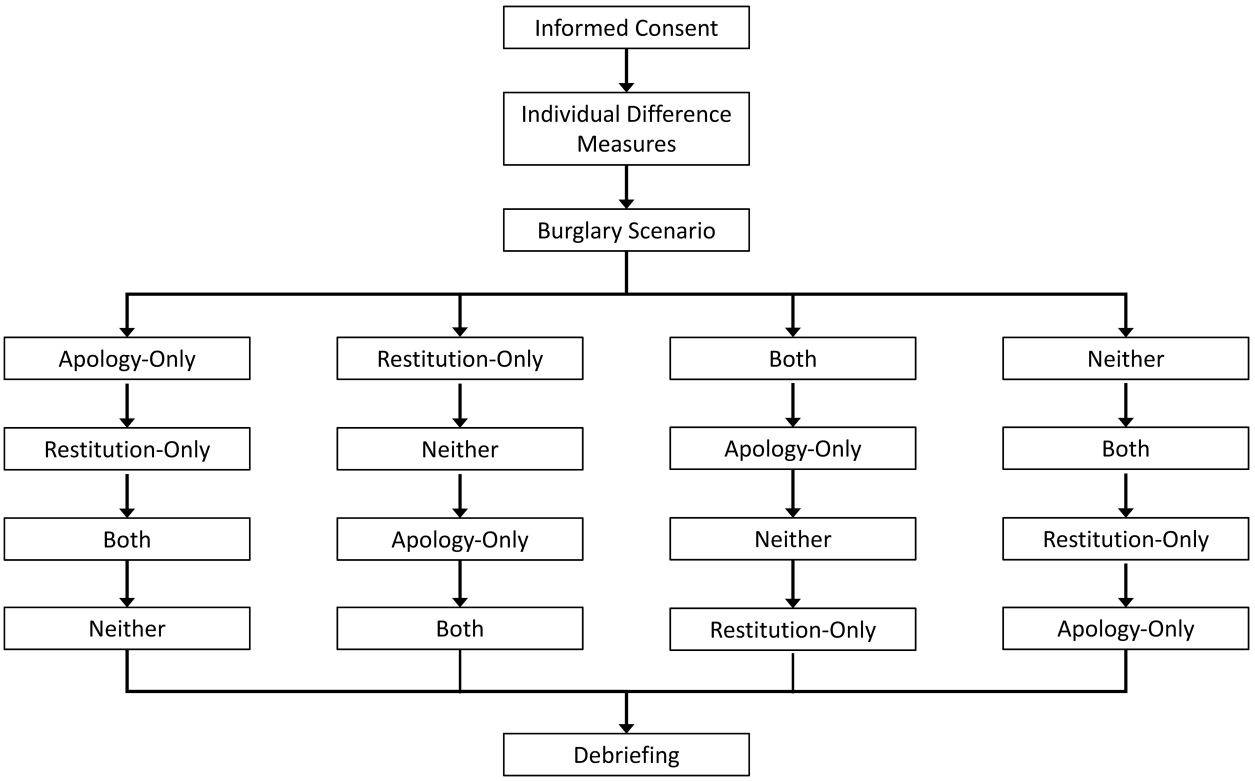

FIGURE 1 | Study flow. Participants were randomly assigned to one of these four condition sequences. Participants first read and imagined each of the four condition scripts, completing the scales after each. Participants subsequently completed eight trials within each condition. Physiology was measured millisecond-to-millisecond and heartbeat-to-heartbeat throughout, and ratings were provided at the end of each condition.

(a) Apology-Only → Restitution-Only → Both → Neither
(b) Restitution-Only → Neither → Apology-Only → Both
(c) Both → Apology-Only → Neither → Restitution-Only
(d) Neither → Both → Restitution-Only → Apology-Only

For the psychophysiology measurement in the second portion of the study, the participants retained the same Latin square sequence of conditions (Apology-Only, Restitution-Only, Both, or Neither). Within each condition, participants completed a block of eight trials; this helped them focus and reduced potential interference from the other conditions.

Thus, within each condition (e.g., Apology-Only), the participant completed eight trials. A sample trial is shown in **Figure 2**. A low-pitched tone signaled the participant to relax by thinking the word one every time he or she exhaled (e.g., Witvliet and Vrana, 1995). The relaxation period before imagery allowed us to measure that trial's baseline physiology data. Then, a high-pitched tone signaled the participant to imagine the scenario for that condition (e.g., Apology-Only). The imagery period was followed by a relaxation period that allowed us to measure physiological recovery. A variable number of relaxation periods occurred, such that a range from 16 to 32 s of relaxation occurred between imagery periods, to ensure that participants relaxed and to reduce the predictability of what was coming next. By the end of the physiology portion of the study, participants had imagined each condition scenario eight times, for a total of 32 imagery trials. As **Figure 2** shows, physiological responses were measured continuously during 4 s baseline (relaxation), 16 s imagery, and 8 s recovery periods. Following each block of eight imagery trials within a condition, participants used a video display and computer joystick to rate their emotional responses privately and record them directly into a computer.

Data Reduction

We used a standard approach to reduce the physiology data and compute a difference-from-baseline metric for each trial within each participant (see Witvliet and Vrana, 1995; Witvliet et al., 2001, 2008b). For each physiology measure (CS, OO, HR, and rate pressure product), each of the 32 trials had its own baseline (4 s), imagery (16 s), and recovery period (8 s). Data were averaged in 4 s epochs (one for baseline, four for imagery, and two for recovery). For each of the epochs during imagery and recovery, deltas were created by subtracting from each epoch that particular trial's baseline data. This approach offers correction to the reference value from the pretrial baseline level, highlights the directional effects of the conditions on each physiological measure (e.g., increases or decreases), and reduces variance due to movement and habituation that can make raw scores particularly difficult to interpret meaningfully. The deltas across the epochs of the eight trials within each of the

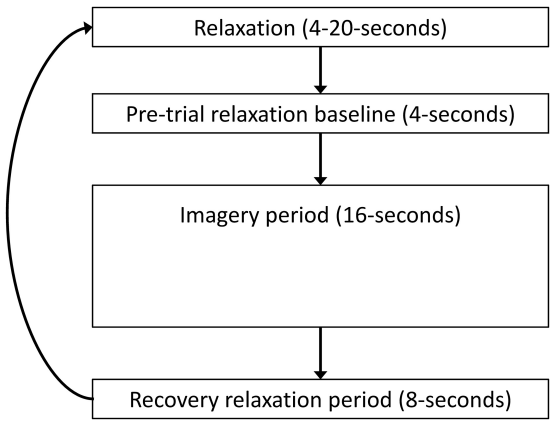

FIGURE 2 | Schematic for a trial of relaxation, pretrial baseline, imagery, and recovery. The participant began with several relaxation periods and then completed eight of these trials within each of the four conditions (Apology, Restitution, Both, and Neither). After the final trial for that condition, the participant rated the emotions experienced during imagery for that condition.

conditions (Apology-Only, Restitution-Only, Both, and Neither) were averaged and are plotted in the panels of **Figure 3**.

Statistical Analyses

For each Apology × Restitution condition, all imagery and recovery epoch deltas, as described in the above data reduction section, were averaged. We then used SPSS to run 2 Apology (present and absent) × 2 Restitution (present and absent) repeated-measures ANOVAs for imagery data and recovery data. We interpreted the results using the multivariate tests because they do not assume sphericity (see Green et al., 2000, p. 213). The F-statistic equivalent for Wilks's lambda is reported for each physiology measure during imagery and for each self-report rating. Whenever an Apology × Restitution interaction was found, all combinations of the four conditions (Apology-Only, Restitution-Only, Both, and Neither) were compared using six paired-samples *t*-tests with *p*-values corrected using the Bonferroni procedure (critical $p = 0.05/6 = 0.008$); to evaluate simple effects in the presence of a statistically significant interaction effect, 0.95 confidence intervals around mean differences were also examined.

RESULTS

We report means, standard deviations, and effect sizes for the 2 Apology × 2 Restitution repeated-measures analyses of variance for state self-report scales in **Table 1** and ratings in **Table 2**. Physiological patterns during imagery and recovery are depicted in **Figure 3**. We verified that participants randomly assigned to each counterbalanced condition order did not differ in their unforgiving, empathic, and positive responses to the offender after reading the crime incident (all scale score $Fs \leq 1.11$, $ps \geq .355$). As a manipulation check, participants provided ratings, with all participants indicating that they could imagine the crime scenario actually happening to them at least a little, 38% reporting that the scenario reminded them of a situation in their lives, and 21% reporting having personally experienced the crime in real life. Those who had and had not experienced a burglary were statistically equivalent across dependent variables; we therefore retained all participants.

Consistent with predictions, apology and restitution each had main effects of decreased unforgiveness (i.e., TRIM scores) and increased empathy and positive responses toward the offender (i.e., forgiveness as assessed on the PRO; see **Table 1**). An Apology × Restitution interaction was significant only for unforgiveness scores on the TRIM. Both apology-only and restitution-only reduced unforgiveness compared to neither; additionally, the combination of both apology and restitution reduced unforgiveness to a greater degree than either one alone. However, the impact of restitution was greater than the impact of apology for reducing unforgiveness.

All single-item emotion ratings (see **Table 2**) showed the predicted main effects of apology and restitution. Participants reported significantly lower levels of anger, fear, and sadness; significantly higher levels of gratitude, empathy, and forgiveness toward the perpetrator; and significantly greater perceived control when either an apology or restitution was present versus absent. Participants also rated their emotions during imagery as more positively valent and less aroused (more calm) when an apology or restitution was present compared to when each was not.

Three ratings showed the interactive effects of apology and restitution. *Post hoc* analyses showed that apology-only and restitution-only reduced anger while also elevating positive valence and gratitude compared to neither an apology nor restitution. However, different patterns emerged for the condition in which both an apology and restitution were received. For anger and valence, the presence of both an apology and restitution combined did not yield different results from the restitution-only condition. For gratitude, by contrast, the effects of apology and restitution were additive, with the combination of both apology and restitution prompting greater gratitude than apology-only or restitution-only.

Imagery Session Physiology[4] (See Figure 3)

Main Effects of Apology and Restitution

During imagery, the conditions in which an apology was present versus absent were associated with less reactivity (smaller deltas) for HR, $F(1,60) = 5.52$, $p < 0.022$, $\eta_p^2 = 0.08$; rate pressure products, $F(1,54) = 5.39$, $p = 0.024$, $\eta_p^2 = 0.09$; and OO muscle activity under the eye, $F(1,59) = 6.31$, $p = 0.015$, $\eta_p^2 = 0.10$. Restitution did not have a statistically significant main effect on any of these measures, $Fs < 0.640$, $ps > 0.43$. Rate pressure product levels also continued to be significantly less elevated in

[4]No other main effects were found for the physiological measures (all Apology $Fs \leq 2.40$, all $ps \geq 0.13$; all Restitution $Fs \leq 1.6$, all $ps \geq 0.20$), and no other interactions during imagery or recovery periods were statistically significant for other physiology measures (all Apology × Restitution $Fs \leq 2.43$, all $ps \geq 0.13$), including other measures of zygomatic EMG, skin conductance levels, and blood pressure. Due to space constraints, n.s. reports are not in the text.

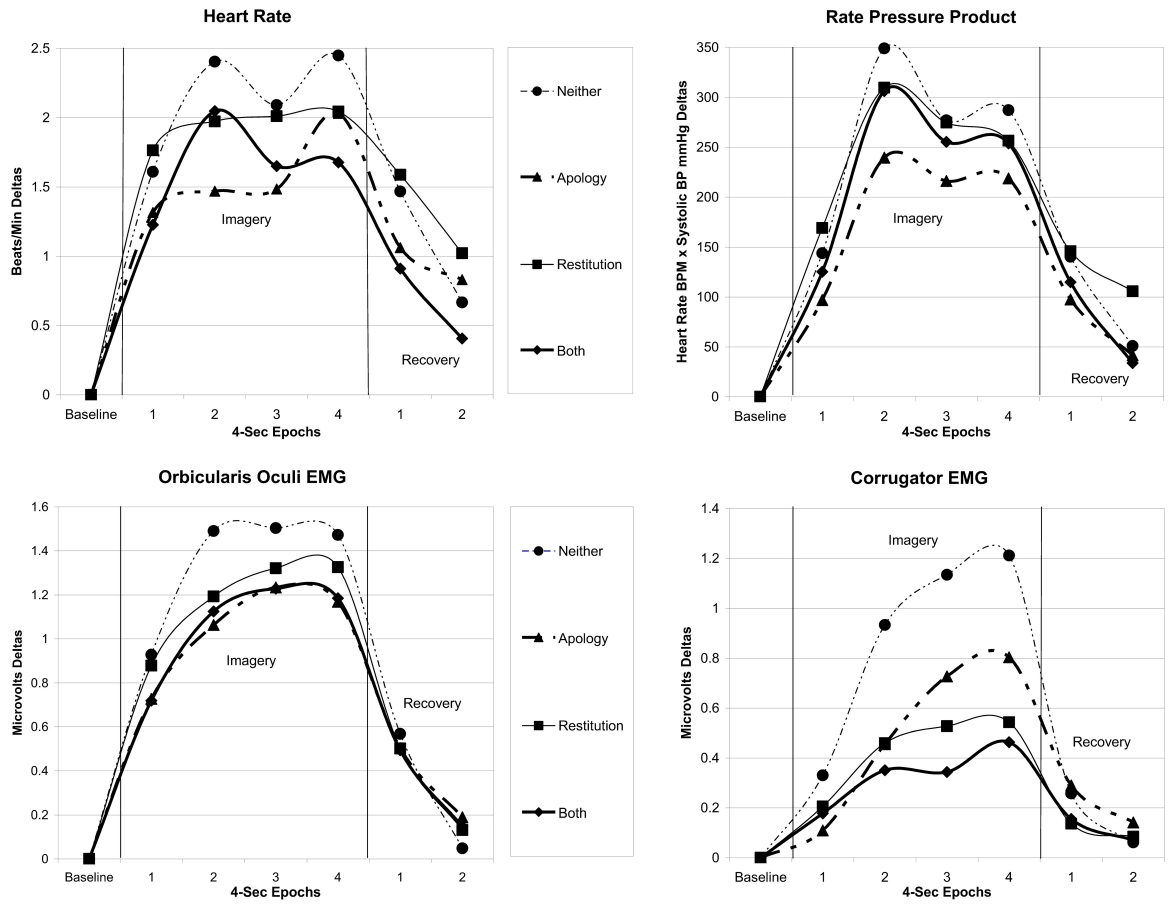

FIGURE 3 | Physiological reactivity and recovery patterns in the sample are depicted to show difference scores for imagery and recovery periods (i.e., with the 4 s pretrial baseline value for that imagery and recovery trial subtracted) by condition over time. The 4 s baseline value is set to zero, so that changes through four 4 s epochs during active imagery and two 4 s epochs of relaxation during the recovery period are clearly shown. Within each of the four conditions, the data were averaged across eight trials.

the recovery period following conditions in which an apology was received, $F(1,54) = 21.06$, $p < 0.001$, $\eta_p^2 = 0.28$. For all other dependent measures, no statistically significant differences occurred during the recovery period, $Fs < 2.40$, $ps < 0.13$.[5]

Corrugator supercilii (CS) muscle activity at the brow was significantly lower during imagery of receiving (versus not receiving) either an apology, $F(1,58) = 4.83$, $p = 0.032$, $\eta_p^2 = 0.08$, or restitution, $F(1,58) = 17.65$, $p < 0.001$, $\eta_p^2 = 0.23$. Lower CS activity after restitution continued as a trend in the recovery period, $F(1,58) = 3.00$, $p = 0.089$, $\eta_p^2 = 0.05$.

Interactive Effects of Apology and Restitution

Only one physiological measure, CS brow muscle activity during imagery, was influenced by an Apology × Restitution interaction, $F(1,58) = 4.00$, $p = 0.05$, $\eta_p^2 = 0.07$. The presence of restitution-only was more potent than apology-only for quelling activity at the brow muscle during imagery (see **Figure 3**, corrugator panel). Similar to valence and anger, the presence of restitution was so potent for CS activity that the addition of an apology did not yield further change.

DISCUSSION

This experiment provides the first psychophysiological investigation of the presence of apology and of restitution as conditions that predict reduced unforgiveness and elevated forgiveness responses. This experiment marshaled self-report and physiological evidence for the roles that a thorough apology

[5]This study was designed to balance the number of male and female participants, although not intended to test sex effects. Because Whited et al. (2010) found that participant sex interacted with a between-subjects lab-based apology for diastolic and mean arterial blood pressure, we conducted similar *post hoc* analyses. We tested the absence vs. presence of apology within participants using the Neither and Apology-Only conditions, with sex as the between-participant grouping variable. A significant Apology × Sex interaction, $F(1,53) = 5.45$, $p = 0.023$, $\eta_p^2 = 0.09$, occurred only for mean arterial pressure imagery deltas during imagery. The pattern of means aligned with the finding of Whited et al. (2010), such that that mean arterial pressure was higher in the males in the apology present condition, whereas females showed the opposite pattern. In the current study, males' mean arterial pressure deltas were reliably higher during apology-only imagery than no-apology imagery, but females' decrease in mean arterial pressure reactivity in response to the presence of an apology was not reliable.

and restitution can play in promoting affective change consistent with emotional forgiveness (Worthington and Scherer, 2004; Worthington, 2006; Witvliet et al., 2010). Because a major contribution to the literature is an analysis of the physiological findings, we discuss this first.

Psychophysiological Changes

Apology and restitution—which signal accountability through a perpetrator's relational and reparative responses after wrongdoing—each subdued activity at the CS brow muscle and also decreased the negativity of valence ratings, as predicted (see Witvliet and Vrana, 1995). Furthermore, a significant interaction showed that restitution was so potent in decreasing CS activity—while elevating positive valence and diminishing anger—that the further addition of an apology did not yield additional change.

Only the presence of an apology calmed activity at the OO muscle under the eye as well as HR reactivity. Past research manipulating the affective arousal and valence of imagery found that emotionally high (vs. low) arousal conditions prompted greater OO activity regardless of valence (Witvliet and Vrana, 1995). In addition to its calming effect during imagery, an apology was associated with less cardiovascular stress and myocardial oxygen demand in the recovery periods, as indicated by the rate pressure product level deltas (see Kitamura et al., 1972).

These data complement results from laboratory investigations that have associated apologies with improved cardiovascular recovery (Anderson et al., 2006; Whited et al., 2010; Kubo et al., 2012). Importantly, Schwartz et al. (2003) have assembled a strong theoretical case that cardiovascular reactivity may play a role in long-term health effects. Persistent activation in the absence of stressors (e.g., elevated rate pressure products, impaired HR variability during the recovery period) is more likely to accumulate in adverse effects over time. Prior research has shown that rumination about an interpersonal offense reliably impairs HR variability, an indicator of vagal tone and parasympathetic activity (Witvliet et al., 2010, 2011). Unforgiveness—when chronic—has been hypothesized to increase the risk of coronary heart disease (for a review, see Harris and Thoresen, 2005) and stress-related disorders (for a review, see Witvliet et al., in press[6]).

Self-Reported Evidence for Emotional Change

Apology and restitution had independent and interactive effects on self-reports related to forgiveness and emotional change, which replicate and extend self-report research (Witvliet et al., 2020). Both apology and restitution significantly decreased the negativity of valence ratings and the intensity of arousal ratings. These collective changes in response to the hypothetical scenario are consistent with the emotional differences induced by focusing on unforgiving versus forgiving imagery about a real-life offender (Witvliet et al., 2001).

Apology and restitution also reliably reduced unforgiveness (i.e., TRIM scores) and ratings of anger, sadness, and fear. Furthermore, apology and restitution increased scores across gratitude, empathy, and forgiveness measures. These patterns are consistent with Worthington and Wade's (1999) hypothesis that emotional forgiveness involves supplanting negative unforgiving emotions with positive other-oriented emotions. The conditions that promoted forgiveness also increased perceived control, paralleling findings for state forgiveness in response to both real-life transgressors (Witvliet et al., 2001) and a scenario-based criminal offender (Witvliet et al., 2008b).

Interactions of apology and restitution pointed to the potency of restitution-only beyond apology-only to reduce unforgiveness and anger, while elevating gratitude and positive valence. In particular, valence and anger were so responsive to restitution that the addition of an apology did not further elevate the positivity of participants' emotion or decrease their anger ratings. Similarly, the CS brow muscle was so responsive to the presence of restitution that adding an apology did not further subdue activity there.

This study of perpetrator response effects also emphasizes gratitude. The even stronger impact of restitution-only than apology-only on gratitude is consistent with Emmons and Shelton's (2002) view that gratitude intensifies when a personal, positive outcome—such as tangible restitution—clearly results from the actions of another. This pattern echoes findings by Emmons and McCullough (2003) that when people focus on benefits even in adversity (e.g., restitution after an injustice in our study), they experience greater gratitude and a range of emotional benefits. Furthermore, gratitude has been shown to reduce negative affect (McCullough et al., 2004), and benefit-focused reappraisal after an offense has been found to generate gratitude while fostering forgiveness along with emotional and cardiovascular regulation (Witvliet et al., 2010). This experiment points to gratitude as an important topic to advance research on justice, accountability, and forgiveness.

The current experiment provides affective and stress-related physiological responses that replicate and extend self-report responses (Witvliet et al., 2020) and that align with coded behavioral (and self-report) responses in a role-play simulation (Kiefer et al., 2020). Apologies and restitution represent verbal relational and tangible recompense indications of offenders' accountable responsibility-taking for an injustice toward a victim, and they have the capacity to evoke increases in forgiveness with emotional and embodied change.

Limitations and Suggestions for Future Research

The use of hypothetical crime offenses rather than an autobiographical one allowed us to increase internal validity by exerting control over the content of the offense, ensure that the offense was blameworthy and one-sided with quantifiable restitution, and extend the literature programmatically (Witvliet et al., 2008b, 2020). A limitation of hypothetical offenses is

[6]Witvliet, C. V. O., Cheadle, A. D., and Root Luna, L. M. (in press). "Forgiveness: Psychophysiological side-effects and pathways to health," in *Handbook of Forgiveness in Philosophy and Psychology*, eds B. Enright, and G. Pettigrove (New York, NY: Routledge).

that they can lack ecological validity and psychological realism or reduce participant involvement. However, all of the present participants reported being able to imagine the scenario actually happening to them, with nearly two in five participants indicating that it was similar to a situation they experienced and one in five reporting past experience with being burglarized. Statistical tests showed that participants who did and did not personally experience the crime gave similar responses.

Kiefer et al. (2020) have begun to expand on the ecological validity in apology and restitution research by studying role-play simulations of restorative justice using family group conferencing. Groups of four people were comprised of an offender (male), a victim (male), the offender's mother, and the victim's mother. Each quartet saw a video of lawyers tell about the crime and its effects from both sides. Before engaging in 30 min of mediated role-play, the offender was randomly assigned to apologize with an offer of restitution or forbidden from doing so. Responses of each of the three other participants in each quartet were analyzed. Generally, the victim and the victim's mother forgave more in the apology-with-restitution condition than in the no-apology and no-restitution condition. However, the offender's mother was equally likely to forgive her son in each condition—and less likely to forgive than either the victim or the victim's mother. Although role-play simulations have their own challenges in ecological validity, this role-play simulation's results aligned with and extend the present findings. A valuable next step would be to study apology and restitution in the context of actual restorative justice mediations (Armour and Umbreit, 2006). Such work could incorporate ambulatory physiology monitoring and daily diary methods to assess psychophysiology.

In light of restorative justice research, one current finding especially warrants follow-up research. Restitution was associated with reductions in negative affective self-reports and facial expressions at the corrugator. Why was restitution—which also reduced arousal—not associated with changes in OO activity under the eye (Witvliet and Vrana, 1995) or significant cardiovascular effects? One clue may be found in the justice results found by Witvliet et al. (2008b). In that study, signs of cardiovascular stress (rate pressure products) were lower for retributive versus no justice, but not for restorative justice, which included perpetrator remorse and restitution. The current experiment parsed apology and restitution, linking cardiovascular stress reduction to apology, whereas the apology was not strongly manipulated by Witvliet et al. (2008b). Future work could investigate why the apology condition reliably calmed cardiovascular stress and arousal under the eye, whereas restitution responses did not. One possibility is that in this context, the apology signaled perpetrator empathy and social support for the victim, which may have reduced stress-related physiology even more than tangible recompense. Understanding this will have implications for emerging understandings of justice and its relationship to victim well-being and health.

CONCLUSION

This work provides psychophysiological evidence for the effectiveness of apology and restitution in facilitating empathy and forgiveness in a context that did not excuse injustice (Worthington, 2006). Findings are consistent with theorizing about accountability (Witvliet, 2020) and the injustice gap generated by transgressions (Exline et al., 2003). This work also advances the relatively under-examined domain of antecedents to forgiveness that have implications for psychophysiological side effects. In turn, these side effects can serve as pathways to health. Apology and restitution are important elements indicative of perpetrator accountability and are relevant to restorative justice (Petrucci, 2002; Witvliet et al., 2008b; Kiefer et al., 2020). Thus, it may be fruitful to identify ways in which the willingness to engage in accountable repair responses toward victims of wrongdoing may be linked to empathic and self-regulatory mechanisms that may undergird both repentant change in perpetrators and responsible forgiveness in victims.

DATA AVAILABILITY STATEMENT

The studies involving human participants were reviewed and approved by the Human Subjects Review Board, Hope College. The participants provided their written informed consent to participate in this study.

ETHICS STATEMENT

All participants provided written informed consent to the study procedure, which was approved by the local Ethics Committee (Hope College).

AUTHOR CONTRIBUTIONS

CW and EW conceived the study. CW programmed the study, collected and analyzed data, and drafted the manuscript. LR was involved in the data collection and cross-checking of analyses. CW, LR, EW, and J-AT contributed to conceptualizations of the findings, substantively revised the manuscript, and read and approved the submitted version.

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Self-Control Modulates the Behavioral Response of Interpersonal Forgiveness

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Previous studies have shown that forgiveness is associated with the ability of self-control. However, whether self-control can modulate interpersonal forgiveness remains unclear. In the current study, we aimed to explore the relationship between self-control and the process of forgiveness using a behavioral measure of forgiveness during which participants distributed money between themselves and unknown others who had previously treated them fairly or unfairly in an adapted decision-making task. Seventy-two participants with low or high self-control were recruited based on their scores on the self-control scale (SCS). Results showed that participants exhibited increased anger and decreased happiness after experiencing unfair treatment. Participants with high self-control distributed more money to opponents who previously treated them unfairly compared with those with low self-control, whereas no such difference was observed to opponents who previously treated them fairly between the two groups. A significantly positive correlation was also found between the forgiveness rates and participants' self-control scores. These findings suggest that self-control modulates interpersonal forgiveness responses. Individuals with high self-control expressed an increased prosocial response toward people who previously offended them, which is similar to the process of forgiveness.

Keywords: self-control, interpersonal forgiveness, decision-making, cognitive process, prosocial behavior

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INTRODUCTION

Experiencing conflict, offense, or unfairness is inevitable in a social situation; forgiveness is regarded as a good approach to reduce these threats and increase harmony in society (Burnette et al., 2014). Psychological studies on forgiveness have been around for approximately 40 years; however, a consistent definition of forgiveness remains lacking (Berry et al., 2005; Worthington, 2007; Riek and Mania, 2012). Most researchers agree that interpersonal forgiveness is a transformation process of prosocial motivation (McCullough et al., 1997; McCullough, 2000), including the reduced motivation of retaliation and avoidance and increased benevolent motivation toward a transgressor (McCullough et al., 2000). In the current study, McCullough's definition of forgiveness was used and considered as a changing process of prosocial motivation during which individuals choose a prosocial approach (e.g., forgiveness, mercy, and reconciliation) toward a perpetrator instead of retaliation or avoidance (McCullough et al., 1997; Worthington and Wade, 1999).

After being offended, the dominant response toward a perpetrator is anger, hostility, or revenge rather than forgiveness (Slotter et al., 2012; Civai, 2013; Gilam et al., 2019). When choosing

to forgive, individuals have to overcome the influence of automated negative reactions (e.g., hostility and revenge), which requires the involvement of cognitive control or self-control (Pronk et al., 2010; Wilkowski et al., 2010; Maier et al., 2018). Self-control refers to one's ability to consciously suppress impulsive, habitual, or automatic cognition, emotions, and reactions to achieve a specific goal (Baumeister et al., 2007; Muraven et al., 2007). Studies show that high self-control is associated with improved interpersonal relationships and suppression of their impulses and reactions (Baumeister and Heatherton, 1996; Vohs and Heatherton, 2000; Tangney et al., 2004; Cheung et al., 2014).

Previous studies have also explored the relationship between self-control and forgiveness. Research has indicated a positive correlation between self-control and forgiveness (Tangney et al., 2004; DeWall et al., 2010; Vohs et al., 2011; Pronk et al., 2019). Finkel and Campbell (2001) first explored the relationship between self-control and forgiveness in romantic relationships and found that self-control can predict individual differences of forgiveness. In a large behavioral survey of self-control, a moderately positive correlation between self-control and the tendency to forgive others was found (Tangney et al., 2004). DeWall et al. (2010) explored the relationship between self-control and forgiveness by combining the physiological indicators of self-control (i.e., the efficiency of the human body's utilization of glucose). They observed that deficiency in glucose is related to a low tendency to forgive others and a low rate of cooperation. Research suggestes that the higher the self-control ability is, the better the relationship quality will be no matter whether it is between friends, lovers, or couples. Moreover, people with high self-control have a high tendency of forgiveness and relationship satisfaction, as well as the absence of conflict (Vohs et al., 2011). A recent meta-analysis study confirmed a small to moderate correlation between self-control and forgiveness, and a relationship was proven to became stronger when forgiveness was measured by low retaliatory motivation rather than high benevolent motivation (Burnette et al., 2014). Pronk et al. (2019) investigated the changes in self-control and forgiveness of newly married couples in the first 4 years of marriage. The results showed that the level of self-control and forgiveness gradually increased over time, and a positive concurrent correlation existed between them. Neuroimaging studies observed increased activation of the dorsolateral prefrontal cortex (DLPFC), which plays a vital role in cognitive control when overcoming unwanted negative emotional responses (Maier et al., 2018). Forgiving a transgressor is associated with elevated responses of DLPFC, which suggests that many cognitive control resources are needed to inhibit negative emotional responses toward a transgressor (Brüne et al., 2013).

In the present study, we aim to explore whether self-control can modulate interpersonal forgiveness using a behavioral measure of forgiveness. This study is the first to explore the relationship between self-control and interpersonal forgiveness using the behavioral measurement paradigm combined with adapted "ultimatum game" (UG) and "dictator game" (DG) to measure forgiveness. The behavioral measurement paradigm can better conceal the purpose of the experiment, obtain more real responses from participants, and avoid the limitation of self-report scales as a social expectation effect (Worthington et al., 2015; Li and Lu, 2018). In addition, the behavioral measure of forgiveness provides a new perspective to investigate the psychological process of forgiveness that questionnaires cannot achieve (McCullough et al., 2003; Dorn et al., 2014). In this behavioral task of forgiving response, two stages were included. The first stage was the adapted "UG" in which the participants would experience offense or unfair treatment and then observe the allocation proposal of participants made in the adapted "DG" as indexes of forgiveness or not. Previous studies have found that the behavioral measure paradigm of forgiveness can induce the same offensive feelings as in the real environment and has a significant positive correlation with individuals' self-reported trait forgiveness (Sanfey et al., 2003; Harlé et al., 2010; Carlisle et al., 2012; Dorn et al., 2014; Gilam et al., 2019). On this basis, we made two hypotheses: (1) after completing the adapted UG, participants would express emotional fluctuation because of the unfair experience; and (2) participants with high self-control would give a more fair distribution to opponents who previously treated them unfairly than those with low self-control.

MATERIALS AND METHODS

Participants

Two-hundred seventy participants were selected from a pool of undergraduate students at a university in China based on their scores on the 13-item brief self-control scale (SCS; Tangney et al., 2004; Tan and Guo, 2008; Unger et al., 2016). Scores for the SCS ranged from 21 to 61 (Cronbach's $\alpha = 0.77$). On the basis of a previous study (Tan and Guo, 2008), participants were selected for either the high self-control group (i.e., score on the SCS was in the highest 27%) or the low self-control group (i.e., score on the SCS was in the lowest 27%). The participants were randomly selected and voluntarily participated in the current study. According to the experimental design, the prior analysis shows that the sample size is 36 when the statistical power is 0. 95 (Faul et al., 2007). In the current study, after removing eight participants who did not trust the cover story that they were playing with real opponents, the final high self-control group comprised 36 students (14 males, 22 females, average age = 20.50 years, $SD = 1.03$), whereas the low self-control group consisted of 36 students (14 males, 22 females, average age = 20.28 years, $SD = 0.78$). Chi-square tests of gender and self-control group showed that no significant interaction existed between the self-control group and gender ($x^2_{(1)} = 1.71$, $p = 0.19$). In comparison with the low self-control group, the high self-control group reported significantly higher level of self-control ($t_{[70]} = 14.54$, $p < 0.001$, $d = 3.47$; low self-control group: $M = 30.47$, $SD = 3.57$; high self-control group: $M = 45.08$, $SD = 4.86$). This study was conducted in accordance with the recommendations of the SHNU Ethics Review Board. All subjects gave written informed consent in accordance with the Declaration of Helsinki. The protocol was approved by the SHNU Ethics Review Board.

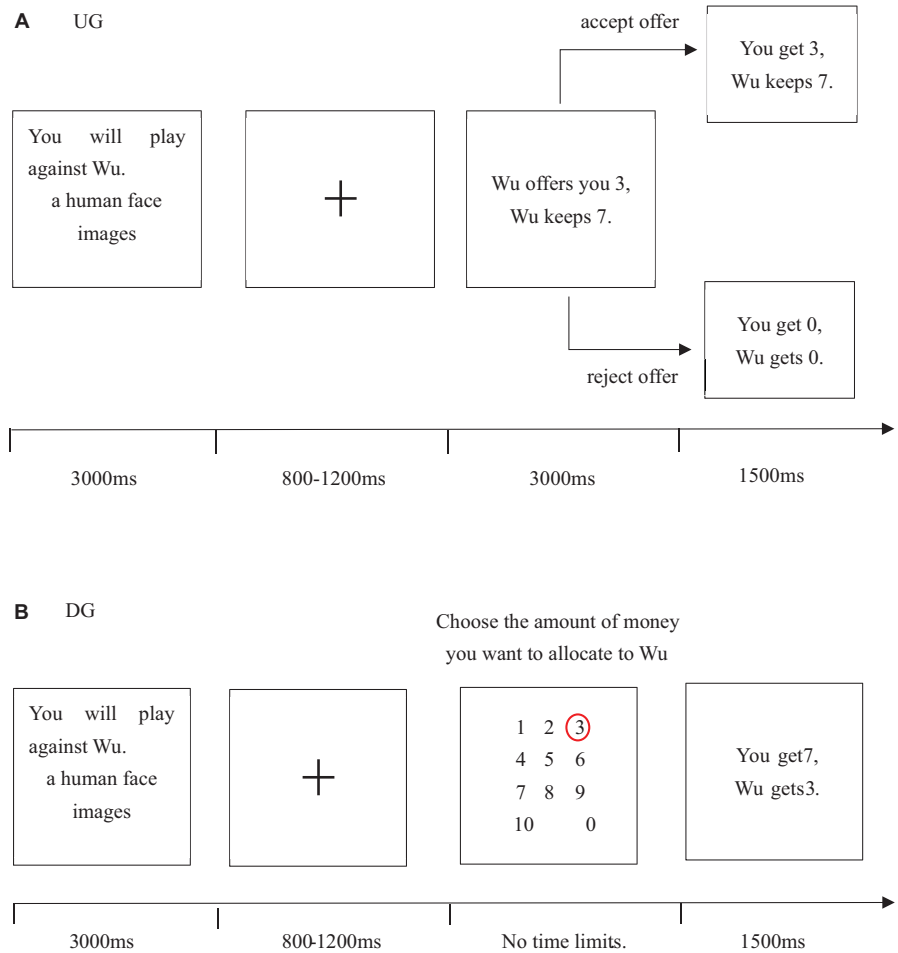

FIGURE 1 | Schematic structure of behavioral experimental paradigm. The behavioral experimental paradigm consists of two stages: adapted UG **(A)** and DG **(B)**.

Behavioral Experiment

Before the experiment was conducted, the subjects were told that they would play a money allocation game online with other opponents, and their performance in the task would influence their final payment. The behavior experiment included two stages (**Figure 1**). In the first stage, the participants acted as the recipient against four other participants (i.e., two male and two female proposers) in an adapted UG. The proposer would allocate 10 RMB each trial and provide his distribution proposal, whereas the recipient (i.e., the subject) would choose to either accept or reject the proposer's offer. If the offer was accepted, both sides would share the money according to the allocation proposal. Conversely, if the offer was rejected, both would not receive anything. In addition, two fair opponents of the four proposers (one male and one female) would consistently make relatively fair proposals (splits of 5:5; 4:6; and 3:7), whereas the other two unfair opponents (one male and one female) would consistently make relatively unfair proposals (splits of 2:8; 1:9; and 0:10). Hence, the implicit task in the UG was to identify whether the proposer was fair.

The specific experimental process of UG was as follows. First, participants saw the name and picture of their opponents (viewing period for 3000 ms), and this was followed by a jittered 800–1200 ms of anticipation period (random fixation "+" appears on the screen). Then, the opponent's proposal was presented for 3000 ms in the decision-making period. During this period, the subjects had the option to accept or reject by pressing the "j" button for rejection, which would result in both sides receiving nothing, or the "f" button for acceptance, which would result in 10 yuan beeing split according to the offers. Finally, in the feedback phase for 1500 ms, the amount of money each side received appeared on the screen.

In the second stage, the subjects' roles were reversed to be dictators (i.e., proposers), and participants were asked to distribute 10 RMB with four previous opponents (two fair opponents and two unfair opponents) in the DG each trial. The receiver had no right to refuse and could only passively accept the dictator's proposal unlike in UG (Kahneman et al., 1986). If participants chose a fair distribution proposal (e.g., a split of 5:5) with their former unfair opponents, then they still acted kindly after being treated unfairly, which is similar to the performance of

forgiving the former unfair opponents. Conversely, if participants chose an unfair distribution proposal (e.g., eight for themselves and two for opponents), then they were retaliating or punishing the former unfair opponents (Will et al., 2014, 2016). In addition, participants that chose to give a prosocial inequality allocation proposal (e.g., two for themselves and eight for opponents) to their opponent more than half of the sum (i.e., more than 5 RMB), which was regarded as a fair distribution, as suggested in a previous study (Maier et al., 2018).

The experimental process of DG is similar to UG. After the viewing period of 3000 ms and the anticipated period of jittered 800–1200 ms, the subjects were asked to decide how much money (0–10 RMB) to allocate to their previous fair or unfair opponents. Finally, the participants could see how much money they and their opponents had received in the feedback phase of 1500 ms. The experiment comprised 144 trials, 72 in UG, and 72 in DG. During the experiment, the interval between each trial was jittered 2000–3000 ms. All measures, conditions, and data exclusions were been reported. Details on each experimental condition can be found in the **Supplementary Material**.

Experimental Procedure

First, 270 undergraduates were tested using the brief SCS. Subsequently, participants who met the requirements were invited to the laboratory for experiments according to their score (score in the highest 27% and the lowest 27%). Prior to the experiment, the subjects filled in the informed consent form and demographic information. Moreover, the subjects' basic emotional states (e.g., anger, fear, happiness, and sadness) were measured using a five-point scale. Then, the subjects completed the adapted UG and re-evaluated their emotional states. Finally, participants completed the adapted DG as well as the measurement of the basic emotional states. Then, the subjects were asked how they felt about the experiment, some expressed doubts about the manipulation of the experiment and did not trust the cover story that they were playing with real opponents (eight subjects had been removed in the subsequent analyses). Thereafter, we explained the purpose and method of the experiment to the subjects, including the purpose of deceiving the real opponents of the subjects to obtain objective and real experimental results. Finally, the participants expressed their understanding and accepted payment of 25–30 yuan.

RESULTS

Changes of Emotional States Before and After Each Stage

We conducted a repeated-measures ANOVA at three time points (i.e., baseline state, after UG, and after DG) for each emotional state to explore the changes of emotional states before and after each stage. The results showed that, after Phase 1, subjects felt more anger ($p < 0.01$, $d = 0.49$) and less happy ($p < 0.05$, $d = 0.29$) compared with the baseline state. In comparison with the baseline state, participants felt less fear ($p < 0.05$, $d = 0.40$) and less happy ($p < 0.05$, $d = 0.32$) after Phase 2. No other significant differences were found in other emotional states at different time points compared with other time points.

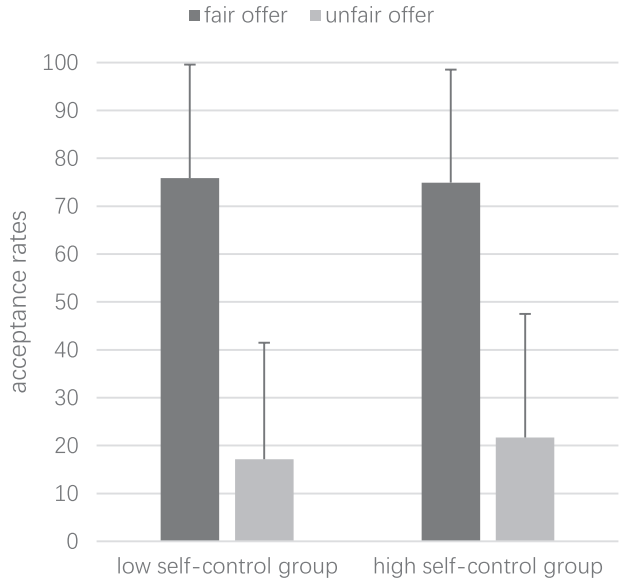

FIGURE 2 | UG acceptance rates (%). The figure shows the acceptance rates of fair offer (dark area) and unfair offer (light area) for low self-control group (**left side of picture**) and high self-control group (**right side of picture**). Error bars represent positive standard errors.

Acceptance Rates of Unfair and Fair Offers in UG

Low self-control subjects accepted 75.84% fair proposals and 17.14% unfair proposals (**Figure 2**), whereas high self-control accepted 74.92% fair proposals and 21.68% unfair proposals (**Figure 2**). No significant difference was found between the high and low self-control groups in accepting fair proposals ($t_{[70]} = 0.17$, $p > 0.05$) and unfair proposals ($t_{[70]} = -0.77$, $p > 0.05$). However, participants in each group accepted more fair proposals than unfair proposals (low self-control: $t_{[70]} = 10.36$, $p < 0.001$, $d = 2.44$; high self-control: $t_{[70]} = 9.13$, $p < 0.001$, $d = 2.15$).

Distribution Behavior in DG

The results showed that for the former unfair opponents, the rate of fair distribution was 47.38% in the low self-control group and 52.62% in the unfair distribution, whereas the rate of fair and unfair distribution in the high self-control group was 69.14% and 30.86%, respectively (**Figure 3A**). However, for the former fair opponents, the low self-control group had 80.25% fair distribution and 19.75% unfair distribution, whereas the high self-control group had 84.88% fairness and 15.12% unfairness (**Figure 3B**). We also conducted a 2 × 2 × 2 repeated-measures ANOVA with opponents (classified according to the offer in UG as formerly fair vs. formerly unfair) and allocation proposal (fair vs. unfair) as within-subject factors, self-control group (low self-control vs. high self-control) as a

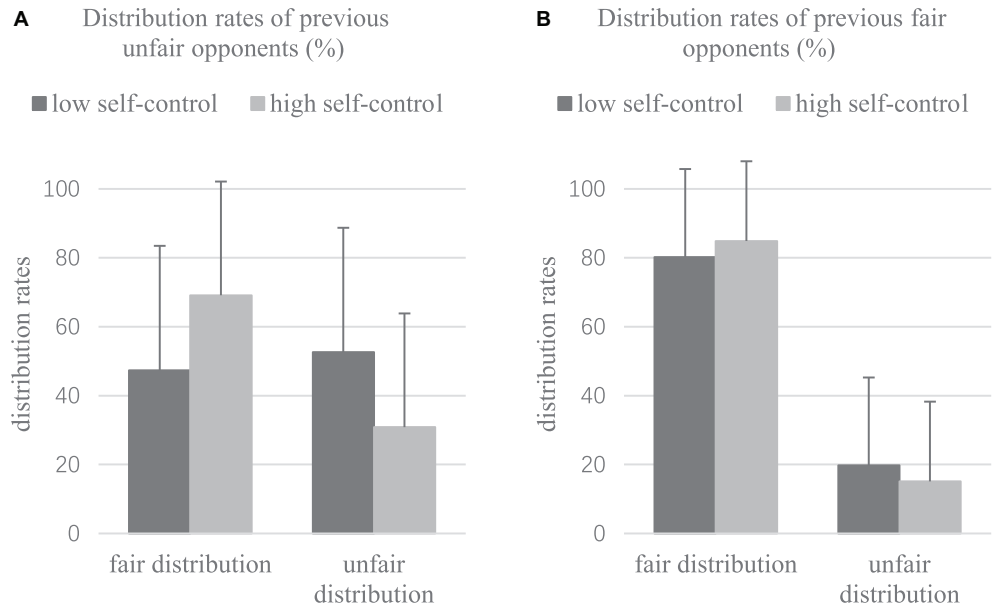

FIGURE 3 | DG distribution rates (%). Two pictures show the allocation rates of subjects in the low self-control group (dark area) and the high self-control group (light area) to previous unfair opponents **(A)** and fair opponents **(B)**. The ratios between the number of trials representing fair distribution to previous fair opponents, unfair distribution to previous fair opponents, fair distribution to previous unfair opponents, and unfair distribution to previous unfair opponents as well as the total number of trials presented in DG are calculated. Error bars indicate positive standard errors.

between-subject factor, and distribution rates selected in DG as a dependent variable. The results showed a significant main effect of allocation proposals ($F_{[1,70]} = 49.484$, $p < 0.001$, $\eta^2 = 0.414$) and a significant interaction effect of allocation proposals × self-control groups ($F_{[1,70]} = 5.171$, $p < 0.05$, $\eta^2 = 0.069$) and opponents × allocation proposals ($F_{[1,70]} = 36.839$, $p < 0.001$, $\eta^2 = 0.345$). A simple effect analysis showed that subjects in the high self-control group made more fair distributions ($t_{[70]} = -2.28$, $p < 0.05$, $d = 0.54$) and fewer unfair distributions ($t_{[70]} = 2.28$, $p < 0.05$, $d = 0.54$) than subjects of the low self-control group. Moreover, a significant three-factor interaction of opponents × allocation proposals × self-control groups ($F_{[1,70]} = 4.574$, $p < 0.05$, $\eta^2 = 0.061$) was observed. Individuals with high self-control carried out more fair distributions ($p < 0.01$) and fewer unfair distributions ($p < 0.01$) to the previous unfair opponents compared with those with low self-control. However, no significant difference was found between the allocation proposals of the high and low self-control groups to the previous fair opponents (both $ps > 0.05$).

Correlation Between Forgiveness Rate and Self-Control

To further explore the relationship between self-control and interpersonal forgiveness, we examined the correlation between self-control scores and forgiveness rates (fair distribution proposals to former unfair opponents) and retaliation rates (unfair distribution proposals to former unfair opponents). The results showed a significant positive correlation between self-control and forgiveness rate ($r_{(72)} = 0.26$, $p < 0.05$) and a significant negative correlation with retaliation rate ($r_{(72)} = -0.26$, $p < 0.05$).

DISCUSSION

In this study, we aimed to explore the relationship between self-control and interpersonal forgiveness. An adapted economic decision-making task was used to simulate the process of interpersonal forgiveness, and the self-reported SCS was used to measure individuals' ability of self-control. The results are consistent with our hypotheses that individuals with high self-control make more fair distribution toward opponents who previously treated them unfairly than those with low self-control. This result suggests that individuals with high self-control give a more forgiving response toward opponents who previously offended them than those with low self-control. We also found that the subjects felt more anger and less happiness after experiencing unfair treatment during the adapted UG. These findings suggest that self-control modulates interpersonal forgiveness.

The results show that after the participants completed the adapted UG, they felt more anger and less happy than the emotional states at the baseline. This result is consistent with previous research using the UG, which has shown that UG can induce the negative feelings of the subjects and let the subjects experience similar feelings after being offended in an actual situation (Sanfey et al., 2003; Harlé et al., 2010; Gilam et al., 2019). In UG, when subjects encountered an unfair opponent's proposal, they feel that they were offended or unfairly treated and that their self-interest was damaged, which caused negative emotions

(Sanfey et al., 2003). Similarly, Carlisle et al. (2012) found that subjects in offense conditions felt less positive and more negative emotions after experiencing the unequal distribution of raffle tickets in Round 1 compared with the subjects in the no offense condition, which was consistent with the feelings experienced by participants during UG. In addition, the subjects' happiness decreased after DG compared with the emotional states at baseline. This result may be due to the offended experience of the UG process and the difficulty in returning to the baseline level of happiness.

In UG, the subjects in high and low self-control groups accepted more fair distributions compared with unfair distributions. Thus, the subjects could realize the two situations of fair and unfair distributions in UG, and they tended to pursue fairness and equity (Trivers, 1971; Fehr and Fischbacher, 2004); thus, fair distributions were more accepted. This finding can be confirmed by previous studies that found similar results (Sanfey et al., 2003; Brüne et al., 2013; Maier et al., 2018). Moreover, a small number of unfair distributions were accepted, that is, most of the unfair distributions were rejected, which may be due to individuals' pursuit of fairness, even if it damaged their own interests.

The relationship between self-control and interpersonal forgiveness could be observed from the participants' allocation proposals toward opponents who previously treated them unfairly in the DG. In line with our hypothesis, the participants with high self-control carried out a more fair distribution to opponents who treated them unfairly than those with low self-control. This result suggests that participants with high self-control tended to give a forgiving response to previously unfair opponents more than those with low self-control; however, no differences were observed between the two groups in terms of previous fair opponents. Moreover, a positive correlation was observed between self-control scores and forgiveness rates. These findings were guaranteed by previous studies that found that self-control could predict interpersonal forgiveness (Tangney et al., 2004; Vohs et al., 2011; Burnette et al., 2014; Pronk et al., 2019). Self-control is positively related to interpersonal forgiveness (Finkel and Campbell, 2001; Bal Balliet et al., 2011), and the correlation between self-control and forgiveness is strong when forgiveness is measured with low retaliation rather than high benevolence (Burnette et al., 2014). A recent longitudinal study on self-control and forgiveness in marriage found a positive correlation between self-control and forgiveness, and, over time, married individuals have been proven to have more self-control and become more forgiving (Pronk et al., 2019). In addition, individuals with high self-control are more willing to forgive offenders (Tangney et al., 2004; Vohs et al., 2011). When individuals are offended, the first reaction is destructive and the emotions are negative (e.g., anger and retaliation) to safeguard their own interests (Righetti et al., 2013). Self-control is regarded as an important ability that enables individuals to shift from caring for their own interests to caring for more values and considerations (i.e., pro-relationship behavior) (Finkel and Campbell, 2001). Increased self-control makes individuals have greater potential to suppress the destructive impulse after deep consideration and show a constructive behavior, such as forgiving offenders (Finkel and Campbell, 2001; Hofmann et al., 2009; Pronk and Righetti, 2015). Moreover, self-control can help individuals suppress the impulse to retaliate by reducing the rumination of offensive events (Pronk et al., 2010). A neuroimaging study also found that granting forgiveness toward previously unfair opponents elicits increased activation of the DLPFC, a brain region mainly responsible for cognitive control (Brüne et al., 2013; Maier et al., 2018). These findings suggest that when individuals are offended or treated unfairly, high self-control may help them suppress prevailing negative emotions caused by unfair treatment and promote prosocial behavior, such as forgiveness.

This study has some limitations. One is that some subjects questioned the authenticity of economic decision-making tasks, which may affect the experimental results. Thus, these subjects were excluded from the subsequent analyses. Moreover, this study repeated previous research findings and found that self-control could modulate interpersonal forgiveness. Nevertheless, different behavioral measurement paradigms for measuring forgiveness involve different forgiveness-related psychological processes, and future research requires the use of other behavioral measurement paradigms to verify the relationship between self-control and interpersonal forgiveness. Third, participants were not required to report their intention when giving fair distribution toward a prior unfair opponent, which makes the forgiving conclusion negotiable. However, we found no significant difference in anger levels after DG between the high and low self-control groups ($t_{[70]} = 1.727$, $p > 0.05$). The measurement and analysis of anger can reveal whether the subjects' behaviors are due to forgiveness or forbearance. Additionally, the finding helps us ensure that participants forgive their previous unfair opponents to some extent. Future research needs to collect self-report data when using the behavioral paradigm of forgiveness. Finally, our study was a cross-sectional one, and we did not manipulate self-control; thus, the causal relationship between self-control and interpersonal forgiveness could not be determined. Future studies may use longitudinal research or manipulate self-control to examine the causal relationship between self-control and interpersonal forgiveness.

In sum, the current study extends previous findings concerning self-control and interpersonal forgiveness and provides a different perspective of behavioral measure to further explore the relationship between self-control and interpersonal forgiveness. This study has been the first to explore the relationship between self-control and interpersonal forgiveness using the behavioral measurement paradigm combined with adapted UG and DG. Our findings suggest that, when confronted with interpersonal conflicts, individuals with high self-control ability could suppress the negative emotions generated by their instincts and show increased prosocial behaviors consistent with their long-term goals toward transgressor, such as forgiveness.

DATA AVAILABILITY STATEMENT

The datasets generated for this study are available on request to the corresponding author.

ETHICS STATEMENT

The studies involving human participants were reviewed and approved by the Shanghai Normal University Ethics Review Board. The patients/participants provided their written informed consent to participate in this study.

AUTHOR CONTRIBUTIONS

HJL and HL conceived and designed the experiments. HL collected the data and performed the statistical analysis. HJL and HL contributed to the writing of manuscript.

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SUPPLEMENTARY MATERIAL

The Supplementary Material for this article can be found online at: https://www.frontiersin.org/articles/10.3389/fpsyg.2020.00472/full#supplementary-material

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Efficacy of the REACH Forgiveness Intervention in Indian College Students

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The present study investigated the efficacy of the REACH Forgiveness psychoeducation program for the first time in Indian college students and examined theoretically-based predictors of program response based on the model of relational spirituality and forgiveness. This was an intervention experiment that spanned 5 weeks and included three measurement occasions (weeks 1, 3, 5) and two separate deliveries of the forgiveness intervention (weeks 2 and 4). Participants were N = 124 students at Karnatak University in Darwha, India (100 Hindu; 18 Muslim, 5 Christian, and 1 Jain). This was a manualized, secular intervention led by a trained facilitator in a group, psychoeducational format. Measures included forgiveness and unforgiveness as well as assessments of positive and negative affective states and spirituality. Participants who received immediate forgiveness training showed significant and large positive changes in forgiveness and unforgiveness, as well as, more positive affect and increased self-esteem in contrast to wait-list comparisons. Perceiving one's offender as having a similar spirituality to oneself was a consistent predictor of response to the REACH Forgiveness program. Specifically, perceiving the offender as having a similar spirituality was related to less growth of unforgiveness and more growth in empathy, positive affect, and emotional forgiveness as a result of the psychoeducational program. The REACH Forgiveness psychoeducational approach is efficacious in an Indian college student sample, and some relational spirituality variables are important predictors of response to the program. Future studies should consider the role of Indian culture in promoting forgiveness and possibly tailor the intervention to suit the significant proportions of Hindus and Muslims in India.

Keywords: REACH Forgiveness, forgiveness training, India, psychoeducation, forgiveness, well-being, wellness

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INTRODUCTION

McCullough et al. (1997) define interpersonal forgiving as "the set of motivational changes whereby one becomes (a) decreasingly motivated to retaliate against an offending relationship partner, (b) decreasingly motivated to maintain estrangement from the offender, and (c) increasingly motivated by conciliation and goodwill for the offender, despite the offender's hurtful actions" (p. 322). These changes are often assessed by using the Transgression-Related Inventory of Motivations

(McCullough et al., 1998). According to Exline et al. (2003), those motivations are closely linked with emotional forgiveness (assessed by the Emotional Forgiveness Scale, Worthington et al., 2007), which are transformations in which negative emotions toward the transgressor are replaced with positive, other-oriented emotions. Sometimes these changes involve decisions to forgive (assessed by the Decisional Forgiveness Scale, Worthington et al., 2007) which are behavioral intentions to act more benevolently toward the offender in the future.

There has been strong interest in helping people become more forgiving. Some of this interest has been due to its considerable benefits to mental and physical health, happiness, and quality of life (Toussaint et al., 2015). Numerous approaches to promoting forgiveness have been developed (Enright, 2001; Luskin, 2002; Worthington, 2008). The present study tested the REACH Forgiveness method of promoting forgiveness, which is one of the most widely-used approaches to forgiveness psychoeducation (Worthington, 2008, 2020; Worthington et al., 2000, 2018). The primary objective of this study was to examine the efficacy of the REACH Forgiveness program in India, a culture in which no program to promote forgiveness has been previously tested.

Numerous studies have examined the efficacy of the REACH Forgiveness program (for a recent review, see Worthington, 2020), and meta-analyses have borne out the efficacy of this approach (Wade et al., 2014; Akhtar and Barlow, 2018). The comprehensive meta-analysis by Wade et al. (2014) provided a couple of key findings that are relevant here. First, Wade et al. (2014) noted that levels of forgiveness were higher in individuals in forgiveness treatments compared both to individuals in alternative treatments and non-treated controls by a standardized difference of about 0.5. Second, Wade et al. (2014) characterized a dose-response relationship between the amount of time invested in the forgiveness intervention and the effect sizes on forgiveness outcomes. The relationship can be described as the following: 0.10 + 0.05*(number of hours of intervention). It is important to note, however, that these findings apply to all forgiveness interventions studied and not just the REACH Forgiveness approach. Nevertheless, these meta-analytic results offer useful guidelines for using forgiveness interventions.

The REACH Forgiveness intervention is flexible and has been adapted to suit the needs of diverse groups. For instance, the REACH Forgiveness intervention has been adapted to the needs of Christians (Lampton et al., 2005; Stratton et al., 2008; Worthington et al., 2010; Greer et al., 2014). It is flexible in terms of mode of application. Self-directed learners have found the 6-hour downloadable Microsoft Word or online workbooks to be effective (Greer et al., 2014; Harper et al., 2014; Lavelock et al., 2017; Nation et al., 2018). Furthermore, the REACH Forgiveness methods have been adapted and used effectively in several cultural contexts. Participants from Australia, Ghana, Indonesia, Philippines, and international students studying in the United States have found the REACH Forgiveness method efficacious using intervention methods including 6 to 13 h in-person trainings, downloadable workbooks, and online materials (Worthington et al., 2010; Lin et al., 2014; Nation et al., 2018; Kurniati et al., 2020; Osei-Tutu et al., 2020). Specifically, culturally adapted REACH Forgiveness programs have been found to reliably decrease unforgiveness and increase forgiveness and empathy. Sometimes culturally adapting the method has strengthened it (Kurniati et al., 2020), but at other times, it has made no difference (Osei-Tutu et al., 2020).

Although the REACH Forgiveness program has been tested in the Philippines and Ghana, using the Christian-adapted version, and in Indonesia using a secular model that was adapted to the culture, REACH Forgiveness interventions have not been examined in India, the second most populous country in the world (India Population, 2019). The importance of understanding the effectiveness of forgiveness psychoeducation in a country such as India cannot be overstated. India is perhaps one of the most divided countries on earth with religion, caste, and language creating many divisions among its population (Mission India, 2017). It is imperative to better understand forgiveness in a country that has a history of intra-societal divisiveness and that represents such a large proportion of the world's population.

The purpose of this present study was to evaluate the efficacy of the secular REACH Forgiveness program in a sample of Indians that is largely composed of Hindu and Muslim adherents. The secular version is non-sectarian. However, these religions both value forgiveness (see Rye et al., 2000). It might be that religious participants can take the secular concepts and apply their own theological practices, beliefs, and values to it—just as Rye et al. (2005) found in their *post hoc* interviews of religious participants who had been randomly assigned to either a secular or religious forgiveness intervention. Furthermore, it is important to note that previous international studies have examined unforgiveness and forgiveness as outcomes, but only one study—an internet-delivered secular version of secular REACH Forgiveness—has examined broader outcomes such as empathy, stress, and depression. It showed benefits only for empathy (Nation et al., 2018). Thus it is important to determine whether REACH Forgiveness methods are capable of generating not only benefits to forgiveness and unforgiveness, but also other closely related outcomes (e.g., involving emotional expressivity and mood and also self-esteem) that have been shown to be positively affected in United States samples (Sandage and Worthington, 2010; Sandage et al., 2015; Worthington et al., 2015; Wade et al., 2018).

Finally, Worthington and Sandage (2016) summarized numerous research studies within a model of forgiveness that considered relational spirituality. This model argues that forgiveness is dependent on relational characteristics of the victim, offender, transgression, and the sacred. There are six relationships between these four elements in the model. They include connections between victim and offender (VO), victim and transgression (VT), offender and transgression (OT), victim and sacred (VS), offender and sacred (OS), and transgression and sacred (TS). The relational characteristics all affect forgiveness. It would be difficult in a single study comprehensively to test all six relational aspects of this model. Therefore, we focused on key relational variables that we expected would be predictive in India. For example, the victim's religious beliefs and values and dispositions are related to whatever they hold to be sacred.

In addition, the victim's perception of the offender as similarly (or differently) religious or spiritual is thought to be related to forgiveness (Davis et al., 2008) because people tend to forgive others perceived to be in their in-groups more than those perceived to be in their out-groups. Additionally, the offense could be related to the sacred if a victim considered the offense to be a desecration of something sacred. Pargament et al. (2005) have shown that such offenses are very difficult to forgive. Most research on the forgiveness and relational spirituality model has studied the forgiveness of transgressions under naturally occurring conditions. In the present article, we seek to assess person-level characteristics (i.e., religious identity as Hindu or Muslim, religious commitment, and spirituality (VS); and dispositions of gratitude, shame-proneness, and guilt-proneness), perceived spiritual similarity (OS), and desecration (TS) as predictors of responsiveness to a forgiveness training—the first study to do this.

Given the research reviewed above, we hypothesized that participants in REACH Forgiveness training, relative to a wait-list comparison group, would show decreased unforgiveness and increased forgiveness as well as benefits to overall emotions and self-esteem, and these benefits would replicate when the wait-list comparison group later received the training. In addition, we tested the predictive power of the forgiveness and relational spirituality model to predict response to the REACH Forgiveness training. Previous research has examined the predictive power of the forgiveness and relational spirituality model in predicting forgiveness in naturally-occurring settings (see Worthington and Sandage, 2016, for a comprehensive review), but none have tested the predictive power of gains in response to a REACH Forgiveness intervention. Our formally stated hypotheses are as follows:

Hypothesis 1: Receipt of forgiveness training will result in changes in forgiveness, emotional reactions, and self-esteem when the immediate training participants have completed training (Time 1 to Time 2) and when the wait-list participants have completed training (Time 2 to Time 3), and gains by the immediate training participants will be maintained (Time 2 to Time 3). Outcome measures will be three groups of measures: forgiveness and unforgiveness (i.e., unforgiveness, decision to forgive, and emotional forgiveness), emotion (i.e., empathy, negative expressivity, positive affect, negative affect), and self-esteem. This will be examined through repeated-measures analyses of variance and *t*-tests as well as independent *t*-tests.

Hypothesis 2: Variables in the relational spirituality model (Davis et al., 2008; Worthington and Sandage, 2016) will predict responsiveness to training. Those predictor variables will include person characteristics (i.e., religious identity as Hindu or Muslim, religious commitment, and spirituality; and dispositions of gratitude, shame-proneness, and guilt proneness), perception of the offender's relationship with the sacred (Similarity of Offender to the Sacred, SOS, Scale), and the relationship of the transgression to the sacred (Sacred Desecration). Multiple regression will be used to examine correlations of each pre-training relational spirituality predictor variable with post-training outcome measures, controlling for pre-training levels of the outcome measures.

MATERIALS AND METHODS

Design and Procedure

The present study was a REACH Forgiveness intervention in which participants were randomly assigned (by drawing a card) to immediate training or wait-list comparison groups and tested three times at baseline (T1), 2 weeks following baseline assessment (T2), and 4 weeks following baseline assessment (T3). The REACH Forgiveness training was conducted 1 week after T1 1 week before T2 for those assigned to immediate REACH training (i.e., in week 2) and 1 week after T2 but 1 week before T3 for those assigned to a wait-list comparison group (i.e., in week 4). Where "T" represents an assessment, "X" represents the REACH Forgiveness training, the design took the form:

Week:	1	2	3	4	5
REACH:	T1	X	T2		T3
Control:	T1		T2	X	T3

Trainings were manualized and led by a research fellow working with one of the co-authors and trained by two of the co-authors. Training lasted 12 h and included training videos provided on www.evworthington-forgiveness.com, in-person training by one co-author, and background reading of journal articles and books on the REACH Forgiveness method. The trainings were led in group settings with group sizes of 10 to 11 members. The REACH Forgiveness program began with writing about a past offense the participant had experienced and indicating how severe and how long ago it was and completing some assessments of forgiveness (not included in study measures). During a training week of the study, 6-hour psychoeducational group interventions were completed over 3 days. The design and procedure of the study followed the best-practices for conducting psychoeducational forgiveness groups (Worthington et al., 2000).

Participants

Participants in this study were 124 students from Karnatak University pursuing degrees in various disciplines. An overall sample size of $N = 124$ offers repeated-measures *t*-tests within the immediate treatment and wait-list groups that possess power of 0.88, assuming $\alpha = 0.05$ and $d = 0.4$ [the expected repeated measures *t*-test effect size for a 6-hour training according to Wade et al. (2014)]. Independent groups *t*-tests comparing immediate treatment to wait-list participants possess power of 0.80, assuming $\alpha = 0.05$ and $d = 0.5$ (the expected independent groups *t*-test effect size according to Wade et al. (2014). Participants were 55 (44%) men and 69 (56%) women. Mean and median age was 23 ($SD = 1.44$, *Range* = 21–30). Self-reported religious affiliations were Hindu ($N = 100$, 89%), Muslim ($N = 18$, 15%), Christian ($N = 5$, 4%), and Jain ($N = 1$, 0.8%). Students lived

in urban (N = 55, 44%), rural (N = 25, 20%), and mixed (N = 44, 36%) environments and all but three (2%) students were single. Participants reported being severely hurt by the offense they experienced (M = 4.59, SD = 0.76; possible range = 1–5), which is typical of most intervention research that studies forgiveness. Although a few individuals (N = 7, 6%) identified offenses that occurred 36 or more months ago, resulting in a positively biased average (M = 12 months, SD = 17.10), the median time since the offense was 9 months. No differences by condition in severity or time since the offense were observed (Fs < 3.26, ps > 0.07). Participants were provided with informed consent at the time they joined the intervention and again at follow-up. The study was approved by the Institutional Review Board at Karnatak University. Inclusion criteria for the study included: (a) responding "yes" to the question, "Have you experienced a hurtful incident that still bothers you enough to create negative feelings such as anger, resentment, bitterness, hate, feelings of wanting to hurt the person back, anxiety, hostility etc.?" (b) rating current unforgiveness at or above 2 (0 = *no present unforgiveness*; 1 = *a little unforgiveness*; 2 = *some substantial unforgiveness remains*; 3 = *a lot of unforgiveness*; 4 = *an extreme amount of unforgiveness*), (c) responding "yes" to the questions, "Are you ready to work on the memory of that hurtful experience in a group of other men/women with the idea of possibly forgiving the person?" and, "Are you willing to discuss the hurtful experience within the group?" There was no attrition across the 5-week study period, thus results represent an intent-to-treat design.

REACH Forgiveness Program

The REACH Forgiveness program seeks to promote forgiveness experiences with people who wish to move through the training. Two types of forgiveness are identified: decisions to forgive and emotional forgiveness. Physical health, psychological, relational, and spiritual benefits of forgiveness are identified by group members and discussed. People are invited to make a decision to forgive. People then work through five steps of "REACH." The term "REACH" is an acronym that represents the five key steps that interventionists can use to promote emotional forgiveness in another person. These steps include: R = Remembering the hurt, E = Empathizing with the offender, A = offering a gift of forgiveness that is Altruistic, C = Committing to forgiveness, and H = Holding on to forgiveness when doubt arises. After taking the steps to promote emotional forgiveness, people are re-invited to solidify (or make anew) a decision to forgive. Finally, generalization is sought through twelve steps to become a more forgiving person (i.e., forgivingness). Most research supporting REACH Forgiveness interventions has been secular, but a few studies have investigated Christian-accommodated REACH Forgiveness. In the current study, we utilized the secular version. The materials for the REACH Forgiveness program for groups (utilized in the present study) as well as do-it-yourself workbooks are available at: www.evworthington-forgiveness.com.

Measures

Pilot Testing of Measures

Prior to conducting the experimental phase of this study, a subset of 32 participants was recruited to pilot the study measures to ensure that interpretation of the English scales was acceptable to the participants. Small portions of wording of scales were slightly modified to be more easily readable by native Kannada language readers to enhance clarity, but scales remained intact in their original English form. All scales have been shown to have acceptable psychometric properties and are scored so that higher values indicate higher levels of the construct. Coefficient alphas for all study measures are contained in **Table 1**.

Outcome Measures (T1, T2, and T3)

Unforgiveness

Unforgiveness was assessed using the Transgression-Related Interpersonal Motivations Inventory-18 (McCullough et al., 2010). This scale consists of 18 items with responses of 1 = *strongly disagree* to 5 = *strongly agree* scale. An example item is, "I have given up my hurt and resentment." Scores on this measure possess good estimated internal consistency (αs > 0.85), moderate 8-week, test-retest temporal stability (r = 0.50), and excellent factorial and construct validity (McCullough et al., 1998, 2001, 2006).

Decisional Forgiveness Scale

The extent to which an individual had made a decision to forgive their offender was measured with the Decisional Forgiveness Scale (Worthington et al., 2007). This scale assessed behavioral intentions to act more forgiving toward the offender. It consists of eight items with responses of 1 = *strongly disagree* to 5 = *strongly agree* scale. An example item is, "I will try to act toward him or her in the same way I did before he or she hurt me." Scores on this measure have good estimated internal consistency (α = 0.78), good 3-week, test-retest temporal

TABLE 1 | Coefficient alphas for all study measures.

Outcome Measures	T1	T2	T3
Core Measures			
Unforgiveness	0.97	0.99	0.93
Decisional Forgiveness	0.76	0.63	0.29
Emotional Forgiveness	0.87	0.98	0.91
Emotion Measures			
Empathy	0.98	0.99	0.96
Expressivity	0.71	0.73	0.77
Positive Affect	0.96	0.98	0.89
Negative Affect	0.95	0.99	0.92
Self-Perception			
Self-Esteem	0.56	0.95	0.95
Measures in the Forgiveness and Relational Spirituality Model (Worthington and Sandage, 2016)			
Religious Affiliation	–		
Religious Commitment	–		
Spirituality	–		
Dispositional Gratitude	0.72		
Shame-Proneness	0.95		
Guilt-Proneness	0.67		
Similarity of Offender Spirituality	0.86		
Sacred Desecration	0.95		

stability (r = 0.73), and excellent factorial and construct validity (Worthington et al., 2007).

Emotional Forgiveness Scale

The degree to which an individual felt emotional forgiveness toward their offender was measured with the Emotional Forgiveness Scale (Worthington et al., 2007). This scale consists of eight items with responses of 1 = *strongly disagree* to 5 = *strongly agree* scale. An example item is, "I feel love toward him or her." Scores on this measure have good estimated internal consistency (α = 0.81), good 3-week, test-retest temporal stability (r = 0.73), and excellent factorial and construct validity (Worthington et al., 2007).

Empathy

Batson's Empathy Adjectives were used to measure the extent to which an individual felt emotional, other-focused feelings of empathy toward the offender (Batson et al., 1987). The scale has eight items with responses of 1 = *not at all* to 6 = *extremely* scale. Example adjectives are, "sympathetic," "moved," and "compassionate." Scores on this scale have acceptable estimated internal consistency (αs ≈0.70) and robust factorial and construct validity (Batson et al., 1987; Niezink et al., 2012).

Negative Expressivity

The Berkeley Expressivity Scale assesses bodily (e.g., facial and postural) changes that typically reflect emotional experience such as frowning or smiling (Gross and John, 1997). The scale contains three subscales including positive and negative expressivity and a subscale that indexes impulse strength. Only the negative expressivity scale was included in the present study and is scored so that high values indicate a low level of negative expressivity. The negative expressivity subscale contains six items with responses of 1 = *strongly disagree* to 7 = *strongly agree*. An example item is, "Whenever I feel negative emotions, people can easily see exactly what I am feeling." Scores on this measure have good estimated internal consistency (α = 0.86) and excellent factorial and construct validity (Gross and John, 1997, 2003).

Positive and Negative Affect

The Positive and Negative Affect Scales were used to assess positive and negative mood (Watson et al., 1988). Each scale consists of 10 items with responses of 1 = *very slightly or not at all* to 5 = *extremely scale*. Example positive and negative affect items, respectively, are, "interested," "excited," and "strong" and "distressed," "upset," and "hostile." Scores on this measure have good estimated internal consistency (αs > 0.84), good 1-week, test-retest temporal stability (rs ≈0.80), and excellent factorial and construct validity (Watson et al., 1988).

Self-Esteem

The Rosenberg Self-Esteem Scale is the most widely used instrument to assess a participant's global self-evaluation of personal worth (Rosenberg, 1965). The scale has 10 items with responses of 1 = *strongly agree* to 4 = *strongly disagree* scale. An example item is, "I take a positive attitude toward myself." Scores on this measure have excellent estimated internal consistency (α = 0.91) and item convergence and divergence characteristics and excellent factorial and clinical validity (Sinclair et al., 2010).

Measures Within the Forgiveness and Relational Spirituality Model (Davis et al., 2008; Worthington and Sandage, 2016; T1 Only)

Religiousness and Spirituality

Religiousness and spirituality were measured with three single-item measures. Religious affiliation was measured by asking, "What is your religious affiliation?" Response options were: Buddhism, Hindu, Muslim, Christian, Jain, and Sikh. Religious commitment was assessed with the item, "How committed are you to your religion?" Spirituality was assessed with the item, "How intense is your spiritual life?" Response options for religious commitment and spirituality items were 1 = *not at all* to 5 *totally*.

Trait Gratitude

The Gratitude Questionnaire was used to assess the tendency to recognize and respond with positive emotion to the good will and generosity of others and positive experiences in one's life (McCullough et al., 2002). The scale has six items with responses of 1 = *strongly disagree* to 7 = *strongly agree*. An example item is, "I have so much in life to be thankful for." Scores on this measure have good estimated internal consistency (α = 0.82) and excellent factorial and construct validity (McCullough et al., 2002).

Shame-Proneness and Guilt-Proneness

Shame and guilt were assessed using the Test of Self-Conscious Affect (Tangney et al., 2000). This scale contains independent subscales that measure characterological shame and the experience of guilt. Sixteen scenarios are presented to participants and each scenario contains separate shame and guilt responses. An example scenario is, "While out with a group of friends, you make fun of a friend who's not there." The shameful response, "You would feel small . . . like a 'rat,'" and the guilty response, "You would apologize and talk about that person's good points" have response options of 1 = *not likely* to 5 = *very likely*. Scores on this measure have acceptable estimated internal consistency (α = 0.74 shame; α = 0.69 guilt), moderate 3- 5-week, test-retest temporal stability (r = 0.85 shame; r = 0.74 guilt), and excellent construct validity (Tangney, 1990, 1996; Fontaine et al., 2001).

Similarity of Offender Spirituality

The Similarity of Offender Spirituality scale was used to assess a victim's appraisals of spiritual similarity of the offender and victim (Davis et al., 2009). Similarity in basic religious beliefs as well as humanistic similarity was assessed. The scale has nine items with response options of 0 = *completely disagree* to 6 = *completely agree* scale. An example item is, "I thought about how similar my basic religious beliefs were to his/hers." Scores on this measure have good internal consistency (α = 0.87) and excellent factorial and construct validity (Davis et al., 2009).

Sacred Desecration

The extent to which a participant perceived the offense as an intentional and direct or indirect violation against God or one's belief in a higher power or against one's religious beliefs or spirituality or anything the participant holds sacred was assessed using the Sacred Desecration scale (Pargament et al., 2005). The scale has 10 items with responses of 1 *not at all* to 5 *very much* scale. An example item is, "This event was both an offense against me and against God." Scores on this measure have excellent estimated internal consistency ($\alpha = 0.92$) and excellent factorial and construct validity (Pargament et al., 2005).

Analyses

To examine the first hypothesis, analyses included mixed-model analyses of variance (significance tests = F, effect size = η_p^2) and independent groups (effect size = d) and repeated-measures (effect size = d) t-tests. Models were estimated with and without covariates, but the pattern and significance of the results were virtually identical. Thus, results are reported without covariates included in the model. Analyses addressing the first hypothesis examined all eight outcome variables measured at T1, T2, and T3, including unforgiveness, decisional and emotional forgiveness, empathy, negative expressivity, affect, and self-esteem. To examine the second hypothesis, analyses included multiple regression models in which post-training forgiveness, emotion, and self-perception outcomes were predicted by pre-training levels of the outcomes themselves and relational spirituality predictors. All variables adhered to assumptions regarding linearity and normality, and statistical significance was set at $p < 0.006$ (Bonferroni adjustment $\alpha = 0.05/8$ outcomes) to control type I error inflation that results from examining eight non-independent outcomes.

RESULTS

In **Table 2**, we report the means and standard deviations for immediate-training and wait-list comparison participants across all time points. As expected, immediate-training and wait-list comparison participants showed improvements across time, but only at appropriate times (T1-T2 for immediate-training and T2-T3 for wait-list comparisons). This is evidenced by significant condition by time interactions (see **Table 3**; λs ≤ 0.49, Fs ≥ 62.58, ps ≤ 0.001, η_p^2s ≥ 0.51) that were present for all outcome variables except expressivity ($\lambda = 0.95$, $F = 2.95$, $p = 0.060$, $\eta_p^2 = 0.05$). Repeated measures t-tests revealed that participants in the immediate-training condition showed significant improvements on all variables (ts ≥ 9.43, ps ≤ 0.001, ds ≥ 1.20) except expressivity ($t = -2.54$, $p = 0.014$, $d = -0.32$) from T1 to T2 and either maintained these changes (i.e., non-significant changes) from T2 to T3 or showed continued improvement (see **Table 4**; ts ≥ 3.15, ps ≤ 0.003, ds ≥ 0.40). Repeated measures t-tests revealed that participants in the wait-list comparison condition showed no changes from T1 to T2 on any outcome variables. Significant improvements (ts ≥ 5.04, ps ≤ 0.001, ds ≥ 0.65) occurred from T2 to T3 for wait-list participants on all outcome variables (see **Table 4**). For participants in both immediate-training and wait-list comparison conditions significant improvements (ts ≥ 3.34, ps ≤ 0.001, ds ≥ 0.42) on all outcomes occurred from T1 to T3 (see **Table 4**). Independent t-tests were used to

TABLE 2 | Means and standard deviations for immediate training and wait-list comparison participants across time.

	Time 1		Time 2		Time 3	
	M	*SD*	*M*	*SD*	*M*	*SD*
Core Measures						
Unforgiveness						
Immediate Training	3.93_a	1.13	1.48_b	0.54	1.37_b	0.66
Wait-List Comparison	4.15_a	0.97	4.13_a	1.03	1.32_b	0.49
Decisional Forgiveness						
Immediate Training	2.69_a	0.82	3.77_b	0.32	3.94_b	0.41
Wait-List Comparison	2.44_a	0.71	2.53_a	0.79	3.97_b	0.40
Emotional Forgiveness						
Immediate Training	2.12_a	0.98	4.31_b	0.67	4.64_c	0.67
Wait-List Comparison	1.76_a	0.80	1.79_a	0.91	4.59_b	0.61
Emotion Measures						
Empathy						
Immediate Training	2.03_a	1.42	4.67_b	0.99	5.21_c	0.99
Wait-List Comparison	1.81_a	1.18	1.95_a	1.29	5.19_b	0.86
Expressivity						
Immediate Training	5.56_a	0.85	$5.81_{a,b}$	0.93	5.91_b	0.88
Wait-List Comparison	5.53_a	0.97	5.57_a	0.76	5.91_b	0.93
Positive Affect						
Immediate Training	1.94_a	1.06	3.95_b	0.43	4.49_c	0.67
Wait-List Comparison	1.81_a	1.00	1.78_a	1.08	4.34_b	0.61
Negative Affect						
Immediate Training	3.95_a	1.12	1.32_b	0.53	1.25_b	0.62
Wait-List Comparison	4.15_a	1.07	4.10_a	1.33	1.22_b	0.55
Self-Perception						
Self Esteem						
Immediate Training	1.70_a	0.29	3.00_b	0.78	3.25_c	0.89
Wait-List Comparison	1.77_a	0.39	1.61_b	0.30	3.26_c	0.83

Means in each row that share subscripts do not differ significantly at Bonferroni-adjusted $p < 0.006$.

TABLE 3 | Condition by time interaction statistics for all outcome variables.

	λ	*F*	*p*	η_p^2
Core Measures				
Unforgiveness	0.27	160.41	<0.001	0.73
Decisional Forgiveness	0.49	62.58	<0.001	0.51
Emotional Forgiveness	0.35	112.76	<0.001	0.65
Emotion Measures				
Empathy	0.48	66.23	<0.001	0.52
Expressivity	0.95	2.95	0.060	0.05
Positive Affect	0.37	102.57	<0.001	0.63
Negative Affect	0.34	117.64	<0.001	0.66
Self-Perception				
Self-Esteem	0.35	113.43	<0.001	0.65

TABLE 4 | Within-participant changes for immediate training and wait-list comparison participants.

	Time 1 vs. Time2			Time 2 vs. Time 3			Time 1 vs. Time 3		
	t	*p*	*d*	*t*	*p*	*d*	*t*	*p*	*d*
Core Measures									
Unforgiveness									
Immediate Training	13.09	<0.001	1.66	1.44	0.154	0.18	12.54	<0.001	1.59
Wait-List Comparison	0.34	0.736	0.04	15.53	<0.001	1.97	16.12	<0.001	2.05
Decisional Forgiveness									
Immediate Training	−9.43	<0.001	−1.20	−2.51	0.015	−0.32	10.69	<0.001	−1.36
Wait-List Comparison	−1.42	0.160	−0.18	−12.84	<0.001	−1.63	−13.26	<0.001	−1.68
Emotional Forgiveness									
Immediate Training	−12.63	<0.001	−1.60	−3.20	0.002	−0.41	−14.23	<0.001	−1.81
Wait-List Comparison	−0.53	0.596	−0.07	−16.60	<0.001	−2.11	−18.35	<0.001	−2.33
Emotion Measures									
Empathy									
Immediate Training	−11.09	<0.001	−1.41	−2.99	0.004	−0.38	−13.69	<0.001	−1.74
Wait-List Comparison	−1.16	0.251	−0.15	−15.29	<0.001	−1.94	−17.24	<0.001	−2.19
Expressivity									
Immediate Training	−2.54	0.014	−0.32	−1.32	0.192	−0.17	−3.34	0.001	−0.42
Wait-List Comparison	−0.32	0.752	−0.04	−5.04	<0.001	−0.65	−5.15	<0.001	−0.66
Positive Affect									
Immediate Training	−12.91	<0.001	−1.64	−6.47	0.000	−0.82	−12.93	<0.001	−1.64
Wait-List Comparison	0.44	0.660	0.06	−12.96	<0.001	−1.65	−14.27	<0.001	−1.81
Negative Affect									
Immediate Training	13.56	<0.001	1.72	0.93	0.356	0.12	13.29	<0.001	1.69
Wait-List Comparison	0.57	0.569	0.07	13.00	<0.001	1.65	15.48	<0.001	1.97
Self-Perception									
Self-Esteem									
Immediate Training	−11.25	<0.001	−1.43	−5.92	<0.001	−0.75	−11.66	<0.001	−1.48
Wait-List Comparison	2.94	0.005	0.37	−12.86	<0.001	−1.63	−12.08	<0.001	−1.53

Repeated measures t-tests and effect sizes (d).

examine differences between immediate-training and wait-list comparisons at T1, T2, and T3 and showed that at T1 there were no significant differences on any outcome variable ($ts \leq 2.30$, $ps \geq 0.023$, $ds \leq 0.21$), at T2 there were significant differences on all variables favoring improvement of immediate-training over wait-list comparisons ($ts \geq 3.13$, $ps \leq 0.002$, $ds \geq 0.28$) except on expressivity ($t = 1.58$, $p = 0.116$, $d = 0.14$), and at T3 there were no significant differences by condition ($ts \leq 1.93$, $ps \geq 0.055$, $ds \leq 0.17$) on any variable (see **Table 5**).

Table 6 contains the regression coefficients for all relational spirituality variables predicting all post-training forgiveness, emotion, and self-perception outcomes, controlling for pre-intervention levels of these outcomes. Controlling for pre-training levels of each construct, relational spirituality predictors accounted for 52, 8, 37, 24, 74, 43, 57, and 82% of the variance in post-intervention levels of unforgiveness, decisional forgiveness, emotional forgiveness, emotional expressivity, positive affect, negative affect, and self-esteem, respectively. With regard to unique predictors of change in outcomes, similarity of offender spirituality was the most consistent predictor showing significant, negative associations with growth in unforgiveness, emotional expressivity, and self-esteem ($\beta s = -0.17$ to -0.42, $ps \leq 0.005$) and significant, positive associations with empathy ($\beta = 0.40$, $p = 0.002$), and positive affect ($\beta = 0.46$, $p < 0.001$) and a positive association that approached significance for emotional forgiveness ($\beta = 0.32$, $p = 0.008$). Shame-proneness showed significant, positive associations with growth in emotional forgiveness, emotional expressivity, and self-esteem ($\beta s = 0.43$ to 0.67, $ps \leq 0.003$). Trait gratitude was negatively associated with growth in self-esteem ($\beta = -0.15$, $p = 0.001$). Guilt-proneness was negatively associated with growth in negative affect ($\beta = -0.33$, $p < 0.001$) and perceiving the offense as a sacred desecration was positively associated with growth in positive affect ($\beta = 0.35$, $p = 0.007$).

DISCUSSION

The present study largely supports the first hypothesis that forgiveness training will result in changes in forgiveness,

TABLE 5 | Comparison of immediate training and wait-list comparisons at all time points.

	Time 1			Time 2			Time 3		
	t	*p*	*d*	*t*	*p*	*d*	*t*	*p*	*d*
Core Measures									
Unforgiveness	−1.15	0.253	−0.10	−17.98	<0.001	−1.61	0.51	0.613	0.05
Decisional Forgiveness	1.83	0.070	0.16	11.37	<0.001	1.02	−0.47	0.640	−0.04
Emotional Forgiveness	2.30	0.023	0.21	17.48	<0.001	1.57	0.46	0.649	0.04
Emotion Measures									
Empathy	0.91	0.365	0.08	13.17	<0.001	1.18	0.11	0.913	0.01
Expressivity	0.13	0.895	0.01	1.58	0.116	0.14	0.00	1.000	0.00
Positive Affect	0.69	0.495	0.06	14.67	<0.001	1.32	1.31	0.192	0.12
Negative Affect	−1.01	0.315	−0.09	−15.31	<0.001	−1.38	0.34	0.738	0.03
Self-Perception									
Self Esteem	−0.98	0.328	−0.09	13.08	<0.001	1.17	0.09	0.925	0.01

Independent t-tests and effect sizes (d).

TABLE 6 | Relational spirituality predictors of forgiveness, emotion, and self-perception outcomes resulting from REACH Forgiveness training.

	Unforgiveness			Decisional Forgiveness			Emotional Forgiveness			Empathy		
	B	β	***p***	***B***	β	***p***	***B***	β	***p***	***B***	β	***p***
Pre-Training	−0.35	−0.73	0.000	0.01	0.02	0.931	−0.27	−0.40	0.009	−0.08	−0.11	0.465
Person Variable												
Hindu	−0.12	−0.09	0.475	0.02	0.02	0.888	0.18	0.11	0.453	0.08	0.03	0.843
Muslim	−0.13	−0.09	0.482	0.12	0.11	0.516	0.19	0.10	0.471	−0.18	−0.07	0.672
Religious Commitment	0.03	0.05	0.620	−0.11	−0.25	0.085	−0.06	−0.08	0.503	−0.10	−0.09	0.486
Spirituality	−0.10	−0.17	0.108	0.07	0.16	0.265	0.09	0.11	0.351	0.05	0.05	0.716
Gratitude	0.07	0.10	0.180	−0.10	−0.19	0.065	0.13	−0.14	0.104	−0.04	−0.03	0.752
Shame-Proneness	−0.17	−0.32	0.020	0.04	0.10	0.591	0.29	0.43	0.003	0.39	0.39	0.014
Guilt-Proneness	0.19	0.12	0.124	0.20	0.18	0.096	0.19	0.10	0.266	−0.15	−0.05	0.585
Offender's Relationship with the Sacred												
Similarity of Offender Spirituality	−0.21	−0.42	0.000	−0.04	−0.11	0.378	0.20	0.32	0.008	0.37	0.40	0.002
Relationship of the Transgression to the Sacred												
Sacred Desecration	0.06	0.13	0.341	−0.09	−0.27	0.153	−0.07	−0.12	0.412	0.17	0.19	0.221

	Expressivity			Positive Affect			Negative Affect			Self-Esteem		
	B	β	***p***	***B***	β	***p***	***B***	β	***p***	***B***	β	***p***
T1	0.35	0.31	0.000	−0.28	−0.54	0.000	−0.14	−0.31	0.016	0.14	0.05	0.310
Person Variable												
Hindu	0.10	0.04	0.635	0.18	0.13	0.343	−0.06	−0.04	0.707	0.06	0.03	0.709
Muslim	0.10	0.04	0.675	0.15	0.09	0.495	0.02	0.02	0.894	0.16	0.07	0.378
Religious Commitment	−0.13	−0.12	0.106	−0.05	−0.08	0.463	0.06	0.09	0.327	0.02	0.02	0.735
Spirituality	0.14	0.13	0.089	0.07	0.11	0.327	−0.02	−0.04	0.700	0.01	0.01	0.941
Gratitude	−0.16	−0.12	0.026	0.07	0.09	0.262	0.12	0.16	0.020	−0.17	−0.15	0.001
Shame-Proneness	0.43	0.45	0.000	0.01	0.02	0.885	−0.10	−0.17	0.178	0.57	0.67	0.000
Guilt-Proneness	−0.25	−0.10	0.106	0.14	0.09	0.314	−0.51	−0.33	0.000	−0.07	−0.03	0.557
Offender's Relationship with the Sacred												
Similarity of Offender Spirituality	−0.16	−0.17	0.005	0.25	0.46	0.000	−0.02	−0.04	0.625	−0.19	−0.24	0.000
Relationship of the Transgression to the Sacred												
Sacred Desecration	0.04	0.04	0.612	0.18	0.35	0.007	−0.06	−0.11	0.362	0.07	0.09	0.253

Pre-training assessment of respective construct. T1 = respective outcome measured at Time 1.

emotional reactions, and self-esteem. Additionally, the present study provides the first evidence of the efficacy of the REACH Forgiveness program in India. This supports findings from a number of studies demonstrating the efficacy of this psychoeducational approach. For instance, the present findings are similar to a randomized controlled trial (RCT) of the REACH Forgiveness program that utilized undergraduate students (N = 97) in a 6-hour, in-person design. The REACH Forgiveness group showed greater improvements, compared to controls, in forgiveness at both post-test and 6-week follow-up assessments (Sandage and Worthington, 2010). Also, our results are similar to a study of 145 married couples randomly assigned to a control condition or a 9-hour, in-person, REACH Forgiveness counseling intervention with individual couples. Those in the REACH Forgiveness intervention reported greater improvements, compared to controls, in forgiveness, as well as, relationship quality, empathy, and negative mood across 1-, 3-, 6-, and 12-month follow-up assessments (Worthington et al., 2015). Again, similar to the present findings, a recent RCT with 162 middle-aged adults comparing a 12-hour, in-person, REACH Forgiveness group condition to a 12-hour, in-person, process group therapy condition and a wait-list control showed that the REACH Forgiveness group condition was better than the wait-list condition at reducing unforgiveness and rumination and increasing empathy and benevolence at mid-, and post-intervention and 6-month follow-up assessments, but REACH Forgiveness was equally effective as process group therapy focused on forgiveness on these same outcomes (Wade et al., 2018). Furthermore, several other studies have evaluated the REACH Forgiveness program using 6 to 13 h in-person trainings, downloadable workbooks, and online materials. Although the mode of delivery differs, the present psychoeducational groups show findings similar to samples from Australia, Ghana, and Indonesia and mixed foreign students studying in the United States (Worthington et al., 2010; Lin, 2012; Nation et al., 2018; Kurniati et al., 2020; Osei-Tutu et al., 2020).

Although the REACH Forgiveness program has been tailored and been shown to be effective with Christians (Lampton et al., 2005; Stratton et al., 2008; Worthington et al., 2010; Greer et al., 2014), the present study also offers the first evidence that a secular REACH Forgiveness program is effective in a largely Hindu sample (with a substantial minority of Muslims). It is important to note that the REACH Forgiveness program in the present study was not tailored to the Hindu, Muslim, or indeed any faith. Rather, the secular version of the program was implemented and yielded good benefits for the participants in mixed-religious groups. This outcome is reminiscent of the work of Rye et al. (2005) who evaluated the effectiveness of two versions of an eight-session forgiveness group intervention for divorced Christians. They described this intervention as "based loosely on Worthington's (1998) REACH model of forgiveness" (p. 883). Participants (N = 149) were randomly assigned to a secular or a religiously accommodated (Christian) forgiveness condition, or to a no-intervention comparison condition. People in both intervention conditions reported more forgiveness of an ex-spouse than those in the control, but did not differ from each other. *Post hoc* interviews showed that Christians in both secular and religious interventions actually used the same religious coping strategies. Thus, the secular treatment worked as well as the religiously accommodated one to produce the focal outcome—forgiveness. This is common in psychotherapy intervention research on secular and religiously accommodated treatments. Captari et al. (2018), in a comprehensive recent meta-analysis of almost 100 religiously accommodated treatments, showed that secular and religiously accommodated treatments did not differ on the focal outcome. However, religiously-tailored interventions are typically more favorably received by religious participants and yield stronger spiritual benefits (Captari et al., 2018). Consequently, it might be worthwhile to invest in tailoring the REACH Forgiveness group program to suit the specific needs of the Hindu faith. Future research could determine whether this might yield even stronger forgiveness and emotional well-being benefits or more spiritual benefits.

Recall that Wade et al. (2014) characterized the dose-response relationship between effect sizes for forgiveness outcomes and amount of time spent in forgiveness training as: 0.10 + 0.05 (hours of intervention). Hence, we can derive an expected amount of gain in forgiveness given that participants in the present study were engaged in a 6-hour psychoeducational program. The predicted amount of change in forgiveness should be 0.4 standardized units of change. Immediate-training (ds $\geq$ 1.20) and wait-list comparisons (ds $\geq$ 0.65) both showed changes that notably exceeded this expected change. Wade et al. (2014) also reported aggregate changes in outcomes reflecting positive (i.e., hope) and negative affect (i.e., depression) as 1.00 and 0.34, respectively, which the present study effect sizes (ds $\geq$ 1.41 positive affect and ds $\geq$ 1.42 negative affect) again compare favorably too. Finally, Wade et al. (2014) showed that between-condition differences in forgiveness yielded standardized effect sizes of about 0.5, and in the present study between-condition differences at T2 were about twice that size (ds $\geq$ 1.02).

Given the impact of the REACH Forgiveness program in India, it is worthwhile considering what may have contributed to these powerful changes. First, the leader was an experienced and skilled facilitator who was trained by two of the co-authors (EW and SK). Hence, the fidelity of the training program, although not objectively measured, was likely quite high. Second, inclusion criteria for the sample was the experience of an event that remained, at minimum, substantially unforgiven and participants indeed reported severe hurt. Another inclusion criterion was that participants needed to be motivated to work on their unforgiveness in a group setting. These inclusion criteria likely created an environment in which participants shared and worked on significant past offenses and were motivated to get past them. Third, as a result of recent national events in India, forgiveness may be salient and there may presently be a favorable cultural climate for encouraging forgiveness (Mission India, 2017; Chandrasekharan, 2018). But, this may be fragile and short-lived, and current tensions between India and Pakistan as well as new governmental policies that marginalize Muslims highlight the tenuous nature of forgiveness, reconciliation, and peace in that region (BBC News, 2019; New York Times, 2019). Nevertheless, the participants in the present study appear to

have been highly motivated to pursue forgiveness in their own personal lives and cultural factors are likely to influence these individual motivations.

The second hypothesis in this study was that relational spirituality variables would predict responsiveness to the intervention. For a few variables, this was true. However, for others it was not. Hence, hypothesis two was partially supported. Similarity of offender spirituality had the most consistent relationship to outcomes. Clearly consistent with the relational spirituality and forgiveness model (Davis et al., 2008; Worthington and Sandage, 2016), perceiving the offender as having a similar spirituality was related to less growth of unforgiveness and more growth in empathy, positive affect, and emotional forgiveness (though the similar spirituality and emotional forgiveness association only approached significance).

Other findings are less clearly explained by the relational spirituality and forgiveness model. For instance, perceived similarity of offender spirituality was related to less emotional expressivity and self-esteem—not more, as had been hypothesized. Shame-proneness was positively related to growth in emotional forgiveness, emotional expressivity, and self-esteem. Gratitude was negatively associated with growth in self-esteem. Guilt-proneness was negatively associated with growth in negative affect, and perceiving the offense as a sacred desecration was positively associated with growth in positive affect. When people perceive that a sacred desecration has occurred, they typically react with strong negative emotion (Pargament et al., 2005). Thus, one potential reason for this latter finding is merely that the initial reactions were so negative emotionally that regression to the mean accounted for the positive correlation. In the present study, we used the forgiveness and relational spirituality model for the first time to predict responsiveness to a forgiveness intervention rather than naturally occurring forgiveness. It could well be that different variables altogether are active. Additional research is needed on this and other interventions in which forgiveness and relational spirituality variables are examined.

Limitations

Despite the considerable benefits that REACH Forgiveness training offered to participants in the present study, there are some limitations that should be mentioned. First, this is not a representative sample of Indians. Participants were all students of Karnatak University, all had considerable levels of education and were engaged in higher educational pursuits. These are characteristics that are not shared widely by all citizens of India. Second, although the effects of REACH Forgiveness training were of good size, all effects were measured through self-reported outcomes. The impact of REACH Forgiveness training on actual behavior, long-term attitudes, or visceral responses to an offender were not measured. Third, like most interventions, the internal validity of the study was high, but external validity may not be high. This psychoeducation took place in a highly controlled setting at a university psychology department. Fourth, overall the reliability of the measures in the present study was exceptional. In **Table 1**, we see that in 24 administrations of core, emotional, and self-esteem measures and five single-administration religious variables, only four administrations (of the 29) resulted in an alpha less than 0.7. One possible reason is that we pre-tested the questionnaires. In the instance of an exceptionally low reliability coefficient we urge caution in interpretation. This would be decisional forgiveness at T3. Three other marginal reliabilities were also observed for T2 decisional forgiveness ($\alpha = 0.63$), T1 self-esteem ($\alpha = 0.56$) and guilt-proneness ($\alpha = 0.67$). However, in these latter cases the data certainly contain more measurement error but are still quite interpretable. This was not intended as a psychometric study, so it is not possible to determine the cause of these low or marginal estimated reliabilities. It is a point of concern because low estimated reliability increases measurement error which reduces the ability of the variable to correlate with other variables and lowers the sensitivity of the variable to experimental manipulations. Furthermore, the pre-testing phase of our work should not be interpreted as a cross-cultural validation of these measures. Future psychometric work should be done on these assessments.

CONCLUSION

This is the first examination of the REACH Forgiveness program in India. The present study offers a strong and consistent pattern of findings in the immediate-training group that replicated in the wait-list comparison group and suggests REACH Forgiveness training is of utility in India. Findings from this study revealed benefits in forgiveness and unforgiveness, positive and negative affect, and spirituality outcomes, and all effect sizes were well greater than expected. Keeping in mind sample, self-report, and measurement limitations of the study, it appears that the evidence weighs strongly in favor of continued use and evaluation of the REACH Forgiveness program in India. No special adaptations were necessary to the program, a mostly Hindu sample responded very favorably, and future investigators may wish to determine what key features of program tailoring (e.g., religious) might offer additional improvements and reach. As the only empirically-tested forgiveness psychoeducation program in India at present, continued efforts to understand, enhance, and expand on REACH Forgiveness training in India would seem well-advised. The present study offers a step forward to REACH Forgiveness in one of the most divided and largest populations on earth.

DATA AVAILABILITY STATEMENT

The datasets generated for this study are available on request to the corresponding author.

ETHICS STATEMENT

The study involving human participants was reviewed and approved by the Institutional Review Board at Karnatak University Dharwad. The participants provided their written informed consent to participate in this study.

AUTHOR CONTRIBUTIONS

All authors designed the study and shaped the hypotheses. EW and SK assisted in providing and organizing materials for IRB approval (i.e., training manuals, summary descriptions of the training, copies of measures) many of which were incorporated into the writing of the Materials and Methods. SK and SM oversaw all procedural aspects of the study. SM delivered the psychoeducational content, collected and entered data. LT conducted the analyses. LT, EW, AC, SK, and AB contributed to interpreting the results and to conceptualizing and assisting with editing the manuscript into its final form.

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The Role of Self-Regulation in Forgiveness: A Regulatory Model of Forgiveness

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Forgiveness is an emotion regulation process that is important for both physical and mental health. Given its benefits, studying the facilitation of forgiveness is important. Researchers have already demonstrated the relationship between self-control and forgiveness. However, in this study, we aim to extend previous research by examining the regulating processes of forgiveness and the possible mediating role of emotion regulation in the relationship between self-regulatory strength and forgiveness. University students (N = 317) in Hong Kong who were recruited to participate in this study completed an online survey. The results of this study indicated that both self-regulatory strength and emotion regulation were significant predictors of forgiveness. Interestingly, cognitive reappraisal significantly mediated the association between self-regulatory fatigue and forgiveness. This suggests a potential self-regulation mechanism that leads to a prorelationship response and provides evidence for a regulatory model of forgiveness.

Keywords: forgiveness, emotion regulation, self-regulatory strength, self-control, self-regulatory fatigue

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INTRODUCTION

Forgiveness is a central feature of social life, helping to facilitate interactions between individuals and groups, as well as bolstering the functioning of committed, ongoing relationships (see Worthington and Wade, 2020 for a review). Empirical work has ranged from intergroup forgiveness (Van Tongeren et al., 2014) to interpersonal relationships (Fehr et al., 2010). One of the primary social benefits of forgiveness is its ability to preserve and restore valued relationships (e.g., Burnette et al., 2012). Though the conceptualizations of the forgiveness process have spanned the arenas of cognition, motivation, and behavior, the most consistent corpus of research has focused primarily on emotional processes. For example, researchers have examined the role of emotion in the forgiveness process in terms of emotion-focused coping strategies (Worthington and Scherer, 2004), emotional intelligence (Rey and Extremera, 2014), emotion regulation strategies in conflict resolution (Halperin, 2014), and physiological responses (Witvliet et al., 2001).

Previous research has demonstrated the relationship between emotion regulation and forgiveness (see Burnette et al., 2014 for a meta-analytic review), since forgiveness is often conceptualized as being rooted in emotions and requires a person to regulate their emotions toward the transgressor. Specifically, forgiveness is defined as the replacement of negative emotions

(e.g., resentment, bitterness, anger, hatred, or hostility) toward a transgressor with positive emotions (i.e., empathy, sympathy, compassion, or love; Worthington et al., 2007). In other words, based on the *emotional replacement hypothesis*, forgiveness juxtaposes positive emotions against negative emotions; these positive emotions neutralize or replace all or part of the negative emotions (Worthington and Wade, 1999). However, such emotional transformations do not occur naturally or easily; individuals must overcome their natural tendencies to respond to an offender with anger and vengeance and instead engage in some form of regulation to respond positively. Accordingly, self-regulatory strength or emotion regulation looms large for many instances of the forgiveness process.

Self-Regulatory Strength and Forgiveness

The ego-depletion model of self-regulation suggests that all forms of self-regulation draw on a common inner resource or limited pool of energy, called self-regulatory strength, which can be depleted. When individuals engage in an act of self-regulation that consumes considerable regulatory resources, subsequent self-control attempts can be impaired (Baumeister et al., 1998). Self-regulatory strength refers to the overall amount of self-regulatory capacity available to an individual pursuing a given goal, such as an interpersonal goal (Luchies et al., 2011). In short, when people engage in difficult tasks that require actively engaging the self and overriding a natural default behavior or sustained engagement in an arduous activity, the strain on one's psychological resources can impair future endeavors that will require one to engage in similarly difficult processes.

However, the evidence regarding self-regulation, or, more specifically, ego-depletion, is mixed. For example, a preregistered study of the ego-depletion effect across multiple laboratories failed to replicate (Tangney et al., 2004; Hagger et al., 2016). Whether this failure to replicate is indicative of the lack of a reliable effect or another problem of the experimental design (e.g., imprecise tuning of the manipulation to the participant sample; see Baumeister, 2019; Caspi, 2000) remains to be seen; but it must be noted that the self-regulatory model in social psychology—and, by extension, within forgiveness processes—is not entirely undisputed and requires closer scrutiny. Finally, given that the experimentally manipulated ego-depletion effect is contested, work that employs nonmanipulated (i.e., self-reported) indices may help provide insights into these processes (though these have their own limitations, including the inability to draw causal conclusions).

Forgiveness may be one such instance of a process requiring self-regulatory strength; and, indeed, there has been some evidence of the importance of self-regulatory capability for forgiveness. Finkel and Campbell (2001) found that dispositional self-regulatory strength was positively associated with individuals' accommodative tendencies (e.g., forgiveness) in romantic relationships, and that temporary self-regulatory fatigue decreased individuals' likelihood of engaging in accommodative responses (e.g., forgiveness) to their partner's destructive behaviors. Several other studies found that self-control predicted interpersonal success, higher relationship quality, greater relationship satisfaction, and fewer relationship conflicts from childhood to adulthood (Tangney et al., 2004; Luchies et al., 2011; Vohs et al., 2011). A meta-analytic review revealed that self-control had statistically robust association with small to moderate magnitude across 40 studies and 5,105 participants (Burnette et al., 2014). Building on this prior work, because forgiveness is an emotion regulation process that falls within the broader self-regulatory domain, we hypothesized that low self-regulatory strength (or high self-regulatory fatigue) is associated with lower forgiveness levels.

Emotion Regulation and Forgiveness

Forgiveness is an emotion regulation strategy for coping with interpersonal conflict (Worthington and Wade, 2020). In particular, people may use emotion-focused coping when the perceived best way of dealing with an interpersonal transgression is to attempt to ameliorate immediate negative responses such as anger and hostility. In this way, this emotion regulation strategy requires self-regulatory strength, as it is one instantiation of a self-regulatory process. Following an offense, individuals may also seek to regulate their emotional experiences through emotion-focused coping strategies, such as self-soothing or avoidance (Worthington and Scherer, 2004).

Unforgiveness is theorized as a stress response to appraisals of interpersonal stressors, such as transgressions, betrayals, offenses, and wrongs (Berry et al., 2001). According to Lazarus and Folkman (1984) stress and coping model, an interpersonal transgression is an interpersonal stressor, and the forgiveness process is one way of reacting to, or coping with it.

Cognitive reappraisal is an antecedent-focused emotion regulation strategy that plays a vital role in reinterpreting an interpersonal harm (McCullough, 2001). Cognitive reappraisal involves transforming how an individual construes a situation in order to decrease its emotional impact (Gross, 1998). Forgiveness can function as a cognitive reappraisal process that eradicates anger, hostility, rumination, and their adverse effects in spite of feeling emotional pain and the desire for revenge (Worthington et al., 2007). Positive reappraisal of past negative events, such as reappraising the transgressor's motivations in a benevolent manner (McCullough, 2001), is a key step in the forgiveness process. Therefore, in this study, we hypothesized that emotion regulation, especially cognitive reappraisal, is associated with higher forgiveness levels.

The Mediating Role of Emotion Regulation

We see a gap in the existing forgiveness research regarding understanding how self-regulatory strength may operate through emotion regulation to impact the forgiveness process. Because forgiveness requires that individuals override their default, natural reactions to interpersonal offenses (i.e., unforgiveness) by instead regulating negative emotions and replacing them with neutral or positive emotions toward the offender, it seems

that some degree of self-regulatory strength is necessary (see Burnette et al., 2014 for a review). To the degree that people have sufficient self-regulatory strength, they should be able to engage in emotion regulation strategies that facilitate forgiveness. Thus, these strategies are likely the mediating mechanisms by which self-regulatory capacity affects forgiveness.

According to the ego-depletion theory, an individual exercising self-control on one task who attempts to exert self-control on a second task simultaneously is more likely to fail due to overstrained resources (Geisler and Schroder-Abe, 2015). Individuals with low self-regulatory strength may be unable to exert self-control in regulating their emotions at all. Studies have shown that trait self-control was associated with successful regulation of negative emotions. Given the associations of self-regulatory strength and emotion regulation with forgiveness, we hypothesized that self-regulatory strength (or low self-regulatory fatigue) would be associated with forgiveness because such people would be better able to engage in emotion regulation (cognitive reappraisal). Thus, we predicted an indirect effects (mediational) model.

In this study, we investigated interpersonal forgiveness via emotion regulation and in consideration of individual differences in self-regulatory strength. Building on the consideration derived from the strength model of self-regulation, we propose a new regulatory model of forgiveness, in which emotion regulation (cognitive reappraisal) mediates the effect of self-regulatory strength (self-regulatory fatigue) on forgiveness.

METHODS

Participants

The participants were 317 students (92 men, 218 women) at a university in Hong Kong. They were between the ages of 18 and 36 (M = 20.6 years, SD = 2.3). Most participants were single (65.8%), and a large number were in a relationship (25.4%). The majority of participants did not have any religious affiliation (60.2%). The rest identified as Christians (17.7%), Catholics (4.1), Buddhist (1.2%), or others (1.5%). Approximately half were majoring in humanities and social sciences (57.2%). The rest were studying commerce (12.4%), sciences and engineering (10.6%), creative media (4.9%), law (3.2%), veterinary medicine and life sciences (0.9%), and energy and environment (0.3%). Participants were recruited via various means, including recruitment posters displayed at university campuses, university-wide mailing list and in-class promotion. They participated in this study voluntarily. After they completed the study, they were automatically entered in a lottery for coffee coupons (HK$50, HK$100, HK$200) as an incentive.

Procedure

Each participant completed an online questionnaire that assessed forgiveness, self-regulatory fatigue, and emotion regulation. Participants provided informed consent before participating in the study. This study was approved by the University Human Research Ethics Committee before it began.

MATERIALS

Self-Regulatory Fatigue

The Self-Regulatory Fatigue Scale (SRF-S; Nes et al., 2013) was used to measure self-regulatory fatigue (the depletion of self-regulatory strength). The SRF-S consists of 16 items aimed at assessing participants' self-regulatory fatigue. Sample items include, "I experience repeated unpleasant thoughts" and "I experience uncontrollable temper outbursts." It employs a five-point Likert-type scale with responses ranging from 1 (*not at all true*) to five (*very true*); higher scores reflect chronic ego-depletion or a scarcity of self-regulatory resources. The SRF-S was shown to be a reliable and valid measurement in a Chinese sample (Wang et al., 2015) and demonstrated acceptable reliability in this study (Cronbach's alpha = 0.70).

Emotion Regulation

The Emotion Regulation Questionnaire (ERQ; Gross and John, 2003) was used to assess emotion regulation. The ERQ consists of 10 items that are assessed on a seven-point Likert-type scale to measures respondents' tendency to regulate their emotions in two ways: (1) cognitive reappraisal and (2) expressive suppression. Example items include, "When I'm faced with a stressful situation, I make myself think about it in a way that helps me stay clam" (cognitive reappraisal) and "I control my emotions by not expressing them" (expressive suppression). Possible responses ranged from 1 (*strongly disagree*) to 7 (*strongly agree*). The Chinese version of the ERQ has been validated in a Chinese population (Zhang et al., 2014). The cognitive reappraisal and expressive suppression subscales have demonstrated acceptable reliability in the present study (Cronbach's alphas = 0.86, and 0.72, respectively).

Forgiveness

Forgiveness was assessed by the Trait Forgiveness Scale (TFS). The TFS consists of 10 items aimed at assessing participants' self-appraisal of their proneness to forgive in interpersonal transgressions (Berry et al., 2005). Sample items include "I can forgive a friend for almost anything" and "I am a forgiving person." Respondents rate each item on a five-point Likert-type scale from 1 (*strongly disagree*) to five (*strongly agree*). This scale has been reported as being reliable and valid across various studies (Berry et al., 2005). Two research assistants translated and back translated it into Chinese. The TFS demonstrated acceptable reliability in the present study (Cronbach's alpha = 0.77).

A demographics questionnaire asking about the participants' gender, age, marital status, religious beliefs, and academic major was also included in this study.

RESULTS

Descriptive statistics and zero-order correlations of study variables are shown in **Table 1**. The results of the correlation analysis indicated that the tendency to forgive was negatively associated with self-regulatory fatigue and positively correlated with cognitive reappraisal. Furthermore, self-regulatory fatigue

TABLE 1 | Descriptive statistics and correlations of study variables.

	M(SD)	1	2	3
1. Forgiveness	3.2 (0.6)			
2. Self-regulatory fatigue	3.0 (0.5)	−0.39**		
3. Cognitive reappraisal	4.9 (0.9)	0.31**	−0.32**	
4. Expressive suppression	16.3 (4.3)	−0.07	0.16**	0.01

$^{**}p < 0.01$.

was negatively associated with cognitive reappraisal and positively associated with expressive suppression. As expressive suppression was not associated with forgiveness, it was removed from all subsequent analyses.

Correlation analyses were also conducted to examine the degree of associations between demographic variables (i.e., gender, age, marital status, religious beliefs, and academic major) and study variables. The results of Spearman's rank correlation analyses showed that only religious beliefs were significantly associated with cognitive reappraisal and forgiveness. Therefore, the variable of religious beliefs (by using dummy coding) was statistically controlled for all subsequent analyses.

A hierarchical multiple regression analysis was performed to test the hypothesized mediation model. The religious beliefs variable was entered into the model in Step 1 to serve as a control. In Step 2, self-regulatory fatigue was added into the model as a predictor. In Step 3, cognitive reappraisal was entered into the model to test for a potential mediation effect. The results of the regression analysis indicated that religious beliefs (Christianity vs no religion) accounted for a significant amount of the variance in forgiveness ($\beta = 0.13$, $p < 0.05$). Self-regulatory fatigue accounted for a significant amount of the variance in forgiveness ($\beta = -0.41$, $p < 0.001$) and cognitive reappraisal ($\beta = -0.33$, $p < 0.001$). Cognitive reappraisal also accounted for a significant additional amount of variance in forgiveness ($\beta = 0.17$, $p < 0.01$) after controlling for self-regulatory fatigue. When cognitive reappraisal was included, the beta weight for self-regulatory fatigue decreased from −0.41 to −0.35 ($p < 0.001$), which suggests a partial mediation model ($R^2 = 0.21$, $F(1,280) = 12.40$, $p < 0.001$) (see **Table 2**).

We further tested the significance of the indirect pathway from self-regulatory strength to forgiveness through the mediation of cognitive reappraisal using the PROCESS macro in SPSS. The bootstrapping procedure utilized 5,000 bootstrap samples and 95% bias-corrected confidence intervals (95% CIs). The exclusion of 0 from 95% CIs indicated a significant mediation effect (Hayes, 2013). The results of the bootstrapping analyses indicated that self-regulatory fatigue had exerted a significant direct effect on forgiveness, $c' = -0.38$, 95% CI [−0.50, −0.26] as well as a significant indirect effect on forgiveness through the mediator of cognitive reappraisal, $ab = -0.07$, 95% CI [−0.12, −0.02] (see **Figure 1**).

Alternate models were tested to eliminate two other possibilities: (1) a forgiving tendency might reduce self-regulatory fatigue, which might make individuals more likely to engage in cognitive reappraisals and (2) people who are generally good at cognitive reappraisal might be more likely forgive, which might then provide more self-regulatory strength. However, the results of hierarchical multiple regression analyses indicated that the F values were decreased, $F(1,280) = 9.77$, $p < 0.001$ in alternate model 1, and the beta coefficients of the key predictor variable were diminished in alternate model 2, which suggests that the alternate models did not fit the data better than the proposed mediation model.

TABLE 2 | Results of hierarchical multiple regression analysis on hypothesized model.

Model	Predictors	R^2	R^2 change	F	β
1		0.02	0.02	1.76	
	Religion				
	Buddhism				0.07
	Christianity				0.13*
	Catholicism				0.01
	Others				0.08
2		0.19	0.16	12.85***	
	Religion				
	Buddhism				0.09
	Christianity				0.16**
	Catholicism				0.04
	Others				0.06
	SRF				−0.41***
3		0.21	0.02	12.40***	
	Religion				
	Buddhism				0.08
	Christianity				0.13*
	Catholicism				0.04
	Others				0.07
	SRF				−0.35***
	CR				0.17**

SRF, self-regulatory fatigue; CR, cognitive reappraisal. $^{*}p < 0.05$, $^{**}p < 0.01$, $^{***}p < 0.001$.

DISCUSSION

In this study, we sought to expand our understanding of the conditions of transforming the motives to forgive by examining whether self-regulatory strength (self-regulatory fatigue) and emotion regulation (cognitive reappraisal) would be associated with the tendency to forgive among Hong Kong Chinese college students. Moreover, this study sought to uncover the regulating processes of forgiveness by investigating the mediating role of emotion regulation (via cognitive appraisal) in the association between self-regulatory strength and forgiveness.

The results of this study revealed that self-regulatory strength depletion (self-regulatory fatigue) was negatively associated with the tendency to forgive. That is, participants who reported lower levels of self-regulatory fatigue demonstrated a higher tendency to forgive others. This is consistent with Luchies et al. (2011) finding that self-regulatory strength has a significant positive impacts on close relationships. This finding supports the strength model of self-regulation in understanding interpersonal outcomes, such as forgiveness. The results of this study

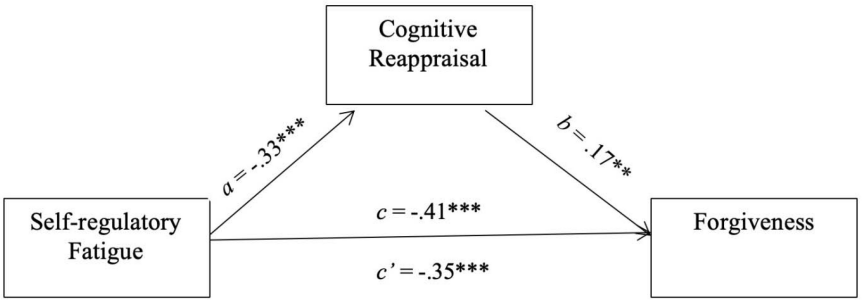

FIGURE 1 | The regulatory model of forgiveness. The *c* and *c'* indicate the total and direct effects from self-regulatory fatigue to forgiveness.

therefore indicate that chronic self-regulatory fatigue inhibits individuals' tendency to engage in the transformation of prosocial motivations (i.e., forgiveness).

We also found that emotion regulation was positively associated with forgiving tendencies. Specifically, participants who regulated their emotions via cognitive reappraisal tended to engage in forgiveness. Our findings align with previous studies that linked cognitive reappraisal to a variety of positive outcomes within the domain of interpersonal relationships, such as positive relationships with others, higher peer rated relationship closeness, and greater peer-rated likability (Gross and John, 2003). Our findings may also point to the possibility that cognitive reappraisal may serve as an important self-regulatory process to transform the motivation of forgiveness.

Scientific research on the underlying processes between self-regulatory strength and forgiveness is lacking. In particular, whether emotion regulation plays a role in the relationship between self-regulatory fatigue and forgiveness remains unclear. The results of this study further elucidate the underpinnings of the transformation of prosocial motivation. Our findings indicate that cognitive reappraisal exerts additional effects beyond the effect of self-regulatory fatigue on forgiveness. More importantly, cognitive reappraisal mediate the negative relationship between self-regulatory fatigue and forgiveness. The findings of this study suggest the possibility that forgiveness may be an additive two-stage process through which individuals first inhibit destructive impulses by exercising their self-regulatory strength and then regulate their emotions via cognitive reappraisal. Both stages require separate exertions of self-regulation (self-regulatory fatigue and cognitive reappraisal). Self-regulatory depletion impairs the ability to engage in constructive cognitive processes, which in turn leads to lower forgiveness levels.

Interestingly, the results of this study showed that religious beliefs were positively associated with forgiveness. In particular, people who identified as Christian reported higher tendencies to forgive in comparison to those who had no religious affiliation. Forgiveness is one of the doctrines central to Christianity; therefore, it is possible that people who follow Christianity believed that they are supposed to forgive because they have been forgiven by God, and will thus be more prone to forgiving others. However, due to the unequal sample size of each religion, we need to be cautious in interpreting this result (see Davis et al., 2013 for a meta-analytic review on religion and forgiveness).

Implications of the Present Research

A possible implication of the fact that self-regulatory fatigue was negatively associated with individuals' ability to forgive others is that impulse regulation may be something of a double-edged sword. On the one hand, impulse regulation allows for thriving relationship functioning in that inhibiting destructive impulses promotes optimal interpersonal interaction. On the other hand, overregulating impulses can be problematic because such regulation depletes individuals' capacity to regulate future impulses. Thus, attempts at constant, perfect self-control are likely to result in self-regulatory depletion or self-regulatory fatigue.

However, indiscriminate impulse indulgence is unlikely to improve relationship outcomes. The present study, for example, suggests that individuals are better able to forgive depending on the extent to which they exert emotional impulse regulation through constructive cognitive processes. Such prorelationship transformation of motivation benefits healthier relationship functioning. Perhaps the best way to achieve a compromise between impulse indulgence and regulation is to learn to recognize cues that indicate depletion (e.g., physical and emotional exhaustion) and to build up self-regulatory strength through repeated exercises (e.g., self-control exercises). Prior theoretical analyses and empirical evidence suggested that self-regulatory strength can be enhanced through such exercises and that exerting self-regulation tends to strengthen and improve our self-regulatory strength, much like weightlifting tends to increase muscular strength (Baumeister et al., 1994).

Emotion regulation can be used to downregulate negative emotions in the aftermath of an interpersonal offense. Emotion regulation involves complex cognitive processing. Cognitive emotion regulation refers to cognitive responses to emotional events that involve the attempt to alter individual emotional experiences, events and/or emotional types (Liu et al., 2019). Specifically, cognitive reappraisal is an effective emotion regulation strategy in which individuals change their understanding of emotional events by giving such events new meaning (McRae et al., 2012). Reframing potentially emotion-eliciting events (e.g., interpersonal transgressions)

influences an individual's willingness to forgive in an interpersonal context.

Limitations and Strengths of the Present Research

We noted several limitations in the present research. First, we examined the tendency to forgive only in college students in Hong Kong. Therefore, the findings of this study may not be applicable to other populations (e.g., married couples) and other cultures (e.g., other Asian cultures). To test the generalizability of our findings, future research should examine the effects of self-regulation processes on forgiveness in other populations and in other cultures.

The use of the self-report method constituted another limitation. The results of this study might be influenced by socially desirable response tendencies, acquiescence bias, and the retrospective reconstruction of prior events. It is also difficult to interpret the results based on the criticism of self-report methodology. Although we used reliable and valid measure to assess people's general propensity to forgive, forgiveness is not a one-size-fits all process—it takes all shapes and forms, and the magnitude of the offense is different from situation to situation. Thus, individual differences in forgiveness are to be expected. Consequently, future research should be conducted to incorporate behavioral or physiological measures of forgiveness and self-regulation in the context of ongoing interpersonal relationships.

This study also adopted a cross-sectional design, which may prevent us from ruling out reverse causalities and testing the multiple-stage self-regulatory processes of forgiveness. It is plausible that individuals high in trait forgiveness tend to preserve self-regulatory strength by disengaging from costly rumination and facilitating constructive cognitive reappraisal. Alternatively, it is also likely that individuals who are generally good at cognitive reappraisal tend to forgive due to less ego-depletion and more self-regulatory strength. Future studies should test the mediation model proposed in this study with a longitudinal design or a laboratory experimental design. Finally, we focused on trait-level variables, which may be less sensitive to temporal shifts than state-level variables. Thus, our findings speak to one's general tendencies or dispositional patterns.

Despite the above limitations, an important strength of the present research is our adoption of a new approach to understand the self-regulation processes of forgiveness. This study demonstrated that self-regulatory fatigue is negatively associated with forgiveness via its association with cognitive reappraisal. This regulatory model of forgiveness indicates that high self-regulatory fatigue hampers cognitive self-regulation processing (cognitive reappraisal), which leads to less accommodative tendencies toward others.

CONCLUSION

This study contributes to the existing literature by proposing a new regulatory model of forgiveness. This model facilitates the understanding of the regulatory processes of forgiveness in two ways: (1) direct pathways from both self-regulatory fatigue and cognitive reappraisal to forgiveness and (2) an indirect pathway from self-regulatory fatigue to forgiveness via cognitive reappraisal. This study furthers our understanding of how self-regulation processes influence the likelihood of forgiveness in an interpersonal context. Self-regulatory strength (i.e., self-regulatory fatigue) and emotion regulation (i.e., cognitive reappraisal) promote the transformation of prosocial motivations (i.e., forgiveness). The nuanced findings regarding the underlying mechanism of forgiveness from self-regulatory fatigue through cognitive reappraisal are more interesting. Consistent with our expectations, high self-regulatory fatigue weakens individuals' ability to resist self-interested, instinctive reactions in favor of more personally costly, prorelationship responses (e.g., forgiveness) and this connection can be partly explained by their failure to engage in constructive cognitive processes.

DATA AVAILABILITY STATEMENT

The datasets analyzed in this manuscript are not publicly available for participants' confidentiality reasons. Requests to access the datasets should be directed to my.ho@cityu.edu.hk.

ETHICS STATEMENT

The studies involving human participants were reviewed and approved by City University of Hong Kong. The patients/participants provided their written informed consent to participate in this study.

AUTHOR CONTRIBUTIONS

MH has done most of the conceptual thinking, theoretical model building, the data collection and the data analysis. DV has offered conceptual framework on self-regulation process. JY has advised on model testing and statistical analysis.

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Empathy Mediates the Relationship Between Motivations After Transgression and Forgiveness

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Previous studies found the associations between motivations after transgression and forgiveness in adults. However, less is known about the relationship between transgression-related motivations and forgiveness among adolescents and the potential mediating role of empathy. These questions were investigated among 445 Chinese adolescents using the Tendency to Forgive Scale, the Transgression-Related Interpersonal Motivations Inventory, and the Interpersonal Reactivity Index. The results found a negative relationship between avoidance and revenge motivation and forgiveness tendency and a positive association between benevolent motivation and forgiveness tendency. In addition, the study also revealed a partial mediating role of empathy regarding the effect of the transgression-related motivations on forgiveness tendency. These findings suggested that empathy plays a vital role in the relationship between transgression-related motivations and forgiveness among adolescents.

Keywords: revenge, avoidance, forgiveness, empathy, adolescents

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INTRODUCTION

People inevitably encounter conflicts and offense which will destroy interpersonal relationships in interpersonal interaction. Avoidance and revenge probably are two main motivations toward a perpetrator after being offended (McCullough and Hoyt, 2002). This is because negative emotional responses like fear, anger, or sadness are predominant responses toward offenses (Slotter et al., 2012; Civai, 2013; Gilam et al., 2019). However, people sometimes can restrain their instinctive impulses to retaliate or avoid and choose forgiveness as an effective strategy to maintain the relationship (Billingsley and Losin, 2017). Forgiveness is regarded as a changing process of pro-social behavior, which means that people give up revenge and avoid the offender and instead choose to show kindness to the offender (Enright et al., 1998; McCullough and Hoyt, 2002).

Previous studies on forgiveness mainly focus on adult samples (e.g., McCullough et al., 1997; McCullough, 2000) rather than on adolescents (e.g., Huang and Enright, 2000; Klatt and Enright, 2009; Barcaccia et al., 2017). Researchers proposed that the tendency to forgive increases as children grow up (Enright et al., 1989); 15- to 16-year-old adolescents would consider forgiveness under the pressure of other people, while adults would not (Enright, 1991). According to the defect mode of adolescent development, adolescence is a period of great turbulence during which they have to face great physical and mental changes and are vulnerable to the adverse effects of their peers (Roth et al., 1998). Therefore, after encountering conflicts, adolescents may adopt a maladaptive coping response to interpersonal offenses because of immature thought (Worthington and Scherer, 2004),

which may lead to retaliation or avoidance that will damage the interpersonal relationship. However, a positive coping strategy like forgiveness may avoid the negative effects of conflict and remove the negative emotions (Yao and Enright, 2018).

Although there is a growing interest in the research of forgiveness among psychologists (e.g., McCullough et al., 1997; Worthington et al., 2001; McCullough and Hoyt, 2002; Toussaint et al., 2015), the definition of forgiveness is still inconsistent (Berry et al., 2005; Worthington, 2007; Riek and Mania, 2012). McCullough et al. (1997) believed that forgiveness is a pro-social change process of motivation, which inclines people to behave by constructive motivation in order to suppress destructive motivation. The tendency to forgive refers to one's global dispositional level of forgiveness across contexts (Brown, 2003). Previous studies suggested that forgiveness can help individuals overcome interpersonal violations, especially negative emotions such as anger, worry, fear, and embarrassment, reduce individual anxiety and depression, and improve self-esteem, subjective well-being, and life satisfaction (e.g., Worthington and Wade, 1999; Maltby et al., 2001; Seybold et al., 2001; Bono and McCullough, 2006; Reed and Enright, 2006). The results associated with forgiveness and positive outcomes are found not only in adult studies (e.g., Maltby et al., 2001; Berry et al., 2005; Lawler-Row et al., 2011) but also in adolescent studies (e.g., Benda, 2002; Gambaro, 2003; Barcaccia et al., 2020). When exploring the role of forgiveness in the mental health of middle school adolescents, Gambaro (2003) found that forgiveness can significantly reduce their anger, decrease the adverse consequences of anger, and improve interpersonal relationships. Hui and Chau (2009) investigated the effect of forgiveness intervention within Chinese adolescents, and the findings revealed that process-based forgiveness interventions are effective for adolescents to improve their psychological well-being. Recent studies on forgiveness in the context of school bullying and Internet bullying found that forgiveness and friendship are protective factors for adolescents to avoid harm and reduce anger, while unforgiveness is significantly related to high depression and revenge (e.g., Barcaccia et al., 2017, 2018; Watson et al., 2017). Moreover, teenagers who suffer from Internet bullying report less internet violence if they have a higher tendency of forgiveness (Quintana-Orts and Rey, 2018).

So, how can we grant forgiveness or improve the tendency of forgiveness? Researchers proposed that empathy, a social cognitive factor, has a stable effect on forgiveness (e.g., McCullough et al., 1997, 1998; Worthington et al., 2001; McCullough and Hoyt, 2002; Zechmeister and Romero, 2002; Fourie et al., 2020). Empathy refers to the ability of sharing and understanding others' emotion and feelings (Decety and Jackson, 2006). McCullough et al. (1997) found that studying empathy-based forgiveness courses is effective in promoting the participants' forgiveness. According to Baston's theory of empathy altruism, researchers speculated that empathy makes individuals care for the needs of the offender, perceive that the offender is also experiencing guilt and pain, and then hope to reconstruct a positive contact with the offender and then promote forgiveness (McCullough et al., 1997). The study also found that empathy has a direct impact on forgiveness and plays a mediating role on forgiveness and apology (McCullough et al., 1998). Some researchers explored the reasons why empathy promotes forgiveness and found that the victims of high dispositional empathy attribute the offense positively and are more likely to forgive the offender (Zechmeister and Romero, 2002). This important role of empathy was also found in studies of forgiveness among adolescents. Hui and Chau (2009) found that empathizing with the offender and thinking from the perspective of others is a key strategy in the process of forgiveness. Adolescents with higher levels of empathy report more frequent forgiveness in the face of relationship aggression than those with lower levels of empathy (Johnson et al., 2013).

Previous studies explored the relationship between motivations after aggression and forgiveness, and empathy for the offender will promote forgiveness toward the offender among adults). However, the association between transgression-related motivations, empathy, and forgiveness is still unclear among adolescents. Therefore, in the current study, we aim to examine the link between transgression-related motivations and forgiveness in adolescents and the potential mediating role of empathy. Based on previous studies (McCullough et al., 1997, 1998; Hui and Chau, 2009; Johnson et al., 2013; Barcaccia et al., 2018), we assumed that the motivations of revenge and avoidance after transgression was negatively correlated with empathy and forgiveness, while the benevolence motivation was positively correlated with empathy and forgiveness. In addition, empathy may mediate the relationship between transgression-related motivations and forgiveness.

METHODS

Participants

Data were collected from 445 junior and senior high school students (188 males, 257 females) from China of ages 12–17 years (M = 15.51, SD = 1.47). The percentage of subjects with ages from 12 to 17 years was 3.4, 17.1, 1.3, 4.0, 51.5, and 22.7, respectively. All students were asked to complete paper-and-pencil questionnaires individually or in class groups. The participants were compensated for by a small gift after completing questionnaires. The study was approved by the Ethics Committee of the School of Psychology at Northeast Normal University for human participant research, and each participant or their parents provided informed consent prior to participating in the study.

Materials and Measures

Tendency to Forgive Scale

The Tendency to Forgive Scale (TTF) is a four-item scale which assesses individual differences in the tendency to forgive one's offense across situations and relationships (Brown, 2003). Sample items include "I tend to get over it quickly when someone hurts my feelings." The participants were asked to response on a five-point Likert scale that ranges from 1 (strongly disagrees) to 5 (strongly agree). The TTF has been demonstrated to have reasonable internal reliability and a high degree of stability over 8 weeks in a prior study (Brown, 2003). The Chinese version of

the TTF was also shown to have a good level of reliability and validity (Jia et al., 2020). In this study, the TTF had acceptable internal consistency.

Transgression-Related Interpersonal Motivations Inventory

The Transgression-Related Interpersonal Motivations Inventory (TRIM) is an 18-item self-report questionnaire that measures the motivational changes of victims toward transgressors (McCullough et al., 2006). Three subscales were included in the TRIM: (1) the revenge subscale includes five items that measure the motivation to seek revenge (e.g., "I want him/her to get what he/she deserves"); (2) the avoidance subscale consists of seven items that assess the motivation to avoid the offender (e.g., I would avoid him/her); (3) the benevolence subscale comprises six items that measure the benevolence motivation toward a transgressor (e.g., "Even though his/her actions hurt me, I still have goodwill for him/her"). Each item is scored on a scale of 1–5 from "strongly disagree" to "strongly agree." Previous studies have demonstrated high internal consistency and reliability of each subscale, and it is also applicable in the youth sample (e.g., McCullough et al., 2000; McCullough and Hoyt, 2002; Nouri et al., 2019). In the present study, Cronbach's alpha of each subscale was 0.79 for avoidance motivation, 0.83 for revenge motivation, and 0.71 for benevolence motivation.

Interpersonal Reactivity Index

Individual differences in empathy were measured using two subscales of the Interpersonal Reactivity Index (Davis, 1980), the empathic concern and the perspective-taking, which were thought to assess affective empathy and cognitive empathy, respectively. The empathic concern subscale is composed of six items and the perspective-taking subscale comprises five items. The response options ranged from 1 (not at all) to 5 (extremely). The responses to these 11 items were averaged to form an empathy index. The Chinese version of the Interpersonal Response Indicator scale has good reliability and validity (Zhang et al., 2010). In the present study, Cronbach's alpha was 0.73.

Statistical Analysis

Data analyses were conducted using SPSS Statistics 22.0 and the PROCESS macro for SPSS (Hayes, 2013). An independent-sample *t*-test was used to analyze the possible gender differences in these variables using the current data. Based on our hypothesis, Pearson's correlations were used to analyze the bivariate correlations between the variables of interest. In the test of the mediating effect of empathy, the bootstrap method in the PROCESS macro for SPSS was used to test the statistical significance of the indirect effects in this study.

RESULTS

Descriptive Statistics and Correlations

Table 1 displays the descriptive statistics and the correlations for the study variables as obtained in the current sample of 445 adolescent students. As expected, the participants' avoidance motivation and revenge motivation were negatively and significantly correlated with their empathy [$r_{(445)} = -0.18$, $p < 0.001$; $r_{(445)} = -0.32$, $p < 0.001$] and forgiveness scores [$r_{(445)} = -0.35$, $p < 0.001$; $r_{(445)} = -0.52$, $p < 0.001$]. In contrast, the adolescents' benevolence motivation is positively and significantly associated with their empathy [$r_{(445)} = 0.33$, $p < 0.001$] and forgiveness scores [$r_{(445)} = 0.30$, $p < 0.001$]. In addition, a significant positive correlation between empathy and forgiveness among adolescents was also observed [$r_{(445)} = 0.33$, $p < 0.001$]. According to three correlation coefficients, we can see that the correlation between revenge motivation and forgiveness is the largest, followed by the correlation between avoidance motivation and forgiveness, and finally the correlation between benevolence motivation and forgiveness is the smallest.

Gender Differences Among Variables

Table 2 shows the gender differences between the variables in the current sample. As shown in the table, avoidance motivation ($t = -5.944$, $p < 0.001$, $d = 0.571$) and benevolence motivation ($t = 3.757$, $p < 0.001$, $d = 0.369$) have significant gender differences, while forgiveness, revenge motivation, and empathy have no significant gender differences. Moreover, boys have higher benevolence motivation and lower avoidance motivation than girls.

Mediation Analysis

Based on the results of the correlation analysis, we used model 4 in the PROCESS program to test the mediating effect of empathy between transgression-related interpersonal motivations and the tendency to forgive. All variables' scores were converted to

TABLE 1 | Descriptive statistics and correlations among variables ($N = 445$).

Variables	*M*	SD	1	2	3	4
Forgiveness	13.30	2.69	–	–	–	–
Avoidance	22.34	5.22	−0.35***	–	–	–
Revenge	12.08	4.25	−0.52***	0.56***	–	–
Benevolence	18.25	4.31	0.30***	−0.43***	−0.39***	–
Empathy	2.43	0.59	0.33***	−0.18***	−0.32***	0.33***

****p < 0.001.*

TABLE 2 | Gender differences among variables.

Variables	Gender	*M*	SD	*t*	*d*
Forgiveness	Male	13.50	2.623	1.349	–
	Female	13.15	2.738		
Avoidance	Male	20.69	4.984	−5.944***	0.571
	Female	23.56	5.067		
Revenge	Male	11.80	4.363	−1.203	–
	Female	12.29	4.156		
Benevolence	Male	19.13	4.403	3.757***	0.369
	Female	17.60	4.122		
Empathy	Male	2.432	0.615	0.097	–
	Female	2.427	0.576		

****p < 0.001.*

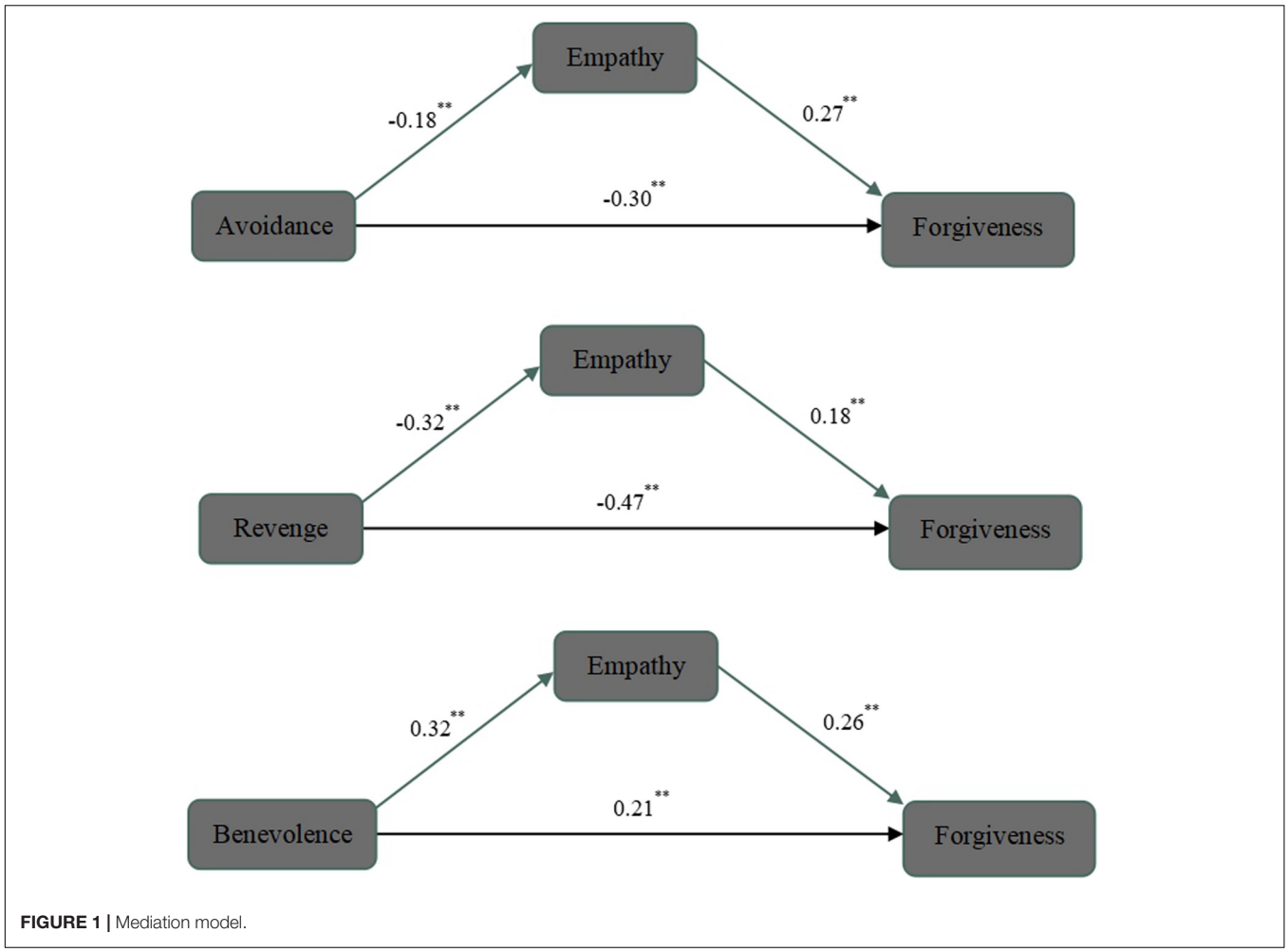

FIGURE 1 | Mediation model.

z-scores first in this analysis. The regression coefficients of each path were significant (see **Figure 1**). The direct prediction effect of avoidance, revenge, and benevolence motivation on forgiveness tendency was significant. Therefore, these three models were all partial mediating model. Furthermore, bootstrap estimates (based on 5,000 bootstrap samples) indicated that the mediator effects of empathy between avoidance [$\beta = -0.05$, CI (-0.09, -0.02)], revenge [$\beta = -0.06$, CI (-0.09, -0.03)], and benevolence motivations after transgression [$\beta = 0.08$, CI (0.05, 0.13)] and the tendency to forgive were significant. In other words, motivations after aggression not only directly impact adolescents' forgiveness but also improve the tendency to forgive through the mediating effect of empathy. The 95% confidence intervals of each point estimation are shown in **Table 3**.

TABLE 3 | Mediating effects of empathy between motivation and forgiveness.

Model	Effect	SE	Boot LLCI	Boot ULCI	Ratio of total effects (%)
Avoidance–empathy–forgiveness	−0.05	0.02	−0.09	−0.02	14.29
Revenge–empathy–forgiveness	−0.06	0.02	−0.09	−0.03	11.32
Benevolence–empathy–forgiveness	0.08	0.02	0.05	0.13	27.59

DISCUSSION

The main goal of the current study is to investigate the relationship between motivations after transgression and forgiveness among adolescents and whether empathy mediates the link between transgression-related motivations and forgiveness. Consistent with our hypotheses, the results revealed that the motivation of revenge and avoidance after transgression was negatively correlated with empathy and forgiveness, while the benevolence motivation was positively correlated with empathy and forgiveness. A significant positive correlation between empathy and forgiveness among adolescents was found. More importantly, empathy has a mediating effect between motivations and forgiveness. Moreover, we found that boys showed higher benevolence motivation and lower avoidance motivation than girls.

In the current study, there are significant gender differences in avoidance motivation and benevolence motivation, while there

are no gender differences in other variables. This result is partly consistent with previous studies (e.g., Berry et al., 2001; Macaskill et al., 2002; Toussaint and Webb, 2005), and we found that there is no significant gender difference in forgiveness. However, the result of empathy is contrary to most studies (e.g., Macaskill et al., 2002; Toussaint and Webb, 2005; Zhao et al., 2018); we found no gender difference in empathy. The reason may be that the social expectations of gender roles have not significantly affected adolescents, and girls are not as motivated as adult women to understand and care about other people's thoughts and feelings. The present findings of avoidance and benevolence motivations contradict those of Tang et al. (2012), who showed no apparent gender differences in motivations. The research of Tang et al. takes adults as samples, while the current research takes adolescents as samples. The cognitive level of adolescents being different from adults may explain this contradiction. Adolescent boys are encouraged to be braver than girls, so they choose less to avoid contact with offenders. Moreover, boys and girls have different views on aggressive behavior, which will affect their motivations after aggression (Miller et al., 2008).

The results showed that the low retaliation motivation, avoidance motivation, and high benevolence motivation are associated with forgiveness among adolescents. In line with prior research, teenagers with high forgiveness show less motivation to retaliate, evade after being violated, and are more inclined to show benevolent motivation (Berry et al., 2001). Research found that adolescents tend to avoid after experiencing offenses, which leads to a decrease of self-esteem and long-term emotional reduction, while adolescents who chose forgiveness reported a significant reduction in anger (Watson et al., 2017). Adolescents seem to encounter more interpersonal conflicts, and cognitive, emotional, or behavioral problems will happen if maladaptive coping responses were adopted (Yao and Enright, 2018). Johnson et al. (2013) found that adolescents can solve conflicts successfully, which will contribute to the reorganization and development of youth friendship. In this process, forgiveness plays an important role in restoring interpersonal communication, increasing interpersonal trust, and promoting conflict resolution. Research found that a reduced motivation of retaliation and avoidance can decrease the victims' anger and behavior problems, which shows the benefits of giving up unforgiveness for mental well-being (Barcaccia et al., 2017). There are differences between different transgression-related motivations and forgiveness, and the correlation between negative motivations and forgiveness is higher, which may be that forgiveness is more promoted by the reduction of negative motivations for adolescents. Barcaccia et al. (2017) have pointed out that teenagers are in an environment of frequent conflicts; forgiving others does not necessarily mean that they increase benevolence and goodwill, but that they only reduce negative motivation in order to maintain an interpersonal relationship.

There is a positive relationship between empathy and forgiveness in adolescents. In addition, empathy is positively correlated with benevolence motivation, while it is negatively associated with avoidance and revenge motivation. This may suggest that the highly empathetic youth tend to focus on others' experiences in a fairly objective or unselfish manner and more likely to forgive offenders instead of taking revenge and avoidance (Toussaint and Webb, 2005). Christensen et al. (2011) found that empathy is the most salient predictor of forgiveness in the parent–child relationship. A study of forgiveness intervention on female aggressive victims showed that, compared with other groups, victims in the forgiveness intervention group had a significant improvement in empathy and academic performance and a significant reduction in anger, hostility attribution, and delinquent behavior (Park et al., 2013). Moreover, we found the significant mediator effect of empathy between motivations after transgression and forgiveness, namely, aggression-related motivations not only directly affect forgiveness but also indirectly affect forgiveness through empathy. Teenagers with higher empathic ability will concern more about the needs of offenders after being violated (Decety and Yoder, 2016). Empathy may increase the possibility of reconstructing the interpersonal relationship between the victim and the offender, even overriding the harm of the aggression and promoting the occurrence of forgiveness (McCullough et al., 1998; Davis and Gold, 2011). These findings suggested that empathy plays an important role in forgiveness granting among adolescents and support McCullough's view that empathy is the most salient social cognitive factor in the relationship between aggression-related variables and forgiveness (McCullough et al., 1997).

The current study has several limitations that need to be mentioned. First, self-reported questionnaires were used in the study, which will affect the ecological validity of the results. Subjects may show more empathy and forgiveness because of social expectation effect. Therefore, future research should use more objective ways to measure forgiveness. Second, the current research uses the average score of cognitive and emotional empathy to establish empathy index and does not consider the two dimensions of empathy separately. However, cognitive empathy and emotional empathy are different dimensions of empathy, which may have different mediating effects on the three types of transgression-related motivation and forgiveness. Future studies can explore the mediating effects of cognitive empathy and emotional empathy, respectively. Third, our study is a cross-sectional study, which cannot determine the causal relationship between transgression-related motivations and forgiveness. Thus, longitudinal research can be used to explore how motivations after aggression affect forgiveness in the future.

In general, this study proves that transgression-related motivations can not only directly influence forgiveness but also indirectly affect forgiveness through empathy. The current study extends previous findings concerning transgression-related motivations and forgiveness among Chinese adolescents and provides evidence that empathy plays an important mediating role in the path of motivations and forgiveness. Adolescents are in a period of frequent interpersonal conflicts, so they need to use an adaptive coping style to solve interpersonal conflicts, such as forgiveness. Therefore, it is worthwhile to carry out forgiveness education for adolescents and consider the important role of empathy as well. In school, through forgiveness education, we can improve the empathic ability of adolescents to promote forgiveness and then reduce the negative impact of an interpersonal conflict on them.

DATA AVAILABILITY STATEMENT

The original contributions presented in the study are included in the article/supplementary material, further inquiries can be directed to the corresponding author.

ETHICS STATEMENT

The studies involving human participants were reviewed and approved by Ethics Committee of Northeast Normal University, China. Written informed consent to participate in this study was provided by the participants' legal guardian/next of kin.

AUTHOR CONTRIBUTIONS

LM and YJ conceived and designed the experiment and contributed to writing the manuscript. LM conducted the experiment and analyzed the data. Both authors contributed to the article and approved the submitted version.

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Spiritually Motivated Self-Forgiveness and Divine Forgiveness, and Subsequent Health and Well-Being Among Middle-Aged Female Nurses: An Outcome-Wide Longitudinal Approach

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Background: Interest in the relationship between forgiveness and health is steadily growing across disciplines within the research community. While there are multiple forms of forgiveness, past research has focused principally on studying forgiveness of others, whereas longitudinal evidence on the associations between other forms of forgiveness and health remains scarce.

Methods: Using longitudinal data from the Nurses' Health Study II (from the 2008 Trauma Exposure and Post-traumatic Stress Supplementary Survey to 2015 questionnaire wave), this study employed an outcome-wide analytic approach to prospectively examine the association between two forms of religiously or spiritually motivated forgiveness, namely, self-forgiveness and divine forgiveness, and a wide array of subsequent psychosocial well-being, mental health, health behavior, and physical health outcomes among middle-aged female nurses (N = 54,703 for self-forgiveness; N = 51,661 for divine forgiveness). All models controlled for sociodemographic factors, prior religious service attendance, and prior values of all outcome variables wherever data were available. Bonferroni correction was used to account for multiple testing.

Results: Self-forgiveness was strongly associated with greater psychosocial well-being (e.g., for top vs. bottom level of self-forgiveness, β = 0.23, 95% CI: 0.20, 0.25 for positive affect) and lower psychological distress (e.g., $\beta = -0.21$, 95% CI: −0.23, −0.18 for depressive symptoms). To a lesser extent, divine forgiveness was also associated with higher levels of psychological well-being and lower psychological distress. For both forgiveness types, there was little evidence of association with physical health or health behavior outcomes, though possible marginal evidence for an association of self-forgiveness with increased mortality.

Discussion: This study provides novel evidence that religiously or spiritually motivated self-forgiveness and divine forgiveness are both positively related to several indicators of psychosocial well-being and inversely associated with psychological distress outcomes, whereas the associations with physical health and health behaviors are less clear. Further longitudinal investigation of the dynamics between these types of forgiveness and health and well-being is warranted.

Keywords: forgiveness, religiously or spiritually motivated forgiveness, self-forgiveness, divine forgiveness, health, well-being, outcome-wide epidemiology, mid-life

INTRODUCTION

Forgiveness is a concept with a range of meanings and implications across time and place. Varied understandings of forgiveness emerged thousands of years ago from the world's major religions, including Buddhism, Hinduism, Judaism, Christianity, and Islam (Rye et al., 2000; Tucker et al., 2015). Philosophers past and present have grappled with the definition, conditions, limits, and morality of forgiveness, with increased attention following the Second World War (Voiss, 2015). In the latter half of the twentieth century, psychologists likewise paid growing attention to the concept of forgiveness, particularly for those who had experienced significant personal trauma. These interests, in turn, led to a rising number of empirical studies of forgiveness that gained traction in the late 1980s and early 1990s (Voiss, 2015). To date, interest in the relationship between forgiveness, well-being, and health continues to grow across disciplinary boundaries, including psychology, medicine, and even public health (Toussaint et al., 2015; VanderWeele, 2018).

Among the rising numbers of forgiveness studies, the vast majority explore the impact of forgiving *others* on health and well-being (Toussaint et al., 2015). Yet, other types of forgiveness, such as self-forgiveness and divine forgiveness, warrant investigation both conceptually and empirically. Conceptually, both divine and self-forgiveness are experienced by offenders, requiring a twofold recognition of the self as (1) a moral agent who has failed and (2) a moral agent as valuable, with capacity to change (Worthington and Wade, 2020b); the difference, of course, is the source: God/higher power and self. Some philosophers have called forgiveness a "species of love," building on Thomas Aquinas's conception of love as desiring the good and desiring union (Stump, 2006). In this view, divine forgiveness might be understood as that which restores a person and brings him or her into renewed relationship with God/higher power, while self-forgiveness may promote the desire for a good or flourishing life and internally unified relationship with oneself or internal peace (Stump, 2006). Philosopher and theologian Søren Kierkegaard wrote extensively about the dialectic between despair, self-forgiveness, and divine forgiveness, ultimately concluding that genuine reception of and faith in divine forgiveness inescapably requires a person to forgive themselves (Kierkegaard, 1983; Podmore, 2009; Hanson, 2017). Other philosophers and historians note important distinctions between forgiveness and reconciliation (Jackson, 2009; Potts, 2019) and highlight the way that social, religious, and philosophical movements in modern Western history influence notions of self- and divine forgiveness. For example, the Reformation in the sixteenth century and the Enlightenment in the late seventeenth and eighteenth centuries both contributed to Western society's move away from an emphasis on religious institutional structures and sacramental rites toward an emphasis on the individual and an inward experience of religion (Konstan, 2012). By extension, these historical movements influence concepts like self-forgiveness and divine forgiveness by emphasizing the affective dimension of forgiveness ("I feel forgiven by God/myself") more so than behavior change predicated on ritualized forms of forgiveness ("because I confessed, I am forgiven and will now do X").

Mirroring philosophical and theological reflection, empirical work has also explored the relationship between self- and divine forgiveness. To date, studies have found that one's sense of being forgiven by a higher power is related to increased self-forgiveness (Hall and Fincham, 2008; McConnell and Dixon, 2012), that positive views of the sacred are associated with greater tendency to forgive the self (Davis et al., 2013), and that divine forgiveness may moderate the relationship between self-forgiveness and psychological distress (Fincham and May, 2019). Longitudinal studies have found divine forgiveness to be positively associated with both self-forgiveness and the forgiveness of others in a monotonic pattern; in other words, as divine forgiveness increases, so do the other two types (Chen et al., 2018).

Empirical study, although mostly cross-sectional, has also started to explore the nature and impact of self- and divine forgiveness on human health and well-being. A recent summary of empirical literature suggests that self-forgiveness can be defined as "a process acknowledging and working through one's responsibility for one's perceived transgression, but then releasing self-condemnation with its associated emotional, cognitive, and behavioral consequences" (Woodyatt and Wenzel, 2020). Within this view, self-forgiveness is composed of two dimensions: a cognitive component of taking responsibility and working through what has occurred, and an affective component of reducing feelings associated with self-condemnation (Griffin et al., 2018). While measured differently among different studies, a recent review of self-forgiveness literature reported a positive association between self-forgiveness and some mental health outcomes (Massengale et al., 2017), while another meta-analysis reported positive correlations between self-forgiveness with some physical health and psychological well-being outcomes (Davis et al., 2015). Divine forgiveness remains the least common

form of forgiveness studied in forgiveness research and is often assessed by a single item (Fincham and May, 2019). The work that has been done has found generally positive relationships between divine forgiveness and psychosocial well-being (Exline, 2020), with less clear relationships to physical health and health behavior (Krause and Ironson, 2017; Chen et al., 2018). While the mechanisms between forgiveness and positive outcomes are generally thought to be beneficial emotion regulation (McCullough et al., 2007; Witvliet and McCullough, 2007), different forms of forgiveness, like self- or divine forgiveness, may influence health and well-being through different mechanisms. One strong commonality between studies on self-forgiveness and divine forgiveness is the call for research that uses longitudinal data to help clarify the relationship between these particular forms of forgiveness and subsequent health and well-being (Exline, 2020; Worthington and Wade, 2020a).

To further investigate understudied forms of forgiveness, this study used an outcome-wide analytic approach (VanderWeele, 2017; VanderWeele et al., 2020) to prospectively examine the association between religiously or spiritually motivated self-forgiveness and divine forgiveness and a wide array of subsequent psychosocial well-being, mental health, health behaviors, and physical health outcomes in a large cohort of middle-aged female nurses in the U.S., controlling for prior values of the outcome variables wherever data were available.

MATERIALS AND METHODS

Study Population

This study used longitudinal data from the Nurses' Health Study II (NHSII) (Colditz et al., 1997). The NHSII began in 1989 with 116,429 female nurses between the ages of 25 and 42 years, living in 14 US states (Bao et al., 2016). Over the past 30 years, participants in the NHSII completed surveys, either by mail or online, every 2 years, with a response rate over 90% at each follow-up cycle. The NHSII questionnaires cover a wide range of items including exposures in early life, physical activity, health problems, alcohol consumption, body weight profile, diet, mental health, and a range of social, economic, and well-being outcomes (Bao et al., 2016). In 2008, a supplemental survey on Exposure and Post-Traumatic Stress was distributed to a subset of NHSII participants, which included questions about spiritually or religiously motivated forgiveness; thus, this year was considered as the baseline for the present study. Data on the outcome variables were taken from the most recent NHSII questionnaire waves, primarily the 2015 wave; if the outcome was not measured at the 2015 wave, we used data from the 2013 or 2011 wave. All covariates were measured at the 2008 wave or prior waves. We excluded those who reported not believing in God or a higher power from all analyses on divine forgiveness. This yielded an analytic sample of 54,703 participants for analyses on self-forgiveness, and 51,661 participants for analyses on divine forgiveness. Details regarding the sample derivation process were reported in **Supplementary Text**. This study was approved by the Institutional Review Board at Brigham and Women's Hospital.

Measures

Forgiveness

Within the 2008 Supplementary Survey on Exposure and Post-Traumatic Stress, the following questions about trait forgiveness (one's general propensity), derived from the Brief Multidimensional Measure of Religiousness/Spirituality (Idler et al., 2003), were asked: "Because of my spiritual or religious beliefs: (1) I have forgiven myself for the things that I have done wrong, and (2) I know that God or a higher power forgives me." Each question was answered on a four-point scale (always or almost always, often, seldom, never) with the exception of Divine Forgiveness, which also included the option "Do not believe in God or a higher power." Those who selected this option were excluded from our analysis on Divine Forgiveness. For the purposes of analysis, we used self-forgiveness and divine forgiveness as two separate exposures, collapsing the bottom two levels of responses due to data sparsity (see **Supplementary Table S1** for further details): never/seldom, often, almost always/always. As a sensitivity analysis, we also considered the responses to both types of forgiveness as continuous scores.

Outcomes

Using data from the 2011, 2013, or 2015 waves, 19 outcomes were assessed in four categories: (1) psychological well-being (positive affect and social integration); (2) psychological distress (depression diagnosis, depressive symptoms, anxiety symptoms, anxiety diagnosis, hopelessness, and loneliness); (3) health behaviors (heavy drinking, current cigarette smoking, frequent physical activity, preventive healthcare use, dietary quality); and (4) physical health (all-cause mortality, type 2 diabetes, stroke, heart diseases, cancer, overweight/obesity, number of physical health problems; sum of the above five physical illness conditions). Further information for how each of these variables was assessed is available in **Supplementary Text**.

Covariates

Data on all covariates were taken from the 2008 supplementary survey or prior waves. Specifically, a wide range of sociodemographic covariates were controlled for, including age (in years), race (non-Hispanic white, others), marital status (married/in domestic relationship, unmarried), geographic region (Northeast, South, West, Midwest), subjective social standing in US and in community (both rated on a scale ranging from 1 to 10) (Giatti et al., 2012), census tract college education rate (continuous), pre-tax household income ($<$\$50,000, \$50,000–\$74,999, \$75,000–\$99,999, $\geq$\$100,000), census tract median income ($<$\$50,000, \$50,000–\$74,999, \$75,000–\$99,999, $\geq$\$100,000), night shift work over past 2 years (none, 1–9 months, 10–19 months, 20+ months), employment status (currently employed, non-employed), childhood abuse (summary score 0 to 5), religious service attendance (never/almost never, $<$1/week, $\geq$1/week), number of close friends (none, 1–2, 3–5, 6–9, 10 or more), menopausal status (premenopausal or uncertain, postmenopausal), and post-menopausal hormone use (yes, no). In addition, we controlled for prior values of all outcome variables wherever data were available to reduce the possibility of reverse causation

(VanderWeele et al., 2016). These include positive affect (continuous score 1–4), depression diagnosis (yes, no), prior depressive symptoms (continuous score ranging from 0 to 30), phobic anxiety (continuous score: 0–16), hopelessness (continuous score: 0–3), alcohol intake (0 g/day, 0.1–9.9 g/day, 10.0–29.9 g/day, ≥30 g/day), smoking status (never smoker, former smoker, current smoker 1–14, 15–24, ≥25 cigarettes/day), physical activity (metabolic equivalents task hours/week: <3, 3–8.9, 9–17.9, 18–26.9, ≥27) (Hu et al., 1999), preventive healthcare use (yes, no), AHEI dietary score (in tertiles) (Chiuve et al., 2012), history of type 2 diabetes (yes, no), stroke (yes, no), heart disease (yes, no), or cancer (yes, no), and body mass index (<25, 25–29.9, ≥30 kg/m^2).

Statistical Analysis

All statistical analyses were performed using SAS, version 9.4 (SAS Institute, Inc., Cary, NC, United States). *P*-values were calculated based on two-sided tests. Chi-square tests and analysis of variance tests were used to examine participant characteristics across levels of forgiveness at baseline.

We used an outcome-wide analytic approach (VanderWeele, 2017; VanderWeele et al., 2020) to examine forgiveness in relation to a wide range of health and well-being outcomes simultaneously. This approach fits similar regression models for the relationship between one exposure and multiple outcomes while controlling for similar covariates in each regression. This helps provide a broad picture of the dynamics across a range of outcomes, facilitates the comparison of effect sizes across outcomes within a same sample, reduces "researcher degrees of freedoms" (Simmons et al., 2011) in choosing regression results, facilitates publication of null results, and may help better inform public health recommendations. Further description of this approach was provided elsewhere (VanderWeele, 2017; VanderWeele et al., 2020). Following this approach, we ran a separate regression model for each forgiveness type and outcome. Depending on the nature of the outcome variable, we ran one of three different models: (1) logistic regressions for binary outcomes with a prevalence <10% to estimate odds ratios; for rare outcomes, odds ratios would approximate risk ratios; (2) Poisson regression models for binary outcomes with a prevalence ≥ 10% to estimate risk ratios (Zou, 2004); and (3) linear regression models for continuous outcomes to estimate beta. With continuous variables, we standardized outcomes (mean = 0, standard deviation = 1) to allow effect sizes to be interpreted in terms of standard deviation change in the outcome variable, which also facilitated comparison of effect estimates across outcomes. All models were fully adjusted for all covariates. Bonferroni correction was used to adjust for multiple testing.

Multiple Imputation

Multiple imputation with a chained equations procedure (five imputed datasets were generated) was used to impute for missing data on all variables. Multiple imputation often produces less biased estimates as compared to other methods of handling missing data (Moons et al., 2006; Sterne et al., 2009; Groenwold et al., 2012).

Sensitivity Analyses

First, to evaluate potential unmeasured confounding, we performed sensitivity analysis using *E*-values (VanderWeele and Ding, 2017; Mathur et al., 2018), which assesses the minimum strength that an unmeasured confounder would have to have on the risk ratio scale with *both* the exposure (self- or divine forgiveness) and the outcome to explain away the association. Next, we reanalyzed the primary sets of models using complete-case analysis. Third, to further reduce concerns of reverse causation, we reanalyzed both forms of forgiveness, restricting to participants who were *free*, at baseline, of the four major physical health problems in our study (type 2 diabetes, stroke, heart disease, and cancer). While controlling for prior illness was the method in our main analysis, our supplementary analysis removing people with all four major illnesses provided more conservative estimates as people who are already sick might be more likely to forgive themselves or accept forgiveness from God or a higher power. To examine forgiveness in relation to the *incidence*, or first-time occurrence, of each type of physical illness, we reanalyzed the models of physical illness outcomes, excluding participants with each condition (one by one) at baseline. In other words, we only included people who had *not* been diagnosed with diabetes at baseline (although they may have had one of the other four conditions) to examine the incidence of diabetes in the later waves of the study. Finally, we also considered the responses to both forms of forgiveness as continuous scores, to compare with our main analysis, which assessed forgiveness as categorical variables.

RESULTS

Descriptive Analyses

Participant characteristics in the full sample are shown in **Supplementary Table S1**. At baseline, the average age of respondents was 53.37 years old (*SD* = 4.65). The majority of the respondents were non-Hispanic White (95.75%), married (81.41%), currently employed (88.78%), and had relatively high SES. The distribution of participant characteristics by levels of self-forgiveness is reported in **Table 1**, and that by levels of divine forgiveness is shown in **Supplementary Table S2**.

Self-Forgiveness and Subsequent Health and Well-Being

Participants who reported the highest level of self-forgiveness (vs. the lowest level) had higher psychological well-being in the domains of positive affect (β = 0.23; 95% CI: 0.20, 0.25) and social integration (β = 0.11; 95% CI: 0.09, 0.13) (**Table 2**). Further, the highest vs. the lowest level of self-forgiveness was associated with nearly all outcomes of psychological distress such as fewer depressive symptoms (β = −0.21; 95% CI: −0.23, −0.18) and lower levels of hopelessness (β = -0.18; 95% CI: −0.21, −0.15). However, there was little evidence of association with health behaviors and physical health outcomes, with the exception of all-cause mortality where the highest vs. the lowest level of self-forgiveness was associated with an increased risk of mortality (RR = 1.33; 95% CI: 1.04, 1.71) (**Table 2**), though this association

TABLE 1 | Participant characteristics (age-adjusted) by self-forgiveness at study baseline (The Nurses' Health Study II 2008 Supplementary Survey, *N* = 53,226).

Participant characteristics	Self-forgiveness		
	Never/seldom (*n* = 7424)	Often (*n* = 23,621)	Always/almost always (*n* = 22,181)
Age, in years (range: 43–64)[a]	53.22 (4.62)	53.32 (4.66)	53.41 (4.65)
Non-hispanic white, %	96.40	95.95	95.30
Marital status, %	77.61	80.99	83.28
Geographic region, %			
- Northeast	38.08	33.19	28.36
- Midwest	29.59	33.21	34.29
- South	15.20	18.11	21.03
- West	17.13	15.48	16.32
Subjective SES in US (range: 1–10)	6.81 (1.42)	7.05 (1.28)	7.26 (1.30)
Subjective SES in community (range: 1–10)	6.46 (1.71)	6.84 (1.54)	7.17 (1.53)
Census-tract college education rate (range: 0–0.88)	0.33 (0.16)	0.32 (0.16)	0.31 (0.16)
Household income, %			
- <$50,000	17.27	15.76	15.40
- $50,000–$74,999	27.24	27.71	27.30
- $75,000–$99,999	20.84	21.57	21.52
- ≥$100,000	34.66	34.96	35.78
Census tract median income, %			
- <$50,000	24.35	25.30	27.05
- $50,000–$74,999	47.59	49.64	48.95
- $75,000–$99,999	20.48	18.97	18.35
- ≥$100,000	7.58	6.09	5.66
Night shift work over past 2 years, %			
- None	90.95	91.82	92.66
- 1–9 months	4.08	3.56	3.03
- 10–19 months	1.30	1.38	1.21
- 20+ months	3.67	3.23	3.10
Currently employed, %	89.11	89.57	87.84
Childhood abuse victimization (range: 0–5)	2.04 (1.56)	1.78 (1.48)	1.65 (1.48)
Religious service attendance, %			
- Never/almost never	38.52	21.70	17.91
- <Once/week	41.60	39.71	30.65
- ≥Once/week	19.88	38.60	51.44
Number of close friends (range: 0–5)	1.52 (0.72)	1.72 (0.64)	1.81 (0.65)
Depressive symptoms (range: 0–30)	9.42 (6.03)	6.33 (4.74)	4.63 (4.24)
Depression diagnosis, %	23.84	15.16	12.31
Anxiety symptoms (range: 0–15)	3.16 (2.60)	2.55 (2.21)	2.07 (2.02)
Hopelessness (range: 0–3)	1.30 (0.93)	0.90 (0.88)	0.67 (0.90)
Positive affect (range: 0–3)	1.68 (0.81)	2.05 (0.72)	2.29 (0.73)
Preventive healthcare use, %	81.75	85.47	86.34
Alcohol intake, %			
- 0 g/day	31.59	31.18	37.35
- 0.1–9.9 g/day	44.25	46.48	42.51
- 10.0–29.9 g/day	18.64	18.40	16.62
- 30+ g/day	5.52	3.94	3.53
Cigarette smoking, %			
- Never smoker	59.86	65.57	68.70
- Former smoker	31.76	28.35	26.17
- Current smoker 1–14/day	4.34	3.42	2.91
- Current smoker 15–24/day	2.88	1.98	1.71
- Current smoker ≥ 25/day	1.16	0.67	0.51
Physical activity (METS[b]), %			
- <3	19.32	15.56	15.36
- 3–8.9	20.01	18.97	18.75
- 9–17.9	19.10	21.07	20.78
- 18–26.9	12.77	13.87	14.63
- ≥27	28.79	30.52	30.49
Dietary quality (AHEI score[c]), %			
- Bottom tertile, %	36.24	32.57	31.10
- Middle tertile, %	32.99	34.02	32.89
- Top tertile, %	30.77	33.41	36.01
BMI categories (kg/m^2), %			
- <20	6.01	5.46	5.20
- 20–24.9	35.77	38.10	38.65
- 25–29.9	28.58	29.53	29.95
- 30–34.9	15.40	15.22	15.12
- 35+	14.24	11.69	11.09
Diabetes, %	5.12	4.58	4.57
CHD, %	1.46	1.07	1.13
Stroke, %	1.69	1.27	1.29
Cancer, %	6.62	6.61	6.48
Postmenopausal status, %	60.74	60.23	60.81
Replacement hormone use, %	14.04	14.34	14.64

Values are means (SD) for continuous variables and percentages for categorical variables, and are standardized to the age distribution of the study population. Values of polytomous variables may not sum to 100% due to rounding. [a]Value is not age adjusted. [b]Metabolic equivalents score (METS) was used to measure physical activity. [c]Alternate Healthy Eating Index (AHEI) was used to measure dietary quality.

did not pass a $p = 0.05$ threshold after Bonferroni correction. The association was also attenuated in our sensitivity analysis that was restricted to participants free of major physical health problems at baseline (**Supplementary Table S3**). The sensitivity analysis using complete-case analyses yielded similar results (**Supplementary Table S4**). The sensitivity analysis examining incidence of physical health outcomes also suggested no evidence of association between self-forgiveness and subsequent physical health (**Supplementary Table S5**). Further, the sensitivity analysis considering self-forgiveness as a continuous variable also yielded similar results to our primary analysis (**Supplementary Table S6**).

Divine Forgiveness and Subsequent Health and Well-Being

To a lesser extent, divine forgiveness was also positively associated with psychological well-being (e.g., positive affect, β = 0.19; 95% CI: 0.15, 0.22) and was inversely associated with psychological distress (e.g., depressive symptoms, β = −0.15; 95% CI: −0.18, −0.12; hopelessness, β = −0.16; 95% CI: −0.20, −0.12) (**Table 3**). Among health behaviors and physical health outcomes, there were few associations, with the exception of some evidence that divine forgiveness was related to higher risk of overweight obesity (RR = 1.06; 95% CI: 1.00, 1.11) and more physical health problems (β = 0.03; 95% CI: 0.00, 0.05). However, these associations did not reach a *p*-value threshold smaller than 0.05 after Bonferroni correction (**Table 3**). The complete-case analyses (**Supplementary Table S7**) and the sensitivity analysis restricting to participants free of major physical health problems at baseline both yielded similar results (**Supplementary Table S8**). The sensitivity analysis that examined incidence of physical health outcomes also suggested little evidence of association with divine forgiveness with the exception of a stronger association with incidence of overweight/obesity as compared to the main model (RR = 1.40; 95% CI: 1.17, 1.68) (**Supplementary Table S5**). It is also interesting to note that although most confidence intervals overlapped the null, point estimates for incident diabetes, heart disease, and cancer were in the opposite direction for self- vs. divine forgiveness. The sensitivity analysis assessing divine forgiveness as a continuous variable also yielded similar results to the primary analysis (**Supplementary Table S9**).

Sensitivity Analyses on Unmeasured Confounding

Although we adjusted for a range of potential confounding variables, this study used observational data and thus there may still have been uncontrolled confounding, for example, aspects of personality, or the experience of a recent major offense. Controlling for baseline outcomes partially helps to mitigate bias from such uncontrolled confounding. However, we also report *E*-values to assess sensitivity or robustness of results to potential unmeasured confounding. *E*-values suggested that several of the associations we observed were at least somewhat robust to unmeasured confounding (**Table 4**). For example, only an unmeasured confounder associated with both self-forgiveness and higher levels of positive affect by risk ratios of 1.77 each, above and beyond the large array of covariates already adjusted for, could suffice to explain away the observed association, but weaker confounding could not. To shift the CI to include the null, an unmeasured confounder associated with both self-forgiveness and higher levels of positive affect by risk ratios of 1.70 each could suffice, but weaker confounding could not. However, for other associations, such as between divine forgiveness and the number of health problems, relatively modest levels of confounding could explain away the association (*E*-value = 1.20 for estimate and 1.08 for CI).

DISCUSSION

Psychosocial Well-Being and Psychological Distress

In this study, religiously or spiritually motivated self-forgiveness and divine forgiveness had positive associations with psychosocial well-being, findings that align with a number of prior studies. For example, a 2015 meta-analysis of self-forgiveness examined 65 studies (largely cross-sectional) and reported positive correlation between self-forgiveness and psychosocial well-being, with self-forgiveness accounting for approximately 20% of the variance in psychological well-being aggregating across measures of depression, anxiety, life satisfaction, and general mental health (Davis et al., 2015). Building off of this study, a follow-up qualitative analysis of self-forgiveness literature, similarly, found that of 60 studies measuring trait self-forgiveness, 59 were robustly linked to mental health, while only one study among adult women with significant trauma reported a null relationship. In our study, the one-item measure of religiously or spiritually motivated self-forgiveness was also associated with improved psychosocial well-being and reduced psychological distress; however, the use of longitudinal data allows for stronger interpretation of results than previous cross-sectional work. Of course, single-item measures are limited in their depth and interpretive potential. However, recent studies employing more nuanced measures of self-forgiveness (e.g., differentiating self-forgiveness from self-exoneration) suggest that both genuine self-forgiveness and self-exoneration were associated with increased well-being (Cornish et al., 2018). One of the few prospective longitudinal studies examining the impact of self-forgiveness on both offender and victim found that genuine self-forgiveness (involving effort to work through one's offense, responsibility-taking, and self-acceptance while acknowledging failure) was associated with positive restorative outcomes for both parties (Woodyatt and Wenzel, 2013). While these studies examine more robust measures of self-forgiveness, the findings align with our study as those who reported the highest levels of religiously or spiritually motivated self-forgiveness had increased levels of social integration and reduced levels of loneliness.

In our study, those who reported the highest levels of divine forgiveness had better psychosocial well-being than those who reported the lowest levels of divine forgiveness, broadly

TABLE 2 | Self-forgiveness and subsequent health and well-being in mid-life (The Nurses' Health Study II 2008 supplementary survey to 2011, 2013, or 2015 questionnaire wave, N = 54,703[a]).

	Self-forgiveness[b]							
	Often vs. Never/seldom				Always/almost always vs. Never/seldom			
Health and well-being outcomes	**RR[c]**	**β[d]**	**95% CI**	***P*-value threshold**	**RR[c]**	**β[d]**	**95% CI**	***P*-value threshold**
Psychosocial well-being								
Positive affect		0.12	0.10, 0.15	<0.0026[e]		0.23	0.20, 0.25	<0.0026[e]
Social integration		0.07	0.05, 0.09	<0.0026[e]		0.11	0.09, 0.13	<0.0026[e]
Psychological distress								
Depression diagnosis	0.98		0.91, 1.06		0.93		0.85, 1.01	
Depressive symptoms		−0.13	−0.15, −0.10	<0.0026[e]		−0.21	−0.23, −0.18	<0.0026[e]
Anxiety symptoms		−0.01	−0.04, 0.02			−0.15	−0.18, −0.12	<0.0026[e]
Hopelessness		−0.12	−0.15, −0.10	<0.0026[e]		−0.18	−0.21, −0.15	<0.0026[e]
Loneliness		−0.10	−0.12, −0.07	<0.0026[e]		−0.12	−0.15, −0.10	<0.0026[e]
Health behaviors								
Heavy drinking	0.97		0.83, 1.13		0.97		0.82, 1.15	
Current cigarette smoking	0.94		0.79, 1.11		0.95		0.79, 1.14	
Frequent physical activity	1.00		0.97, 1.04		1.00		0.97, 1.04	
Preventive healthcare use	1.00		0.97, 1.03		0.99		0.96, 1.02	
Dietary quality		0.00	−0.02, 0.02			0.02	−0.01, 0.04	
Physical health								
All-cause mortality	1.12		0.89, 1.42		1.33		1.04, 1.71	<0.05
No. of physical health problems		0.00	−0.02, 0.02			0.01	−0.01, 0.03	
Diabetes	0.88		0.76, 1.01		0.97		0.83, 1.13	
Stroke	1.08		0.80, 1.46		1.01		0.73, 1.39	
Heart disease	0.89		0.61, 1.30		1.41		0.95, 2.07	
Cancer	0.95		0.88, 1.03		0.97		0.89, 1.05	
Overweight/obesity	1.02		0.98, 1.05		1.02		0.98, 1.06	

RR, risk ratio; CI, confidence interval. [a] *The full analytic sample was restricted to those who responded to the Nurses' Health Study II 2008 supplementary survey in which the exposure variable forgiveness was assessed. Multiple imputation was performed to impute missing data on all variables.* [b] *A set of generalized estimating equations were used to regress each outcome on forgiveness separately. All models controlled for participants' age, race, marital status, geographic region, childhood abuse, socioeconomic status (subjective SES, household income, census tract college education rate, and census tract median income), employment status, night shift work schedule, religious service attendance, number of close friends, and prior health status or health behaviors (prior depressive symptoms, depression diagnosis, anxiety symptoms, hopelessness, positive affect, dietary quality, body mass index, smoking, alcohol intake, physical activity, preventive healthcare use, postmenopausal status, menopausal hormone therapy use, history of diabetes, heart diseases, stroke, and cancer).* [c] *The effect estimates for the outcomes of heavy drinking, current smoking, mortality, diabetes, heart diseases, stroke, and cancer were odds ratio. These outcomes were rare (prevalence < 10%), so the odds ratio would approximate RR. Effect estimates for other dichotomized outcomes were RR.* [d] *All continuous outcomes were standardized (mean = 0, standard deviation = 1), and β was the standardized effect size.* [e] $p < 0.05$ *after Bonferroni correction (the p-value cutoff for Bonferroni correction is p = 0.05/19 outcomes = 0.0026).*

aligning with the small amount of existing evidence on divine forgiveness. For example, a number of cross-sectional studies examining divine forgiveness have found generally positive relationships with well-being and psychological adjustment (Exline, 2020) such as successful aging among older adults (Lawler-Row, 2010), stronger sense of purpose (Lyons et al., 2011), and lower end-of-life anxiety (Krause, 2015). Others note that while divine forgiveness is not as strongly predictive of better mental health as much as the forgiveness of others (Toussaint et al., 2001; Krause and Ellison, 2003), belief in God's forgiveness is a strong predictor of unconditional forgiveness of others, which is associated with better mental health outcomes (Krause and Ellison, 2003; Uecker et al., 2016). While a recent longitudinal analysis among a sample of older adult Christians in the US did not find association between divine forgiveness and psychological well-being (optimism, self-esteem, and life satisfaction), it did find that divine forgiveness improved psychological well-being more among those who were securely attached to God (Kent et al., 2018). Another cross-sectional study exploring beliefs in human sinfulness, divine forgiveness, and mental health found that belief in human sinfulness was not a significant impediment to good mental health among those who frequently feel God's forgiveness, but was related to poor mental health among those who feel God's forgiveness less frequently (Uecker et al., 2016). As our study only used a single measure of divine forgiveness, it was not possible to assess personal religious beliefs about human relationships to the divine, other than excluding those who specifically stated they did not believe in god or a higher power. However, the associations between divine forgiveness and subsequent psychological well-being and reduced psychosocial distress indicate that divine forgiveness may play a positive role in improved psychosocial well-being among those who do believe in a divine being or force.

TABLE 3 | Divine forgiveness and subsequent health and well-being in mid-life (The Nurses' Health Study II 2008 supplementary survey to 2011, 2013, or 2015 questionnaire wave, N = 51,661[a]).

	Divine forgiveness[b]							
	Often vs. Never/seldom				Always/almost always vs. Never/seldom			
Health and well-being outcomes	**RR[c]**	**β[d]**	**95% CI**	***P*-value threshold**	**RR[c]**	**β[d]**	**95% CI**	***P*-value threshold**
Psychosocial well-being								
Positive affect		0.09	0.05, 0.13	<0.0026[e]		0.19	0.15, 0.22	<0.0026[e]
Social integration		0.03	0.00, 0.05			0.12	0.09, 0.15	<0.0026[e]
Psychological distress								
Depression diagnosis	1.03		0.92, 1.16		1.06		0.94, 1.18	
Depressive symptoms		−0.08	−0.12, −0.04	<0.0026[e]		−0.15	−0.18, −0.12	<0.0026[e]
Anxiety symptoms		0.03	−0.01, 0.08			−0.03	−0.07, 0.01	
Hopelessness		−0.07	−0.12, −0.03	<0.0026[e]		−0.16	−0.20, −0.12	<0.0026[e]
Loneliness		−0.06	−0.10, −0.02	<0.01		−0.11	−0.15, −0.07	<0.0026[e]
Health behaviors								
Heavy drinking	0.97		0.79, 1.21		1.06		0.87, 1.30	
Current cigarette smoking	1.20		0.92, 1.56		1.09		0.85, 1.40	
Frequent physical activity	0.99		0.95, 1.04		0.98		0.93, 1.03	
Preventive healthcare use	1.01		0.97, 1.05		1.01		0.97, 1.05	
Dietary quality		−0.03	−0.06, 0.01			−0.03	−0.06, 0.00	
Physical health								
All-cause mortality	0.88		0.62, 1.24		1.05		0.76, 1.46	
No. of physical health problems		0.02	−0.01, 0.04			0.03	0.00, 0.05	<0.05
Diabetes	0.89		0.71, 1.10		0.89		0.73, 1.09	
Stroke	0.87		0.54, 1.40		1.05		0.68, 1.63	
Heart disease	0.71		0.42, 1.22		0.73		0.44, 1.20	
Cancer	0.97		0.87, 1.09		0.98		0.87, 1.09	
Overweight/obesity	1.05		0.99, 1.11		1.06		1.00, 1.11	<0.05

RR, risk ratio; CI, confidence interval. [a]The full analytic sample was restricted to those who responded to the Nurses' Health Study II 2008 supplementary survey in which the exposure variable forgiveness was assessed. Participants who reported not believing in God or a higher power were removed from the analyses. Multiple imputation was performed to impute missing data on all variables. [b]A set of generalized estimating equations were used to regress each outcome on forgiveness separately. All models controlled for participants' age, race, marital status, geographic region, childhood abuse, socioeconomic status (subjective SES, household income, census tract college education rate, and census tract median income), employment status, night shift work schedule, religious service attendance, number of close friends, prior health status, or health behaviors (prior depressive symptoms, depression diagnosis, anxiety symptoms, hopelessness, positive affect, dietary quality, body mass index, smoking, alcohol intake, physical activity, preventive healthcare use, postmenopausal status, menopausal hormone therapy use, history of diabetes, heart diseases, stroke, and cancer). [c]The effect estimates for the outcomes of heavy drinking, current smoking, mortality, diabetes, heart diseases, stroke and cancer were odds ratio. These outcomes were rare (prevalence < 10%), so the odds ratio would approximate RR. Effect estimates for other dichotomized outcomes were RR. [d]All continuous outcomes were standardized (mean = 0, standard deviation = 1), and β was the standardized effect size. [e]$p < 0.05$ after Bonferroni correction (the p-value cutoff for Bonferroni correction is p = 0.05/19 outcomes = 0.0026).

Health Behaviors and Physical Health

Our study found few associations between self- or divine forgiveness and physical health. With regard to self-forgiveness, recent meta-analyses of mostly cross-sectional studies have found weak to moderate associations between self-forgiveness and physical health that decrease with age and when more males were included in the sample (Davis et al., 2015). These results might suggest that a mid-aged female-only sample might yield stronger associations between self-forgiveness and physical health, yet in our analysis, there was little evidence of association with physical health or health behavior outcomes with the possible exception of an increased risk of mortality, though this did not pass the $p < 0.05$ threshold after Bonferroni correction for multiple testing. Despite the weakness of this association in our study, others have noted the potentially "dark side" of self-forgiveness (Thompson, 2011; Woodyatt and Wenzel, 2020). For example, studies found that state self-forgiveness (forgiveness for particular events) was associated with reduced efforts to change or reconcile, particularly when change was hard or emotionally uncomfortable (Cornish et al., 2018; Woodyatt and Wenzel, 2020). In other words, forgiving oneself too easily potentially undermines mechanisms that promote behavior change and maintain healthy relationships, in turn potentially perpetuating cycles of chronic destructive behavior (Thompson, 2011; Davis et al., 2015; Griffin, 2016). Theologians likewise reflect on the need for forgiveness to be a reminder of what right union and relationships look like; "a gracious irritant" that avoids complacency and inspires right action (Jones, 1995). Thus, the associations between self-forgiveness and physical health and health behaviors may merit further study.

In our study, divine forgiveness and physical health only had mild (pre-Bonferroni correction) associations for two outcomes:

TABLE 4 | Robustness to unmeasured confounding (*E*-values[a]) for assessing the associations between forgiveness and health and well-being (The Nurses' Health Study II 2008 Supplementary Survey to 2011, 2013, or 2015 Questionnaire Wave).

Health and well-being outcomes	Self-forgiveness (always/almost always vs. never/seldom)		Divine forgiveness (always/almost always vs. never/seldom)	
	For effect estimate[b]	For CI limit[c]	For effect estimate[b]	For CI limit[c]
Positive affect	1.77	1.70	1.66	1.56
Social integration	1.45	1.39	1.47	1.40
Depression diagnosis	1.36	1.00	1.31	1.00
Depressive symptoms	1.72	1.65	1.56	1.46
Anxiety symptoms	1.56	1.48	1.20	1.00
Hopelessness	1.64	1.56	1.58	1.48
Loneliness	1.47	1.39	1.45	1.33
Heavy drinking	1.25	1.00	1.31	1.00
Current cigarette smoking	1.21	1.00	1.40	1.00
Frequent physical activity	1.00	1.00	1.16	1.00
Preventive healthcare use	1.11	1.00	1.11	1.00
Dietary quality	1.16	1.00	1.20	1.00
All-cause mortality	1.99	1.24	1.28	1.00
No. of physical health problems	1.11	1.00	1.20	1.08
Diabetes	1.25	1.00	1.50	1.00
Stroke	1.32	1.00	1.28	1.00
Heart disease	2.17	1.00	2.08	1.00
Cancer	1.21	1.00	1.16	1.00
Overweight/obesity	1.16	1.00	1.31	1.00

CI, confidence interval. [a]See VanderWeele and Ding (2017) for the formula and Mathur et al. (2018) for the website and R package for calculating E-values. [b]The E-values for effect estimates are the minimum strength of association on the risk ratio scale that an unmeasured confounder would need to have with both the exposure and the outcome, above and beyond the measured covariates, to fully explain away the observed association of forgiveness (always/almost always vs. never/seldom) with various outcomes. [c]The E-values for the limit of the 95% confidence interval closest to the null denote the minimum strength of association on the risk ratio scale that an unmeasured confounder would need to have with both the exposure and the outcome, above and beyond the measured covariates, to shift the confidence interval to include the null value.

number of physical health problems and overweight/obesity. Interestingly, in our supplementary analysis examining forgiveness and incidence of physical health problems, the association between divine forgiveness and overweight/obesity was more pronounced with those who report always/almost always receiving divine forgiveness 40% more likely to develop overweight/obesity at follow-up in 2015. While there are very few studies that specifically examine the relationship between divine forgiveness and physical health, a recent outcome-wide longitudinal study (Chen et al., 2018) also found a mild association between divine forgiveness and overweight/obesity among young adults, and a cross-sectional study with US adults found forgiveness by God related to less favorable waist/hip ratios and less frequent exercise among those who were less committed to their faith (Krause and Ironson, 2017). Given the paucity of longitudinal studies related to divine forgiveness (relative to the forgiveness of others and even self-forgiveness) and the relatively low number of studies examining the relationship between forgiveness and physical health (Toussaint et al., 2020), our study offers early evidence regarding the relationship between divine forgiveness and physical health, which we hope catalyzes others to explore further.

Limitations and Strengths

This study was limited by the use of single-item measures of religiously or spiritually motivated self- and divine forgiveness, which only addressed the emotional component of trait forgiveness (Woodyatt and Wenzel, 2020) and were potentially complicated by the qualifying statement, "Because of my spiritual or religious beliefs. . .". To help mitigate this challenge, we removed participants who selected "Do not believe in God or a higher power" in our analysis on divine forgiveness. Future longitudinal studies might consider expanding the assessment of forgiveness with validated forgiveness scales that include a self-forgiveness component, including Enright Forgiveness Inventory (Enright, 1996), Heartland Forgiveness Scale (Thompson and Snyder, 2003), State Self-Forgiveness Scale (Wohl et al., 2008), and the more recently developed Differentiated Process Scale of Self-Forgiveness (Woodyatt and Wenzel, 2013) and Dual Process of Self-Forgiveness Scale (Griffin et al., 2018). For divine forgiveness, considerations may include the multi-dimensional scale assessing divine forgiveness for a specific offense (Martin, 2008) or a multi-item scale on the conditionality of God's forgiveness (Akl and Mullet, 2010).

The study also had a limited follow-up period, which may not have been enough time to assess the relationship between forgiveness and physical health, particularly the incidence of chronic conditions that tend to develop slowly over time and in later life. The study also included a largely homogeneous sample of white female nurses, which, although quite large, greatly limits the applicability of findings to the general US population as well as populations in other global contexts. As with all observational studies, ours was potentially limited by confounding due to unmeasured factors. However, our use of prospective data, rigorous covariate control, and the sensitivity analyses for unmeasured confounding may help to reduce such concerns.

This study has a number of strengths worth noting. The most critical of these is the use of longitudinal data with a large cohort, which helps address a long-standing gap in forgiveness-related research. By adjusting for prior values of covariates and outcomes in our primary analysis, we were able to reduce concerns of reverse causation, which ultimately provide stronger evidence of causality (Danaei et al., 2012; Hernán, 2015; VanderWeele et al., 2016). We examined multiple associations simultaneously, creating scope to report on strong associations as well as weak or null associations (VanderWeele, 2017; VanderWeele et al., 2020),

which are often excluded from publication due to bias toward "significant" findings. Our analysis was further strengthened by our supplementary analyses, which found largely similar associations across methodologies. Additionally, we included a number of physical health and health behavior outcomes, a number of which were objectively assessed, reducing the potential of bias due to self-reported data. For example, physical conditions were verified by medical chart review, and psychosocial outcomes are assessed using validated measures. Finally, this study examines two forms of forgiveness that are relatively understudied in the forgiveness research landscape, which allows this study to make a novel contribution both methodologically and conceptually.

Implications

Findings in this study highlight the potential that religiously or spiritually motivated self-forgiveness and divine forgiveness may have in improving psychosocial well-being and reducing psychological distress. Recent studies highlight the potential of workbook and counseling interventions to improve self-forgiveness and improve other measures of well-being such as lower self-condemnation, psychological distress, and pessimism, increased drinking refusal, and greater compassion (Toussaint et al., 2014; Cornish and Wade, 2015; Griffin et al., 2015; Bell et al., 2017). However, much remains unknown about the impact of explicit self-forgiveness interventions (Griffin et al., 2018), and even less is known about effective interventions to improve divine forgiveness, although it is likely that such interventions would be best placed in the context of religious teachings suitable to a person's faith tradition, and perhaps integrated with teaching on other forms of forgiveness given their seeming interdependence (Exline, 2020).

While there seems to be mounting evidence for the benefits of self-forgiveness and divine forgiveness on psychosocial well-being, findings from this study indicate an ambiguous relationship between these forms of forgiveness and physical health, indicating, above all, the need for further evidence to better understand the nature of these relationships. While this study makes a strong contribution in its use of longitudinal data and rigorous analysis, longitudinal data from more diverse cohorts, more robust measures of self-and divine forgiveness, and a better understanding of underlying mechanisms are required.

CONCLUSION

This study provides novel evidence that religiously or spiritually motivated self-forgiveness and divine forgiveness are both positively related to several indicators of psychosocial well-being and inversely associated with psychological distress outcomes, whereas the associations with physical health and health behaviors are less clear. Further longitudinal investigation of the dynamics between these types of forgiveness and health and well-being is warranted.

DATA AVAILABILITY STATEMENT

The data analyzed in this study was obtained from the Nurses' Health Study II. These are not publicly available due to restrictions set by the data holder but may be made available upon request and permission from the Channing Division of Network Medicine at Brigham and Women's Hospital. Further information including the procedures to obtain and access data from the Nurses' Health Study is described at https://www.nurseshealthstudy.org/researchers (email: nhsaccess@channing.harvard.edu).

ETHICS STATEMENT

This study was approved by the Institutional Review Board at Brigham and Women's Hospital, Boston, MA, United States. The patients/participants provided their written informed consent to participate in this study.

AUTHOR CONTRIBUTIONS

TV and YC developed the study concept. KL, YC, MP, JH, and TV contributed to the study design and interpretation of results. YC had full access to the data in the study and takes responsibility for the integrity of the data and accuracy of the data analysis. KL drafted the manuscript. YC, MP, JH, and TV provided critical revisions and approved the final submitted version of the manuscript. All authors contributed to the article and approved the submitted version.

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SUPPLEMENTARY MATERIAL

The Supplementary Material for this article can be found online at: https://www.frontiersin.org/articles/10.3389/fpsyg.2020.01337/full#supplementary-material

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Socio-Ecological Hypothesis of Reconciliation: Cultural, Individual, and Situational Variations in Willingness to Accept Apology or Compensation

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The main goal of the present research is to examine socio-ecological hypothesis on apology and compensation. Specifically, we conducted four studies to test the idea that an apology is an effective means to induce reconciliation in a residentially stable community, whereas compensation is an effective means in a residentially mobile community. In Studies 1, 2a, and 2b, American and Japanese participants (national difference in mobility; Study 1) or non-movers and movers (within-nation difference in mobility; Studies 2a and 2b) imagined the situations in which they were hurt by their friends and rated to what extent they would be willing to maintain their friendships upon receipt of apology or compensation. The results showed that compensation was more effective in appeasing residentially mobile people (i.e., Americans and movers) than stable people (i.e., Japanese and non-movers), while apology was slightly more effective appeasing residentially stable people than residentially mobile people (significant in Study 1; not significant in Studies 2a and 2b). In Study 3, by conducting an economics game experiment, we directly tested the hypothesis that mobility would impair the effectiveness of apology and enhance the effectiveness of compensation. The results again partially supported our hypothesis: In the high mobility condition, compensation increased one's willingness to continue the relationship with the offender, when compared to willingness in the low mobility condition. The importance of socio-ecological perspective on the forgiveness literature is discussed.

Keywords: apology, compensation, socio-ecological approach, reconciliation, costly signaling theory

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INTRODUCTION

Occasional offenses are inescapable in any relationship. Of course, time heals most hurt feelings. Yet, apology or compensation or both is often needed for the victims to fully forgive offensives. Given the importance of the interpersonal reconciliation processes (including apology, compensation, and forgiveness) in the maintenance of relationships, it has been actively investigated in social psychology (Ohbuchi et al., 1989; McCullough et al., 1998; McCullough, 2008;

Fehr et al., 2010) in addition to the context of non-human animals (de Waal, 1989) organizations (Bradfield and Aquino, 1999; Aquino et al., 2001), and nations (Long and Brecke, 2003; Hornsey and Wohl, 2013).

The ubiquity of forgiveness across different species points to its evolutionary importance (de Waal, 2000; McCullough, 2008). Psychological research on forgiveness has shown that reconciliatory tendencies and tactics vary substantially across individuals (Howell et al., 2011, 2012) and cultures (Fukuno and Ohbuchi, 1998; Maddux et al., 2011). Although the early evolutionary psychology tends to focus on psychological universals, such as the cheater-detection mechanism (Cosmides, 1989; Tooby and Cosmides, 1992), the growing evolutionary literature suggests that many psychological adaptations are facultative traits (Laland, 2008). That is, people employ adaptive strategies in response to their local environment, such as pathogen level (Low, 1990; Gangestad and Buss, 1993) and sex ratio (Wilson and Daly, 1985; Griskevicius et al., 2012). The aim of the present study is to understand the variation of reconciliatory tendencies in terms of adaptation to socio-ecological environments. Four studies specifically tested whether residential mobility would modify the effectiveness of apology vs. compensation as reconciliation tactics.

Evolutionary Approach to Reconciliation and Forgiveness

While psychologists (mostly clinical and social psychologists) were accumulating knowledge about the human forgiveness process (Worthington, 2005), animal researchers (mostly primatologists) were conducting research on the reconciliation processes of various species (Aureli and de Waal, 2000). Primatologists do not use the term *forgiveness* because "forgiveness is an internal process to which [researchers] have no access in non-human primates" (de Waal and Pokorny, 2005 p. 18). Accordingly, it is difficult to directly compare the human forgiveness process with an animal reconciliation process. Nevertheless, given the similarity in function (i.e., repair of an endangered relationship), de Waal and Pokorny (2005 p. 18) speculate that both processes probably share an emotional switch that "moves the attitude toward another individual from aggressive and/or fearful to friendly, perhaps even affectionate" and that this psychological mechanism in different species may share a common evolutionary origin.

Although a direct comparison of the human forgiveness process and animal reconciliation process is not feasible, there is some evidence suggesting the presence of commonalities in the two processes. For example, McCullough et al. noted that a prominent hypothesis regarding the function of animal reconciliation (i.e., the valuable relationships hypothesis developed by de Waal, 2000) can be tested in humans (McCullough, 2008; McCullough et al., 2013 for reviews). The valuable relationships hypothesis posits that the function of animal reconciliation is to maintain a valuable relationship that is on the verge of dissolution due to conflicts over less important resources (de Waal, 2000). Accordingly, relationship value is a reliable predictor of animal reconciliation (Cords and Thurnheer, 1993 for experimental evidence from long-tailed macaques). McCullough et al. (2010), for example, tested this hypothesis by assessing the temporal course of forgiveness over 3 months and found that the offender's relationship value facilitated the rate of forgiveness (see also Burnette et al., 2012; McCullough et al., 2014; Smith et al., 2020 for further evidence for the valuable relationships hypothesis in humans).

Another observable commonality between the human forgiveness process and the animal reconciliation process is the presence of precursory, benign intent signaling (Silk, 2002). When primates reconcile with their former opponent, conciliatory signals from one of the former opponents tend to precede peaceful post-conflict interactions. Similarly, it has been well established that apologies (a human equivalence of a benign intent signal) and other forms of conciliatory gestures (e.g., compensation) facilitate forgiveness (Ohbuchi et al., 1989; Fehr et al., 2010; McCullough et al., 2014 for a meta-analytic review). Given these two commonalities (i.e., the importance of relationship value and conciliatory signals), it is interesting to examine how people react to different types of conciliatory gestures under different socio-ecological environments, where partners' relationship values vary due to the expected durability of each relationship.

Apology as an Evolved Reparative Signal

Ohtsubo and Watanabe (2009) proposed an evolutionary model of human apology based on the *costly signaling theory*, which was independently developed in evolutionary biology (Zahavi and Zahavi, 1997) and economics (Spence, 1973). Evolutionary models of signals generally assume the presence of an information asymmetry between two parties (i.e., a signal sender knows something that is not directly knowable by the receiver). If both players will benefit from sharing the accurate information, the receiver does not have to worry about intentional deception (Skyrms, 2010). However, this is no longer the case if the sender benefits from misleading the receiver, because the sender might evolve to send deceptive signals (Krebs and Dawkins, 1984). In the case of reconciliation, an exploitative perpetrator might say "I'm sorry. I won't do that again," just to be forgiven and exploit the victim again. Given such a potential conflict of interests, the costly signaling theory predicts that the signal must be sufficiently costly to outweigh the benefit of deception.

Ohtsubo and Watanabe (2009) noted that a costly form of reparative act, such as compensation, could nullify the benefit of exploitation. However, if the perpetrator sincerely wishes to resume the relationship, the cost can be offset by the long-term benefits accruing from the relationship. Therefore, costly compensation signals the honesty of the offender. On the other hand, a minimum form of apology (i.e., just saying "I'm sorry") does not qualify as a costly signal, and its honesty is not guaranteed. Ohtsubo and Watanabe empirically tested this model, and showed that victims would perceive costly forms of reparative acts (e.g., compensation) as being more sincere than non-costly reparative acts (e.g., a verbal apology). This result was replicated in seven countries (Ohtsubo et al., 2012). Furthermore, a recent functional magnetic resonance imaging

study revealed that costly reparative acts engaged the theory-of-mind network in recipients' brain, suggesting that the recipients read sincere intention from costly reparative acts (Ohtsubo et al., 2018). Therefore, it seems that people have a universal psychological mechanism to assess the honesty of apologizers from the costliness of their reparative acts.

Despite the supportive evidence of the costly apology model, merely saying "I'm sorry" is often sufficient to induce the victim's forgiveness. In fact, Silk et al. (2000) developed a model of cheap apology and showed that the model nicely fit the observed reconciliatory patterns of female rhesus macaques. Silk et al.'s model assumes that every pair engages in long-lasting interactions (cf. the Ohtsubo and Watanabe model assumes that at least some signalers do not intend to continue interacting with the current partner). Therefore, a one-time deceptive signal permanently deprives the deceiver of the future benefits accruing from the interactions with the victim. Consistent with this model, Silk et al. showed that two female rhesus macaques were more likely to resume peaceful interactions if one of them made quiet calls-non-costly conciliatory gestures-before approaching her former opponent. It is noteworthy that rhesus macaques live in matrilineal groups, and thus neither of the former opponents is likely to leave her natal group (i.e., they are likely to keep interacting with each other in the same group).

A comparison of the two signaling models of apology suggests that non-costly apology is more effective with repeated interactions or in a stable relationship. This is consistent with evolutionary game theoretic analyses. Conducting a computer simulation study, Hruschka and Henrick (2006) found that a forgiving strategy (i.e., letting a few offenses go in established relationships) evolved in an environment in which each player was allowed to develop long-term relationships with a limited number of others. Stability in interpersonal relationships fostered evolution of forgiveness because partner change was costly (e.g., because developing a new relationship was time-consuming). In contrast, in an environment where people can develop relationships with a large number of others, the unconditional forgiveness strategy is not adaptive because it is easily exploited by mobile freeloaders (Enquist and Leimar, 1993). In other words, an unconditional forgiveness strategy, i.e., accepting verbal apologies (e.g., "I'm sorry"), is adaptive in stable environments, whereas a more cautious strategy, which requires a costly form of reparative act, such as compensation, is more adaptive in mobile environments.

Socio-Ecological Psychology and Reconciliation

Recently, a socio-ecological approach has been applied to systematically investigate the influence of the stability/mobility of one's social environment (Oishi, 2010; Oishi and Talhelm, 2012; Oishi et al., 2015 for reviews). Although this approach developed relatively independently of the evolutionary psychological approaches to cooperation/reconciliation, its basic ideas and definitions of mobility closely approximate the ones used in evolutionary theories: Residential mobility is defined as the frequency at which people change their residence (Oishi, 2010).

Previous studies suggest that residential mobility affects people's social network, in particular the expected length of relationships (Oishi, 2010; Yuki and Schug, 2012). More specifically, individuals who live in a residentially stable environment expect to interact with the same group of individuals for an extended period of time, whereas individuals who live in a residentially mobile environment expect to interact with the same group of individuals only for a short period of time. Moreover, consistent with the aforementioned evolutionary model by Enquist and Leimar (1993), recent studies have shown that people are more cooperative toward their groups in stable environments than in mobile environments (Oishi et al., 2007b, 2009).

Applying the notion of residential mobility to the evolutionary models, we predicted that verbal (no-cost) apology is more effective in residentially stable environments, while compensation is more effective in residentially mobile environments. Although many studies have tested the effectiveness of verbal apologies (Fehr et al., 2010) and compensation (Desmet et al., 2010, 2011) separately, or compared their relative effectiveness without controlling for the relevant socio-environmental variables (Bottom et al., 2002; Ohtsubo and Watanabe, 2009; Komiya et al., 2018; Ohtsubo, 2020) to our knowledge, no study has examined the relationship between residential mobility and acts inducing reconciliation.

However, there is suggestive evidence. As many researchers point out (Yuki et al., 2007; Oishi, 2010; Yamagishi, 2011) there is a substantial difference in residential mobility between the United States and Japan: Almost half of Americans moved between 1995 and 2000 (Schmitt, 2001) while 28.1% of Japanese moved during the same years (Statistics Bureau and Statistics Center of Japan). Thus, based on the above arguments, it is expected that a verbal apology is more effective in Japan than in the United States. Fukuno and Ohbuchi (1998) scenario experiment showed that this was actually the case: An apology offered by the offender was more effective in improving Japanese participants' impressions of the offender than in improving Americans'. Ohbuchi et al. (2009) also showed that Japanese respondents were more satisfied with the offender's apology than American ones were. Moreover, studies of perpetrators' account strategies have also revealed a societal difference mirroring the tendency of victims: Japanese are more likely to apologize than Americans (Hamilton and Hagiwara, 1992; Itoi et al., 1996). In past research, such variations have usually been explained by differences in cultural values such as placing importance on social harmony or relational concerns. Moreover, no study has examined whether compensation is more effective in the United States than in Japan. In contrast, this research is the first attempt to explain this cultural difference in effective conciliatory tactics, if such really exists, by the difference in a socio-ecological factor-residential mobility.

The Present Studies

Overview

To fill the lack of empirical evidence for the socio-ecological hypothesis regarding the relationship between residential

mobility and reconciliation, we conducted four studies, all of which employed the same operationalization of reconciliation-the victim's willingness to maintain the relationship with the perpetrator. On the other hand, these four studies utilized *different* operationalizations of mobility. Study 1 tested the cross-national prediction: Apology would be more effective in Japan than in the United States, whereas compensation would be more effective in the United States than in Japan. Study 2a (Japan) and Study 2b (United States) tested the within-nation prediction: Apology would be more effective in inducing reconciliation from non-movers than frequent movers, whereas compensation would be more effective in inducing reconciliation from frequent movers than non-movers. Because Studies 1, 2a, and 2b were correlational studies, the causal role of residential mobility cannot be established. To address this limitation, we follow previous socio-ecological research (Oishi et al., 2012; Yuki et al., 2013) that used a similar logic and the combination of correlational studies and an experiment. Specifically, Study 3 directly manipulated mobility and tested whether an environment associated with frequent partner change (i.e., high mobility) would make apology less effective and compensation more effective as a reconciliatory tool.

Sample Size Determination and *post hoc* Power Analysis

Because there were no studies investigating the effectiveness of reconciliatory tactics at three different levels (i.e., at the national, individual, and situation levels), we could not accurately estimate the effect size of each study. We thus determined the sample size with reference to conventional cross-cultural research conducted in the past (Komiya et al., 2011). Specifically, we decided to collect at least 40 participants per cell throughout the four studies. We then conducted a *post hoc* power analysis to calculate the power of each study (see section "A *Post Hoc* Power Analysis").

STUDY 1: A UNITED STATES–JAPAN COMPARISON STUDY

Study 1 aimed to expand the previous cross-cultural research on reconciliation by examining the effect of compensations (i.e., a costly reparative act), in addition to the effect of apology (i.e., non-costly reparative act). We predicted that apology would be more likely to promote reconciliation in Japan than in the United States, whereas compensation would be more effective for reconciliation in the United States than in Japan.

Methods

Participants

Fifty-one European American undergraduates at the University of Wisconsin, Madison (24 men and 27 woman) and 50 Japanese undergraduates at Waseda University (37 men and 13 women) participated in this study. They received course credits in exchange for their participation.

Procedure

Participants completed a packet of questionnaire that included three scenarios (Musical, Travel, and Book) with four offender behaviors. All scenarios are presented in **Supplementary Material**. Participants first read a scenario in which an offender caused one of his/her friends trouble. For example, the Book scenario described a situation in which an offender borrowed a book from his friend and stained it by mistake. After each scenario, they read all four possible behaviors of the offender: Neither apology nor compensation (NN condition; saying nothing and not giving compensation), apology without compensation (AN condition; e.g., saying "I'm sorry for staining the book"), compensation without apology (NC condition; e.g., buying a new book and returning it to his friend), and compensation with apology (AC condition; e.g., saying "I'm sorry for staining the book" and buying a new book and returning it to his friend). The scenarios and the perpetrator's behaviors were fixed in the aforementioned order. The questionnaire was translated by two Japanese-English bilinguals using the back-translation method to confirm consistency between cultures.

For each behavior, assuming that the participants had been victims, they rated to what extent they would hope to remain friends with the offender on a seven-point scale, ranging from 1 (definitely not) to 7 (definitely). Because participants' ratings for the three scenarios were correlated with each other within each of the four within-participant conditions (Cronbach's α = 0.80, 0.75, 0.87, and 0.65, for NN, AN, NC, and AC, respectively), we collapsed the three scenarios. In particular, we averaged the three willingness-to-maintain-friendship scores within each condition and used the four aggregated scores in the following analyses. Therefore, each participant had four willingness-to-maintain-friendship scores corresponding to the four within-participant conditions.

Results and Discussion

The means and 95% confidence intervals (95%CIs) of the willingness to maintain friendship are shown in **Figure 1**. A 2 (apology: NN+NC or AN+AC) × 2 (compensation: NN+AN or NC+AC) × 2 (nation: United States or Japan) mixed design ANOVA on the willingness-to-maintain-friendship score revealed the significant three-way interaction, $F(1,99) = 17.86$, $p < 0.001$, partial $\eta^2 = 0.15$. Thus, we moved to the analyses which specifically focused on our concerns. Our central prediction was that apology would be more effective than compensation in Japan, whereas compensation would be more effective than apology in the United States. In other words, we hypothesized that (i) both Japanese and Americans would be more willing to reconcile with the offender in the AN condition than in the NN condition, but the apology effect would be larger for Japanese than Americans, (ii) both Japanese and Americans would be more willing to reconcile with the offender in the NC condition than in the NN condition, but the compensation effect would be larger for Americans than Japanese, and (iii) both Americans and Japanese would be more willing to reconcile with the offender in

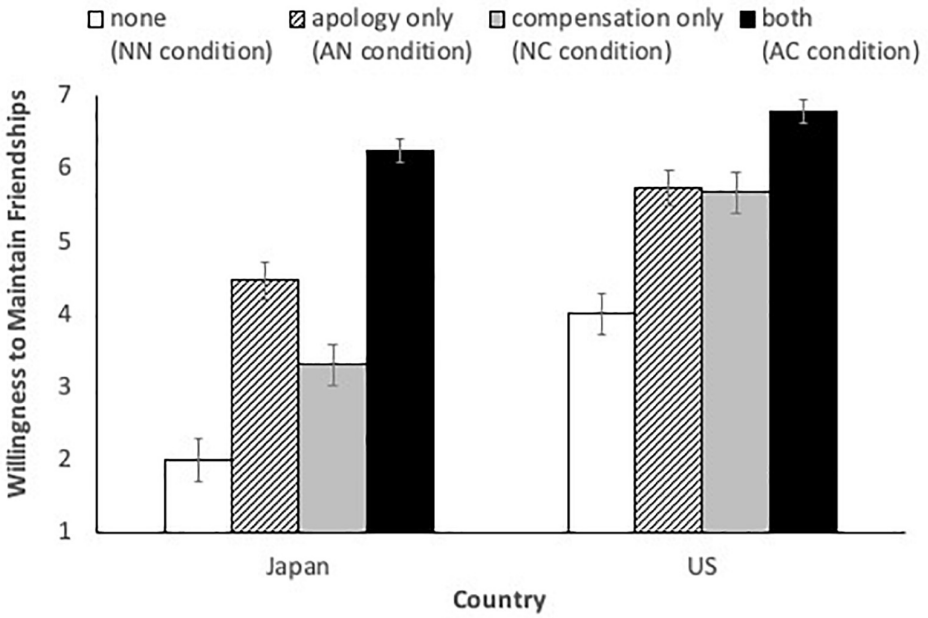

FIGURE 1 | The means and 95% confidence intervals (95% CI) of willingness to maintain friendships in each condition (Study 1). Error bars represent 95% CIs.

the AC condition than in the NN condition, and the size of the effect would not differ between United States and Japan[1].

To test the first hypothesis regarding the role of apology, we conducted a 2 (apology: NN or AN) × 2 (nation: United States or Japan) mixed design ANOVA on the willingness-to-maintain-friendship score (**Figure 1**; white vs. diagonal bars). As expected, both Americans and Japanese were more willing to reconcile with the apologizing offender than non-apologizing offender, $F(1,99) = 474.35$, $p < 0.001$, partial $\eta^2 = 0.83$. More importantly, this effect of apology was qualified by the apology-nation interaction, indicating that the effectiveness of apology was stronger for Japanese than for Americans $t(49) = 18.50$, $p < 0.001$, $d = 2.64$ for Japanese and $t(50) = 12.45$, $p < 0.001$, $d = 1.69$ for Americans. In addition, although we did not predict, the main effect of nation was significant, $F(1,99) = 93.58$, $p < 0.001$, partial $\eta^2 = 0.49$, showing that Americans were generally more willing than Japanese to reconcile with offenders.

Next, we tested the second hypothesis regarding the role of compensation using a 2 (compensation: NN or NC) × 2 (nation: United States or Japan) mixed design ANOVA (**Figure 1**; white vs. gray bars). Again, as expected, the main effect of compensation was significant: Both Americans and Japanese were appeased by the offender's offering compensation, $F(1,99) = 209.86$, $p < 0.001$, partial $\eta^2 = 0.68$. However, the predicted interaction between compensation and nation remained marginally significant, although the effect of compensation was slightly stronger among Americans, $t(50) = 12.15$, $p < 0.001$, $d = 1.63$, than among Japanese $t(49) = 8.54$, $p < 0.001$, $d = 1.22$. In addition, the main effect of nation was again significant, $F(1,99) = 146.46$, $p < 0.001$, partial $\eta^2 = 0.60$.

Finally, we tested the third hypothesis by a 2 (apology: NN or AC) × 2 (nation: United States or Japan) mixed design ANOVA (**Figure 1**; white vs. black bars). Again, as expected, the main effect of apology and compensation was significant: Both Americans and Japanese were appeased by the offender's apology with compensation, $F(1,99) = 891.86$, $p < 0.001$, partial $\eta^2 = 0.89$. Moreover, the main effect of nation was significant, $F(1,99) = 123.84$, $p < 0.001$, partial $\eta^2 = 0.56$. Unexpectedly, there was a significant interaction effect, $F(1,99) = 36.11$, $p < 0.001$, partial $\eta^2 = 0.27$. As seen in **Figure 1**, although both Japanese and American participants were more willing to reconcile with the offender who provided apology and compensation than the offender who did not provide any apology or compensation; $t(49) = 25.72$, $p < 0.001$, $d = 5.46$ (Japanese) and $t(50) = 15.33$, $p < 0.001$, $d = 3.08$ (Americans), the difference between the AC and NN conditions was smaller for Americans than for Japanese. This unexpected result may be due to the fact that Americans were far more willing to reconcile with those who did not provide any apology or compensation than were Japanese, $t(90.02) = 9.75$, $d = 1.94$. Thus, the observed interaction appears to be driven by the American tendency to forgive the offenders who did not provide any apology or compensation.

Overall, the obtained data fit our hypotheses quite well. Apology was a more effective means of relationship maintenance for Japanese compared to for Americans, whereas compensation was a more effective means for Americans than for Japanese.

It should be noted that, however, in this study, Americans were more likely to forgive offenders who did not conduct any reconciliatory acts. That is, the baseline was different between nations. This could be because Americans tend to maintain larger

[1]For the additional analysis to test the fitness of the overall model, the contrast analysis (Rosenthal et al., 2000) see **Supplementary Material**.

social networks in general than others (Oishi, 2010) or due to the American's tendency to be more positive than Japanese (Hamamura et al., 2009). Thus, it is possible that Americans judged offenses as being less severe and are more likely to remain friends even though offender's provided nothing. Importantly, the different level of the baseline could lead to not only the unexpected interaction effect (regarding the third hypothesis), but also the expected interaction effect of nation and apology (regarding the first hypothesis). Given that it possibly comes from a cultural difference, a within-nation analysis could be one way to address this ambiguity.

STUDY 2A: AN EXAMINATION OF THE INDIVIDUAL DIFFERENCE-THE CASE OF JAPAN

Study 1 showed the expected differences between Japanese (low mobility) and Americans (high mobility) in the effectiveness of apology and compensation. However, the cross-nation comparison is vulnerable to various alternative explanations, as Japan and the United States are different not just in residential mobility rates, but also other factors such as language, moral education, religion, and history. Also, we found the baseline difference which could be associated with cultural differences of psychological tendency. If our socio-ecological hypotheses are correct, we should find parallel differences within each nation. Thus, in Studies 2a (Japan) and 2b (United States), we investigated within-nation variations in the effectiveness of apology and compensation. The conceptual replication of Study 1 in each country excludes most of the alternative explanations, such as language, education, and religion. In addition, we did not measure residential mobility of our samples in Study 1. Therefore, strictly speaking, we cannot ascertain whether Japanese undergraduates in fact experienced less moves than American undergraduates. In Study 2, to confirm this assumption, we compared the number of moves that Japanese undergraduates (Study 2a) and American undergraduates (Study 2b) experienced.

Methods

Overview

In Study 2a, we tested (i) whether residentially stable Japanese would be appeased more by apology than residentially mobile Japanese and (ii) whether residentially mobile Japanese would be appeased more by compensation than residentially stable Japanese. To investigate these hypotheses, we analyzed the unpublished data which was collected for another purpose (Komiya et al., 2018)[2]. In the study, all participants read two scenarios, were exposed to either the offender's verbal apology or compensation for the scenarios (thus, unlike in Study 1, conciliatory act was manipulated as a between-participants factor), and reported the willingness to remain friends with the offender. We tested the model in which the willingness to remain friends as the dependent variable and participants' move experience and the reconciliatory act condition as the primary predictor variables.

Participants

One hundred and eighty-five Japanese undergraduates at Kobe University (95 men, 89 women, one unknown) participated in our study in exchange for 500 Japanese yen (roughly 5 USD).

Procedure

Participants were invited to the laboratory and asked to fill out the questionnaires. The questionnaire included two scenarios: a Book Scenario and a Baseball Scenario (for details, see Komiya et al., 2018). The scenario order was counterbalanced.

Participants first read a scenario in which one of his/her friends caused a participant trouble. After each scenario, assuming that he/she had been the victim, participants rated to what extent they would want to remain friends with the offender on a six-point scale ranging from 1 (definitely not) to 6 (definitely). This rating was used as the baseline. The participants then read the scenarios in which they received either apology or compensation from the offender. Participants again rated how likely they were to remain friends with the offender on a six-point scale. Since the ratings across the two scenarios were correlated (r = 0.42 for the baseline; r = 0.53 for the target item), the scenario factor (a within-participant factor) was collapsed for the following analyses (i.e., each participant had a single baseline reconciliation score and a single target reconciliation score).

After finishing the rating, participants were asked to provide all of the residential moves they experienced. We counted the frequency of moves across cities when participants were between 5 and 18 years old (Oishi et al., 2007a). According to this criterion, 114 (62.3%) had never moved, 46 (25.1%) had moved once, 15 (8.2%) moved twice, and 8 (4.4%) moved three times (M_{move} = 0.6 times, SD = 0.82). Also, participants provided the information about the current residential status, choosing from living alone (n = 94), with family (n = 80), or other (e.g., with relatives, n = 7). Because the latter variable (i.e., residential status) may influence the estimated continuity of relationships, we also controlled for this factor. Four people failed to provide the moving and residence information, thus leaving us with 181 participants in the following analyses.

Results and Discussion

Incorporating the baseline rating, residential status ("with family or not" and "living others or not"), the number of moves, conciliatory acts (apology vs. compensation), and the number of moves × conciliatory acts interaction as independent variables, a multiple regression analysis was conducted on the reconciliation score (**Table 1**). Since the model included an interaction term, all variables were mean-centered. The entire model explained the 55% of the variance in the willingness-to-maintain-friendship score, $F(6,174) = 36.05$, $p < 0.001$, $R^2 = 0.55$. As shown in **Table 1**, the results showed a trend for the mobility × conciliatory

[2]Because this study was re-analysis using unpublished data which was conducted for another purpose (Komiya et al., 2018), there was another variation for each scenario (i.e., two versions of each scenario; see **Supplementary Material**). Since the variations did not significantly influence the effect of moving experiences on apology/compensation, we did not include this variation as an independent variable in the following analyses. This variation was not included in Study 2b.

TABLE 1 | The results of regression analysis (Study 2a).

Variables	*b* (*SE*)	β	*t*(174)	*p*	95% CI
Control variables					
Baseline	0.60(0.06)	0.51	10.07	**<0.001**	[0.49, 0.72]
Living with family	0.02(0.13)	0.10	0.19	0.849	[−0.22, 0.27]
Living with someone (not family)	0.71(0.32)	0.11	2.21	**0.029**	[0.07, 1.34]
Independent variables					
Conciliatory acts (apology = −1, compensation = 1)	−0.64(0.06)	−0.54	−10.55	**<0.001**	[−0.76, −0.52]
Number of moves	0.09(0.07)	0.06	1.15	0.252	[−0.06, 0.23]
Moves × conciliatory acts	0.13(0.07)	0.09	1.80	0.073	[−0.01, 0.28]

The bold values mean statistical significance at 5% level.

acts interaction. Simple slope tests revealed that whereas there was no significant effect of moving experiences on the apology effectiveness, $b = -0.05$, $SE = 0.10$, $\beta = -0.03$, $t(174) = -0.44$, $p = 0.66$, 95% CI [−0.26, 0.17], partial $r^2 = 0.001$, there was an effect of moving experiences on the compensation effectiveness, $b = 0.22$, $SE = 0.10$, $\beta = 0.15$, $t(174) = 2.18$, $p = 0.030$, 95% CI [0.02, 0.42], partial $r^2 = 0.027$. That is, frequent movers were more willing to reconcile with the offenders who provided compensation than infrequent movers.

The results supported one of our hypotheses: frequent movers were more willing to reconcile with the offenders who provided compensation than infrequent movers were (cf. the second hypothesis in Study 1). However, infrequent movers were no more appeased by apology than frequent movers (cf. the first hypothesis in Study 1). This insignificant result might be attributable to the small variance in the number of moves in Japan. More than half of the participants (62.3%) in this study did not experience any moves. This relatively small variation might not be enough to find the individual difference of preference for apology. We addressed this issue in Study 2b.

STUDY 2B: AN EXAMINATION OF THE INDIVIDUAL DIFFERENCE—THE CASE OF UNITED STATES (TAKE 2)

Study 2b is a close replication of Study 2a in United States. where the variation in moving experiences among undergraduates would be larger (Schmitt, 2001). In addition, we included ethnicity, i.e., cultural background, as an independent variable in Study 2b. As discussed in Section "Introduction," some studies report the cross-national difference in the effectiveness of apology based on the endorsement of social harmony in the collectivistic cultural contexts (Fukuno and Ohbuchi, 1998; Ohbuchi et al., 2009). Also, more directly Fehr and Gelfand (2010) found that those who emphasized the independent self-construal (i.e., European Americans' cultural tradition) were appeased more by compensation, while those who emphasized relational or collective self-construal (i.e., other Americans' cultural tradition) were appeased more by other cost-free forms of apology. Even within the United States, those who have collectivistic cultural backgrounds may exhibit slightly different patterns than those who have individualistic cultural backgrounds. We thus tested whether ethnicity would affect the effectiveness of apology and compensation (i.e., the ethnicity × offender's behavior interaction) and whether it would interact with moving experiences (i.e., the ethnicity × offender behavior's × move interaction).

Methods

Participants

Two hundred and thirty-nine undergraduates at University of Virginia (100 men, 139 women) participated in our study in exchange for a partial course credit. Because international students ($n = 19$) and participants who refused to write down their moving experiences ($n = 14$) were excluded from the analyses below, the final sample size was 208 (128 Caucasian Americans, 46 Asian Americans, 13 African Americans, two Hispanic/Latinos, and 20 mixed-racial).

Procedure

The procedure was the same as Study 2a except that the variation of each scenario was not used (see **Supplementary Material**; see also footnote 2). Since the ratings were correlated across the scenarios ($r = 0.45$ for the baseline; $r = 0.49$ for the target item), they were averaged as the baseline score and the reconciliation score, respectively. One hundred and fourteen (54.8%) had never moved, 55 (26.4%) had moved once, 24 (11.5%) moved twice, and 15 (7.2%) moved three times and more (maximum: six times, $M_{move} = 0.78$ times, $SD = 1.16$). As expected, this sample experienced more moves than the sample of Study 2a, $t(373.23) = 2.34$, $p = 0.02$, $d = 0.23$ and had larger variation, $F(1,387) = 7.16$, $p = 0.008$ (Levene's test): The number of experiences of moves ranged from 0 to 3 in Study 2a (Japan), while it ranged from 0 to 6. Given the large variation and skewed distribution of residential mobility (Skewness = 1.98 and Kurtosis = 4.37), we applied the square-root transformation to the number of moves before conducting the reported analyses.

Results and Discussion

As in Study 2a, a multiple regression analysis was conducted on the reconciliation score, entering the baseline score (as a control variable), offender's behavior (apology vs. compensation), ethnicity (Caucasians vs. others), the number of residential moves, and the interaction terms across the variables (i.e., offender's behavior × moves,

moves × ethnicity, ethnicity × offender's behavior, offender's behavior × ethnicity × moves) into the equation. Since the model included the interaction terms, all variables were mean-centered. The entire model explained the 57% of the variance in the relationship maintenance score, $F(8,199) = 33.21$, $p < 0.001$, $R^2 = 0.57$ (**Table 2**). As shown in **Table 2**, most importantly, the mobility × offender's behavior interaction was significant. The simple slope tests showed that whereas moving experiences did not affect the effectiveness of apology, $b = -0.06$, $SE = 0.11$, $\beta = -0.04$, $t(199) = -0.56$, $p = 0.57$, 95% CI [−0.28, 0.15], partial $r^2 = 0.002$, it increased the effectiveness of compensation, $b = 0.24$, $SE = 0.10$, $\beta = 0.15$, $t(199) = 2.34$, $p = 0.020$, 95% CI [0.04, 0.44], partial $r^2 = 0.027$. That is, replicating Study 2a, frequent movers were more willing to reconcile with the offenders who provide compensation than infrequent movers, whereas there was no effect of residential mobility on the effectiveness of apology. This interaction was not qualified by ethnicity: The ethnicity × offender's behavior × mobility interaction was not significant (**Table 2**).

In addition, the regression analysis revealed a trend for the ethnicity × offender's behavior interaction (**Table 2**). Simple slope tests showed that there was no significant effect of ethnicity on the effectiveness of apology, $b = 0.03$, $SE = 0.08$, $\beta = 0.02$, $t(199) = 0.34$, $p = 0.74$, 95% CI [−0.23, 0.19], partial $r^2 = 0.001$, but a significant effect on the effectiveness of compensation, $b = -0.18$, $SE = 0.08$, $\beta = -0.16$, $t(199) = -2.36$, $p = 0.019$, 95% CI [−0.34, −0.02], partial $r^2 = 0.027$, showing that Caucasian Americans were more likely to reconcile with the offenders who provided compensation than were non-Caucasian participants.

Overall, Study 2b replicated the results of Study 2a: Frequent movers were more appeased by compensation than infrequent movers were. Also, the effect of residential mobility on compensation was not qualified by ethnicity. Even after controlling for the individual's ethnic background, residential mobility was associated with the effectiveness of compensation. On the other hand, infrequent movers were no more appeased by an apology than frequent movers, even though there was a relatively large variation in moving experiences. This might be due to the ambiguous nature of the scenario study. That is, different participants might have interpreted the offender's apology in different ways-some might have taken it as merely saying "sorry" (as we intended), whereas others might have assumed that the offender exhibited a full-fledged conciliatory gesture involving not only a verbal apology but other elements as well, such as an expression of remorse and acknowledgment of responsibility. This possibility is addressed in Study 3, in which we manipulated the apologetic message as a part of the experimental manipulation. We further discuss possible reasons for this result in Section "General Discussion."

STUDY 3: AN EXPERIMENTAL STUDY

Studies 1, 2a, and 2b provided strong support for our hypotheses regarding compensation and partial support for our hypotheses regarding verbal apology. Because these studies were correlational, the causal role of residential mobility was not established. To address this limitation, in Study 3, we directly manipulated the expected length of interactions and examined how people would evaluate apology and compensation. To this end, we employed a noisy version of the trust game (Berg et al., 1995; Ho, 2012 for the noisy-trust game) that was played by two players. Using this game, we manipulated the experimental analog of residential mobility, which was the key independent variable of Studies 1, 2a, and 2b; approximately half of participants expected to play the game with the same partner for multiple rounds (i.e., low mobility), while the other half expected frequent partner changes (i.e., high mobility). We expected that when participants played with the same partner for a relatively long period of time, they would be willing to stay with their apologizing partner (i.e., an offender who says "I'm sorry" but does not offer any compensation). On the other hand, when their partners changed frequently, people would be less willing to keep interacting with their offender unless the offender offered compensation.

Methods

Participants

Ninety-eight Japanese undergraduate and graduate students at Waseda University (60 men, 38 women, mean age = 20.53, range = 18–32) participated in this study. They were recruited through a flyer posted on a university's portal website. For each experimental session, 10–20 students were invited to the laboratory. Participants in three sessions ($n = 52$) were assigned to the high-mobility condition, whereas those in other three sessions ($n = 46$) were assigned to the low-mobility condition. Due to a computer program error, four participants in the high-mobility condition failed to finish the last round. We included the data of these participants in the analyses (removing their data did not affect any results).

Trade Game (Noisy Trust Game With Apology)

Participants played a series of noisy trust games with the apology option, which we called the "trade game" in the experiment. The program was developed by using the WebMatrix platform (Microsoft©). The game consisted of three sections: (1) the noisy trust game (surrounded by broken line in **Figure 2**), (2) the apology stage, and (3) ratings about the willingness to maintain the relationship. At the beginning of each round, participants were informed of whether they would play this round with the same partner as the one in the previous round.

Noisy trust game stage

In the noisy trust game, participants were randomly paired, assigned to either an investor or a responder role, and played a modified version of the trust game: Both the investor and the responder received an initial endowment of 30 JPY (approximately 0.3 USD). The investor first decided whether to entrust their initial endowment to the responder. If the investor chose the "trust" option, the responder received a tripled amount of the entrusted resource (90 JPY) and then decided whether to share the total resource of 120 JPY equally with the investor. This standard form of the trust game was modified to create the ambiguity of the responder intention: In the "noisy"

TABLE 2 | The results of regression analysis (Study 2b).

Variables	*b* (*SE*)	β	*t*(199)	*P*	95% CI
Control variables					
Baseline	0.72(0.05)	0.72	14.84	**<0.001**	[0.63, 0.82]
Independent variables					
Conciliatory acts (apology = −1, compensation = 1)	−0.12(0.05)	−0.12	−2.41	**0.017**	[−0.22, −0.02]
Ethnicity (Caucasian = −1, other ethnicity = 1)	−0.08(0.06)	−0.07	−1.42	0.157	[−0.19, 0.03]
Number of moves	0.09(0.07)	0.06	1.19	0.235	[−0.06, 0.23]
Move × conciliatory acts	0.15(0.07)	0.10	2.00	**0.046**	[0.002, 0.30]
Ethnicity × conciliatory acts	−0.10(0.06)	−0.09	−1.91	0.058	[−0.21, 0.003]
Move × ethnicity	0.08(0.08)	0.05	1.02	0.307	[−0.08, 0.24]
Move × ethnicity × conciliatory acts	0.06(0.08)	0.04	0.75	0.452	[−0.10, 0.22]

The bold values mean statistical significance at 5% level.

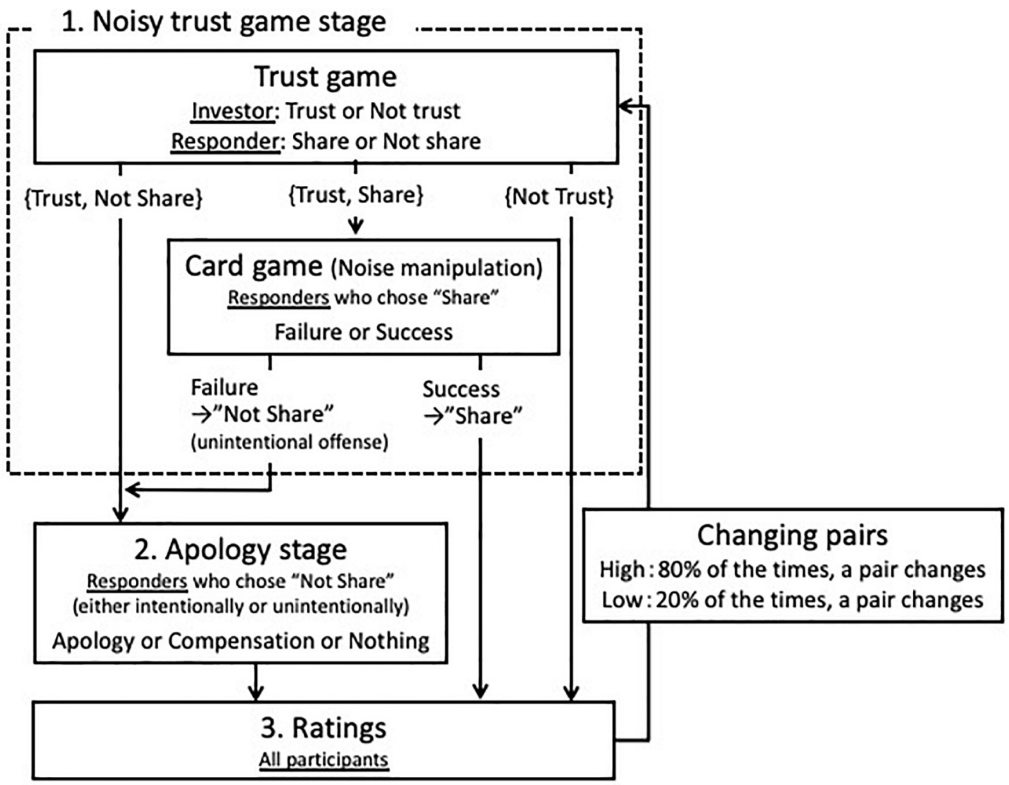

FIGURE 2 | A sequence of trade game. Further explanation is shown in **Supplementary Material**.

game, approximately a third of the cooperative choices of the responders were experimentally altered to the uncooperative choices in a random manner. Therefore, when the investors learned that their responders did not share the resource, they could not be certain about their responders' intention (i.e., the responders might have chosen the share option but their good intention might not have been effectuated). The detailed procedure is shown in **Supplementary Material**.

Apology stage

When the responder failed to share the resource either intentionally or unintentionally, the game went on to the apology stage. In this stage, the non-sharing responder was given three options: "apology," "compensation," and "doing nothing." When the responder chose the apology option, an apology message (i.e., I am sorry to have chosen "not to share") was sent to the partner. When the investor chose the compensation option, the investor's initial endowment was recovered and both players received 30 JPY. When the investor chose the "doing nothing" option, the responder took all of the resources, and the investor was simply informed that he/she would receive 0 JPY on this round.

After all the decisions had been made, participants were informed of the results of the trade game. The investor's choice (i.e., "to trust" or "not to trust"), the responder's choice corrected

by the result of card game (i.e., "to share" or "not to share"), and the responder's choice in the apology stage if applicable (i.e., "apology," "compensation," and "doing nothing") were explicitly shown on the investor's computer display. As for the responder's choice, the investor could not know whether the responder chose not to share intentionally (i.e., choosing not to share in the trust game) or accidentally (i.e., choosing a "failure" card in the card game). Both the investor and the responder knew about the card game and the possibility of noise in the game, and both parties were aware of the other player's knowledge of the noise.

Ratings

At the end of each round, participants rated (i) the likelihood of trusting the same partner on the next round if they would play the game as an investor and (ii) their preference for playing the game with the same partner on the next round. To assess how likely the intention to maintain the relationship (corresponding to maintaining friendships in Studies 1, 2a, and 2b), we averaged these two items ($r = 0.58$). This was our main dependent variable, *maintaining relationships*, for Study 3. As a manipulation check, they also answered their subjective assessment of the likelihood of being paired with the same partner on the next round. All these variables were measured on a seven-point scale, ranging from "1: disagree very much (or very unlikely)" to "7: agree very much (or very likely)."

Procedure

On arrival, participants were ushered to separate cubicles, each equipped with a computer. After completing the informed consent forms, they first read the rules of the trade game. They were then assured that they would receive a sum of money contingent on the score they would accumulate throughout the trade game. Participants then received ID numbers that enable them to anonymously interact with other participants. They were then explained how frequently interaction partners would change in the game. In the high-mobility condition, interaction partners changed 80% of the time after each round, whereas the likelihood was 20% in the low-mobility condition. Participants then played the 20 rounds of the trade game (participants were kept unaware of how many rounds they would play the game). After finishing the 20 rounds, participants completed a post-game questionnaire including some manipulation check items. They were then debriefed and paid their rewards contingent on their game scores.

Results and Discussion

Manipulation Check

We first checked the effectiveness of the partner mobility manipulation. Because each participant rated the likelihood every round, we averaged the ratings across 20 rounds and used the aggregated score in this analysis. A *t*-test indicated the manipulation was successful: Participants in the low-mobility condition were more likely to assess the interaction would continue in the next trial than participants in the high-mobility condition, $M_{low} = 4.90$ (SD = 1.07) vs. $M_{high} = 2.87$ (SD = 0.89), $t(96) = 10.28$, $p < 0.001$, $d = 2.06$.

Trust, Reciprocal Reaction, and Conciliatory Acts

First, we compared a general level of cooperation (i.e., entrusting one's endowment and sharing the entrusted resource) between the low- and the high-mobility conditions. For each participant, the trust rate was obtained by dividing "the number of trust decisions he/she made" by "the number of rounds in which he/she played the investor role." Similarly, the sharing rate was obtained by dividing "the number of sharing decisions he/she made" by "the number of rounds in which he/she had been trusted by his/her partner." The mean trust rate and sharing rate are shown in **Table 3**. Consistent with evolutionary and socio-ecological theorizations, low mobility fostered cooperation: Both the trust rate and sharing rate were significantly higher in the low-mobility condition than they were in the high-mobility condition, $t(96) = 4.99$, $p < 0.001$, $d = 1.00$ for trust and $t(92.23) = 3.87$, $p < 0.001$, $d = 0.78$ for sharing. As a result, participants in the low-mobility condition received a larger monetary reward amount than those in the high-mobility condition, $t(96) = 3.35$, $p = 0.001$, $d = 0.67$ (**Table 3**). These results were consistent with the assumptions of our hypothesis.

We then analyzed the frequency of different types of conciliatory acts. For each participant, the rates of apology, compensation, and do-nothing were computed by dividing "the number of each choice he/she made after unintentional offenses" by "the number of unintentional offenses he/she committed[3]." A series of *t*-tests showed that the mean apology, compensation, and do-nothing rates did not significantly differ between the high- and low-mobility conditions, ts < 1, ps > 0.77 (**Table 3**).

Hypothesis Testing: Reaction to Apology and Compensation

In this section, we analyzed participants' *maintaining relationships* after their partner's "not share" decision, that is, how much participants were willing to forgive their partner's transgression. Although all participants played 20 rounds of the trust games, the number of rounds in which their partner had chosen "not share" varied across participants. Moreover, each participant responded to variable numbers of apology, compensation, and do-nothing instances. Furthermore, the maintaining relationship scores were nested within individual, while the manipulation of mobility was at the level of between-individual[4]. Thus, we tested our hypothesis using Mplus 4.21's

[3]We excluded the intentional offenses from this analysis for two reasons. First, the options of "not to share" and "compensation" (namely, choosing compensation after intentional offenses) was completely irrational in this experiment, as the player would be better off choosing "share" initially (60 JPY), instead of making this decision (30 JPY). Accordingly, there were few such cases (only one in 229 intentional offenses). Second, choosing "apology" after "not to share" might have been a dishonest signal, as anyone was able to send this signal without incurring any cost. If these were deceptive signals, the apology-after-intentional-offense should have been more frequently used in the less cooperative condition (i.e., the high mobility condition) than in the more cooperative condition (i.e., the low mobility condition). Consistent with this prediction, the apology-after-intentional-offense rate was slightly higher in the high mobility condition (0.80, $SD = 0.30$) than in the low mobility condition (0.63, $SD = 0.39$), $t(55.09) = 1.94$, $p = 0.057$, $d = 0.48$. As we are interested in the more or less honest conciliatory acts, we excluded the cases of intentional offense.

[4]Some participants ($n = 13$) never entered the apology stage because they never chose "trust" or their partners always chose "share" and were not affected by the

TABLE 3 | The means (SDs) of cooperation rate, the monetary earning, and the ratio of conciliatory acts by the mobility condition.

	Choice (%)		Earnings	Conciliatory acts (%)		
Mobility	**Trust**	**Share**	**(JPY)**	**Apology**	**Compensation**	**Nothing**
Low	71.85 (29.84)	65.77 (33.92)	950.87 (216.88)	45.98 (40.61)	40.81 (41.17)	13.21 (30.05)
High	40.39 (32.53)	35.87 (41.38)	816.92 (178.78)	48.04 (45.22)	37.25 (45.08)	14.71 (34.30)

multilevel model (Muthén and Muthén, 2007). Specifically, the model was as follows:

Level 1 (within-individual)

$DV = b_0 + b_1{}^*\text{dummy1} + b_2{}^*\text{dummy2} + \text{error},$

where DV = intention to stay in the relationship with the current partner (forgiveness), dummy 1 was coded as 1 = "compensation"; 0 = "do nothing" or "apology," and dummy 2 was coded as 1 = "apology"; 0 = "do nothing" or "compensation." In this dummy coding, "do nothing" was the reference group, and the dummy variable 1 [dummy variable 2] tested whether a participant was more willing to stay with the current partner when the partner compensated [apologized] than when the partner did not do anything. The intercept from this model indicated the degree of willingness to stay in the relationship with the current partner when the current partner did not do anything (i.e., baseline intention to remain in the relationship).

Level 2 (between-individual) model was as follows:

$$b_0 \text{ (Level 1 intercept)} = r_{00} + r_{01}{}^*\text{mobility} + r_{02}{}^*\text{gender} + \text{error}$$

$$b_1 \text{ (compensation slope)} = r_{10} + r_{11}{}^*\text{mobility} + r_{12}{}^*\text{gender}$$

$$b_2 \text{ (apology slope)} = r_{20} + r_{21}{}^*\text{mobility} + r_{22}{}^*\text{gender},$$

where the mobility condition was coded as 0 = low mobility; 1 = high mobility, and gender was coded as 0 = female; 1 = male.

As expected, participants were more willing to stay in the relationship with the current partner when the partner compensated than did nothing, $r_{10} = 2.825$, $SE = 0.423$, $z = 6.681$, $p < 0.001$. They were also more willing to stay in the relationship when the partner apologized than did nothing, $r_{20} = 0.686$, $SE = 0.250$, $z = 2.744$, $p = 0.006$.

Unexpectedly, when the partner did not do anything, participants in the low mobility condition were more willing than those in the high mobility condition to stay in the relationship with the current partner, $r_{01} = -0.604$, $SE = 0.193$, $z = -3.133$, $p < 0.001$ (the estimated values of maintaining relationship after the partner's do-nothing choice were 3.07 and 2.46 controlling for gender in the low and high mobility conditions, respectively). Although we do not have a good explanation of this unexpected effect of mobility, it might have been due to the familiarity effect, which is an experimental artifact. As a necessary consequence of the experimental manipulation, participants in the low mobility condition interacted with the same partner more than those in the high mobility condition. Therefore, participants in the low mobility condition tended to rate their preference for an already-familiar partner more highly. Because of this possibility, we refrain from further interpreting this unexpected finding. There were no gender differences, $r_{02} = 0.469$, $SE = 0.394$, $z = 1.189$, $p = 0.234$.

Most central to our hypothesis, as predicted, participants in the high mobility condition were more willing than those in the low mobility condition to forgive the partner's transgression, when the partner compensated relative to when the partner did not, $r_{11} = 0.765$, $SE = 0.324$, $z = 2.363$, $p = 0.009$ (see right-hand bars in **Figure 3**). There were no gender differences in the effect of compensation, $r_{12} = -0.497$, $SE = 0.556$, $z = -0.894$, $p = 0.371$.

Consistent with Studies 2a and 2b (although contrary to our original hypotheses), there were no differences between the high and low mobility conditions in the relative effect of apology over do nothing, $r_{21} = -0.221$, $SE = 0.163$, $z = -1.355$, $p = 0.175$ (though the result was in the expected direction with the low mobility participants showing a slight tendency to stay in the relationship with an apology: see the left-side bars in **Figure 3**). There were no gender differences, $r_{22} = -0.539$, $SE = 0.351$, $z = -1.534$, $p = 0.125$ (women showing a slight tendency to stay in the relationship with an apology).

In sum, the results generally supported our hypotheses. Participants in the high-mobility condition were more likely than those in the low-mobility condition to forgive the current partner's transgression if compensation was given relative to non-compensation. Our findings suggest that the experimentally induced partner mobility shifted the preference for a reconciliatory behavior of an interaction partner. When people expect to switch partners often, they prefer a concrete compensation from the partner. When people expected to stay with the same partner, they showed a slight tendency toward preferring an apology. The non-significant effect of the low mobility on apology could partly be due to the contexts of the current experiment. In our experiment, low mobility participants did not expect to interact with the same partner for a long period of time—there still was a 20% chance of the partner changing in the next round. If the probability of the partner change had been much smaller and the length of interaction had been much longer (longer than the experimental session of one hour), we might have observed a stronger effect on apology. Related to this point, there are other limitations in the current study due to the experimental settings. For example, participants were not allowed to provide both verbal apology and compensation—an effective combination

"noise." Therefore, those participants' data were excluded from the multilevel-model analysis. According to Maas and Hox (2005) paper, Level 2 sample size of 100 produced unbiased estimates. Thus, our sample size (Level 2 = 85) was less likely to be sufficient to produce unbiased estimates. This issue should be addressed in the future.

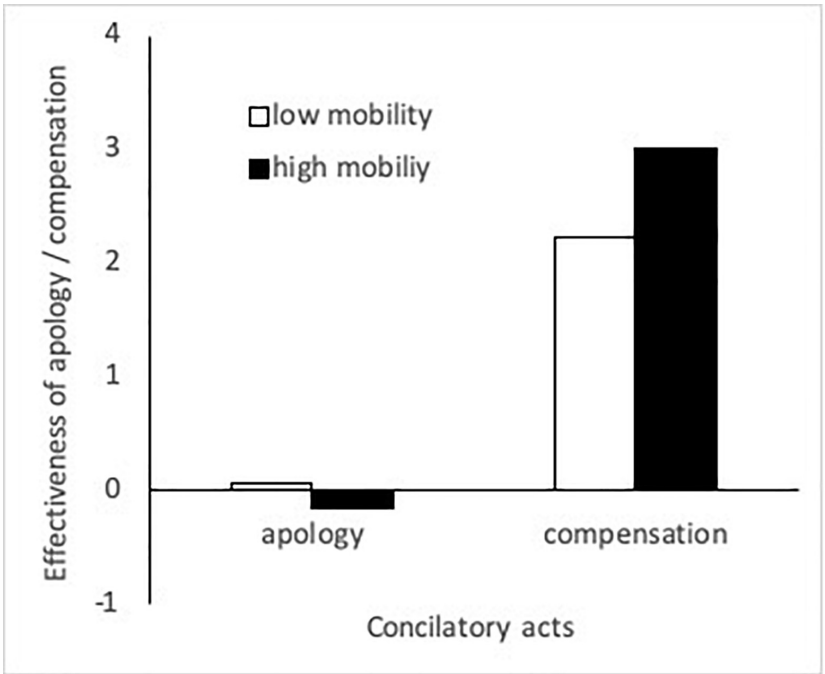

FIGURE 3 | The effectiveness of apology and compensation on forgiveness in the high- and low-mobility conditions, after controlling for gender (Study 3). The scores were calculated by subtracting the estimated intercepts (i.e., did nothing) from the estimated values of forgiveness after each reconciliation behavior (i.e., apology or compensation). The estimated values were calculated by entering the average score (0.61) into each gender term.

conciliatory gestures (Ohtsubo and Watanabe, 2009; Ohtsubo, 2020). This might have undermined the external validity. Moreover, since this experiment was conducted only in Japan, a different pattern might be shown in other cultural contexts such as the United States. It is important to examine these issues in the future.

A *post hoc* POWER ANALYSIS

Before moving on to the general discussion, we note that we conducted a series of *post hoc* power analyses of Studies 1 and 2 (we did not conduct a comparable *post hoc* power analysis for Study 3 due to its complicated design; see also footnote 4 for a discussion of the stability of the findings). Our primary findings were that residential mobility boosts the effectiveness of compensation, whereas it impairs the effectiveness of verbal apology. As reported in each section, for compensation, the effect size ranged from small to medium (i.e., partial $\eta^2 = 0.03$ [$f = 0.18$] in Study 1, partial $r^2 = 0.027$ in Study 2a, and partial $r^2 = 0.027$ in Study 2b [simple slope tests]). As for apology, the effect sizes of mobility fluctuated across studies (i.e., partial $\eta^2 = 0.13$ [$f = 0.39$] in Study 1 vs. partial $r^2 = 0.001$ and 0.002 in Studies 2a and 2b). We used G*power 3.1 to obtain *post hoc* power on the basis of the observed effect sizes and sample sizes (Faul et al., 2009). The estimated powers were the following: 1.00 in Study 1, 0.61 in Study 2a, and 0.67 in Study 2b for the mobility-compensation effectiveness association; and 1.00 in Study 1, 0.07 in Study 2a, and 0.10 in Study 2b for the mobility-apology effectiveness association. These *post hoc* power analyses imply that we did not have sufficient sample sizes in each study. Future studies should address this issue.

GENERAL DISCUSSION

The purpose of the present study was to test the socio-ecological hypothesis of reconciliatory tactics: apology is more likely to lead to reconciliation in a residentially stable context, whereas compensation is more likely to lead to reconciliation in a residentially mobile context. Evolutionary psychologists have investigated the reconciliatory processes assuming that its function is to preserve valuable relationships (McCullough, 2008; McCullough et al., 2014; Ohtsubo and Yagi, 2015). From this perspective, the present study demonstrated how socio-ecological constraints could influence the value of a relationship and the effectiveness of reconciliatory behaviors. Specifically, we predicted that the effect of apology would be larger for people in residentially stable environments than for people in residentially mobile environments, while the effect of compensation would be larger for people in residentially mobile environments than for people in residentially stable environments. Four studies, each employed different conceptualization of mobility, partly confirmed the prediction. Study 1 (cross-national comparison) showed that apologies were received more favorably in Japan (i.e., a less mobile country) than in the United States (i.e., a highly mobile country), while compensation was received more favorably in the United States

than in Japan. An offense was more likely to be forgiven in Japan than in the United States if the offender offered an apology, whereas an offense was more likely to be forgiven in the United States than in Japan if the offender offered a compensation. Studies 2a and 2b (within-country comparison) showed that compensation was more effective to appease those who had experienced more moves than those who had experienced less moves, though there was no significant effect of mobility on the effectiveness of apology. Experimentally manipulating mobility in the laboratory, Study 3 showed that mobility (i.e., frequent partner change) undermined the overall cooperativeness in transient "societies" and increased victims' demands for compensation. Again, Study 3 failed to find the effect of residential mobility on apology.

The Socio-Ecological Hypothesis of Reconciliation

Evolutionary psychologists have recently suggested that reconciliation occurs because breaking up valuable relationships invites more cost than preserving them (McCullough, 2008; Burnette et al., 2012; McCullough et al., 2014; Ohtsubo and Yagi, 2015; Smith et al., 2020). When the relationship is valuable and the exploitation risk is low, people engage in reconciliation for the benefit it affords them. From this perspective, previous studies have examined how each relationship value or individual act affects the occurrence of reconciliation, and successfully provided empirical evidence supporting their hypotheses.

In addition to each individual or relationship characteristic, the present study suggests that the reconciliation process is also constrained by the social ecology surrounding individuals. Specifically, in residentially stable environments, it is more adaptive for people to take a longer time-perspective and to let some mishaps go in order to preserve good relationships (Hruschka and Henrick, 2006). On the other hand, in mobile environments, the cost of quitting the current relationship is relatively low, and thus people may apply a more stringent strategy—to quit the current relationship unless the partner provides a costly, credible signal of reconciliation (i.e., compensation). Our findings provide empirical evidence supporting at least the latter prediction; residential mobility could influence the effectiveness of compensation.

This socio-ecological framework is important because it means that the societal differences in reconciliation styles can be unpacked by a more objective, measurable socio-ecological factor than subjective psychological values (Oishi and Graham, 2010; Oishi, 2014). In the present study, we found a key to explain why compensation is more prevalent in the United States, which is one of the most residentially mobile countries, compared to Japan, which is a residentially stable country (Study 1). The difference in the prevalence of compensation is not attributable to culture, because the individual differences in residential moves (Studies 2a and 2b) and experimental manipulation (Study 3) influenced the preference for compensation. These results contradict explanations appealing to culturally shared values/norms, but rather are consistent with the socio-ecological explanation that emphasizes more objective environmental parameters.

In addition, it is noteworthy that the socio-ecological perspective allows us to directly test the environment-individual interaction. In Study 3, we created high-mobility vs. low-mobility "societies" in a laboratory, and examined how individuals behave in each. In particular, we assessed not only participants' reactions to apology and compensation but also their cooperativeness and reconciliatory tactics. Study 3 suggests that the environmental variable may affect each of these elements, which are also mutually interlocked in a given society. Such dynamics between individuals and environments could not be examined without the socio-ecological perspective. We note that the importance of ecological factors has not been neglected in evolutionary psychology.

In sum, a distinctive feature of this approach was a multi-level demonstration of the effect of mobility and the combination of correlational and experimental approaches to test it. As a result, the present research succeeded in demonstrating that a socio-ecological factor (i.e., mobility) could explain both cross-national differences and individual differences in reconciliatory tactics, confirming the external validity of the effect of mobility on reconciliatory tactics.

Effectiveness of Compensation in High-Mobility Environments

The present research provided clear evidence supporting the relationship between residential mobility and the effectiveness of compensation. In Study 1 and Studies 2a and 2b, residentially mobile people (i.e., Americans and frequent movers) were more likely to be appeased by compensation than less mobile people (i.e., Japanese and less frequent movers). Study 3 also showed that the residentially mobile situations forced people to be more forgiving of the offenders who provided compensation than the residentially stable situations. Overall, all four investigations which examined societal, individual, and situational differences supported our hypothesis that compensation is a more effective way to promote reconciliation in high-mobility environments.

Although the four studies confirmed our hypothesis, the reason why compensation is effective is still unclear. Compensation means two things for victims in mobile environments. First, as we have already noted, as it is a costly conciliatory act, it communicates the perpetrator's sincere intention to victims (Nakayachi and Watabe, 2005; Ohtsubo and Watanabe, 2009; Ohtsubo et al., 2018). In addition, as another possibility, compensation allows victims to immediately recoup their damage at least partially (Darley and Pittman, 2003; Desmet et al., 2011).

Both of the above two aspects of compensation can be important for victims in mobile environments. First, as we saw in Study 3, general cooperation rate tends to be low in mobile environments. Therefore, people in mobile environments must be cautious in assessing credibility of a transgressor's reconciliatory signals. As a result, they may come to prefer more credible signals (e.g., compensation) than less credible signals (e.g., merely saying "I am sorry"). Consistent with this thesis, recent studies (Yamada et al., 2017; Komiya et al., 2019) have uncovered that even outside the context of reconciliation,

people in mobile environments (e.g., United States) tend to send costly signals of commitment within intimate relationships (e.g., romantic gifts) than those is relatively stable environments (e.g., Japan). Second, in highly mobile societies, people may develop a less intimate form of relationship (i.e., exchange relation) with many short-term partners. In exchange relationships, people tend to use a shorter time perspective (Lydon et al., 1997). If the victim cannot expect a long-lasting relationship with his/her perpetrator, it is wise for him/her to ask the perpetrator to provide compensation as soon as possible.

Since this was the first study to examine the effect of mobility on effectiveness of compensation, it is still unclear which aspect of compensation (or joint presence of the two aspects) is more important to account for the observed effect. Although these two factors seem to be deeply intertwined, it may be possible to experimentally separate them. Future studies must disentangle these two accounts of the compensation effect.

Effectiveness of Apology in Low-Mobility Environments

We predicted that people in stable environments would respond more favorably to a non-costly form of apology than those in less stable environments. In residentially stable environments, established relationships can be considered as valuable commodities because it is difficult and costly to cultivate new relationships. Therefore, victims are better off staying in the established relationships with a transgressor (and seeing what he/she will do next) than immediately withdrawing from the relationship. This prediction was partly supported. A cross-national comparison (Study 1) showed apologies were more effective in maintaining relationships in a residentially stable country (i.e., Japan) than in a less residentially stable country (i.e., United States). However, this pattern failed to reach the conventional level of statistical significance in an experimental study (Study 3). The comparable pattern was not found in a within-nation comparison (Studies 2a and 2b). The effectiveness of apology did not depend on the number of moves participants experienced.

The simplest explanation might be culture (here defined as "explicit and implicit patterns of historically derived and selected ideas and their embodiment in institutions, practices, and artifacts" Adams and Markus, 2004, p. 341). That is; relationship concern might be shared among members of a given culture to a similar extent, and might not vary across individuals or contexts with different rates of residential mobility.

Or, apology's effectiveness might be based on social norms. We assumed that a verbal apology would be enough to signal sincerity and preserve relationships, because individuals in a stable community rarely betray each other and exploitation risk is estimated as being low. However, verbal apology might not unconditionally signal sincerity even in a stable community. In a stable community, if someone repeatedly exploits community members and offers perfunctory apologies, he/she will be sooner or later ostracized, whereas this is not the case in a mobile country due to the ease of finding new partners (Wang and Leung, 2010; Wang et al., 2011). It has been shown that such informal sanction against dishonesty serves to keep apparent cheap talk (e.g., merely saying "I am sorry") credible (Ohtsubo et al., 2018). Without such a social norm to enhance credibility of apologies, even residentially stable individuals might not forgive apologizing transgressors. In other words, the informal sanction system might be critical for the effectiveness of verbal apology especially in a stable community, lowering the risk of being exploited. Regardless of which explanation is valid (or other explanation is required), further studies are needed to explain why verbal apologies tended to be more favorably perceived in Japan than in United States.

Theoretical Implications

Culture and Reconciliatory Acts

Cross-national research has typically attributed the difference in the endorsement of reconciliatory acts to cultural differences. In East Asian countries such as Japan, reconciliatory acts were more highly favored than in Western countries such as the United States because they represent the concern for harmonious interpersonal relationships (Itoi et al., 1996; Hook et al., 2009; Ohbuchi et al., 2009). More directly, Fehr and Gelfand (2010) found that those who emphasized the independent self-construal were appeased more by compensation, while those who emphasized relational or collective self-construal were appeased more by other cost-free forms of apology. Their finding was consistent with the findings of Studies 1 and 2b in the present research. Especially, Study 2b showed that Caucasian Americans evaluated compensation more favorably than non-Caucasian Americans (mostly Asian Americans) irrespective of individual residential mobility, confirming that culture plays an important role on determining which type of conciliatory acts is effective in reconciliation.

In contrast, we found that at least a certain type of reconciliatory acts such as compensation could be better explained by a socio-ecological hypothesis rather than by a cultural explanation. This is because cultural, individual, and situational differences of residential mobility are consistently associated with the variation of favoring compensation. This fact suggests the importance of social ecology to explain reconciliatory acts as well as cultural contexts.

More generally, unlike cultural psychological approach, the socio-ecological approach is applicable to within-culture individual differences and situational influences. These features are shared by another growing discipline called human behavioral ecology, which emphasizes human phenotypic plasticity and encompasses between-populations, within-population, and within-individual variations (Nettle et al., 2013). Nonetheless, as human behavioral ecology was pioneered by anthropologists, it tends to employ correlational studies and to not cover social psychological topics, such as reconciliation. The present research is thus unique to emphasize phenotypic plasticity in social psychological phenomena and to employ the experimentation to test the causal effect of a socio-ecological factor.

Communal Cooperation

As a socio-ecological research, this is the first study to examine effects of a socio-ecological factor, residential

mobility in particular, on reconciliatory tactics. Indeed, a large body of research on residential mobility-stability and cooperation has been accumulated since the 1970s. For example, early research has repeatedly shown that rural residents are more helpful than urban residents (Milgram, 1970; Korte and Kerr, 1975; Korte et al., 1975; Steblay, 1987 for review). More recently, Oishi et al. (2007b, 2009) found that residential stability promotes pro-community actions. Lun et al. (2012) further reported that non-movers prefer individuals who selectively cooperate with in-group members to unconditional cooperators, whereas this is not the case with frequent movers.

In a sense, the present research is positioned as a logical extension of these findings. The high level of cooperation in residentially stable societies fosters a social norm of unconditional forgiveness. On the other hand, the relatively low level of cooperation in residentially mobile societies requires a costly act of reconciliation. The present study demonstrated socio-ecological differences in reconciliation tactics as a consequence of communal cooperation and contributed to developing a more elaborated model of communal cooperation.

Limitations and Future Directions

Although the present study is the first study to examine the socio-ecological hypothesis of reconciliatory tactics, there are several limitations. First, the present study fully supported the hypothesis about compensation, but failed to support the hypothesis about apology. As we have already discussed, the lack of social norms which support informal sanction system might attenuate the influence of residential mobility on the effectiveness of apology. Future studies can confirm this prediction by manipulating the chance to develop social norms, such as enabling people to observe other people's behaviors. This examination would clear whether the cultural-value explanation (collectivism) or the socio-ecological explanation (informal sanction system) or both is important to explain the difference of reconciliation at the societal level.

Second, though it is not our main concern, we found unexpected patterns for the baseline. Specifically, Americans (i.e., people living in a high-mobility environment) were more likely than Japanese (i.e., people living in a low-mobility environment) to maintain relationships with offenders who provided no conciliatory acts in Study 1, whereas participants under the low mobility condition reported greater willingness to maintain relationships with the same do-nothing partner than participants under the high mobility condition (Study 3). Although possible reasons why we obtained these patterns were discussed in each section, they remain speculation. It would be promising to investigate which factors determine the level of forgiveness in each socio-ecological environment.

Third, we spotted another seemingly contradictory pattern. Irrespective of the level of mobility, offenders in Study 3 showed no clear preferences for any particular reconciliatory tactics. Combined with the attenuated effect of mobility on victims' preferences for apology, this null effect suggests that the victims' preferences for compensation under highly mobile environments might have the rein on the extant cultural differences. Regardless of the mobility of the environments, perpetrators might first attempt to see their victims' responses by offering non-costly apologies. In a mobile environment, as the victims are highly demanding, the perpetrators may eventually learn that only compensation would work. On the other hand, in a stable environment, the perpetrator might learn that a non-costly apology would work as well as compensation (i.e., a more costly form). If this is the case, the only required psychological mechanism is the victim's preference for compensation in mobile environments. Although the scope of the present study did not encompass perpetrators' behavioral tendencies or relevant social norms, in future studies, it will be worthwhile to investigate these aspects by modifying the present study.

Finally, there are some measurement issues. First, the present study used a single-item or two-items to measure the reconciliatory tendency, which might lower the validity and the reliability. Thus, it would be desirable to replicate the present findings using a multiple-item measure of reconciliation. In addition, we admit that willingness to maintain the relationship is not the same as forgiveness, which is the theme of this special issue. Although, as we argued in the introduction section (especially section "Evolutionary Approach to Reconciliation and Forgiveness"), we believe that willingness to maintain the relationship is closely connected with forgiveness, future research needs to include forgiveness measures to directly examine the conceptual relationship between forgiveness and willingness to maintain the relationship.

CONCLUSION

The present research shows that reconciliatory tactics, apology and compensation, can be constrained by socio-ecological factors such as residential mobility. Evolutionary psychology has accumulated a massive body of work on various social behaviors (e.g., emotion recognition, mate selection), including reconciliatory tactics. At this point, however, the findings from evolutionary psychology have not investigated the ecological influence on reconciliation. Through investigation of societal, individual, and situational differences, the current research provides empirical evidence supporting that residential mobility fosters the preference for compensation. Although the present findings showed that residential mobility at an individual level did not influence the effectiveness of apology, its asymmetry suggests a new possibility that the effectiveness of apology could be based on social or cultural norms. More generally, the current research demonstrates that the socio-ecological approach presents a promising empirical and theoretical framework through which psychological scientists can integrate divergent findings from evolutionary psychology, cultural psychology, and beyond.

DATA AVAILABILITY STATEMENT

The datasets for this study can be found in the OSF: https://osf.io/g8cux/.

AUTHOR CONTRIBUTIONS

AK, HO, and MW contributed conception and design of the study. AK, HO, MW (Study 1 and Study 3), and YO (Study 2a) were involved in data collection in Japan. AK, YM (Study 1), and SO (Study 2b) collected data in the United States. AK and SO performed the statistical analysis. AK wrote the first draft of the manuscript. YO and SO wrote the sections of the manuscript. All authors contributed to manuscript revision and read and approved the submitted version.

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SUPPLEMENTARY MATERIAL

The Supplementary Material for this article can be found online at: https://www.frontiersin.org/articles/10.3389/fpsyg.2020.01761/full#supplementary-material

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Exploring the Psychological Processes That Underlie Interpersonal Forgiveness: Replication and Extension of the Model of Motivated Interpersonal Forgiveness

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When, why, and how does interpersonal forgiveness occur? These questions guided recent research that compared the relative abilities of empathy versus motivated reasoning models to account for the influence of relationship closeness on interpersonal forgiveness. Consistent support was provided for the Model of Motivated Interpersonal Forgiveness. This model hypothesizes that, following relationship transgressions, relationship closeness leads to a desire to maintain a relationship. Desire to maintain a relationship leads to motivated reasoning. And motivated reasoning fosters interpersonal forgiveness. The goal of the present research was to examine two concerns that emerged from the initial support for the Model of Motivated Interpersonal Forgiveness. First, were the measures of motivated reasoning and interpersonal forgiveness conflated, thus reducing the potential for empathy to account for interpersonal forgiveness? Second, did the analytic estimation used reduce the power to detect the mediational role of empathy? The present research examined these questions. When motivated reasoning was measured by thought listings (in addition to the original questionnaire items) and when the analytic estimation provided greater power, the Model of Motivated Interpersonal Forgiveness was replicated.

Keywords: forgiveness, motivated reasoning, empathy, relationship closeness, Model of Motivated Interpersonal Forgiveness

INTRODUCTION

We are a social species, surrounded by and connected to others: relationships give our lives meaning and sustenance (Aristotle. [350 BCE], 2009; Clark and Grote, 2013; Aronson and Aronson, 2018; Murray and Holmes, 2011). As humans, we are bound at some point to slight, disappoint, hurt, and even betray the people in our lives; be they family, close friends, or acquaintances (e.g.,

Rusbult et al., 1991; Fincham et al., 2004; Keiningham et al., 2010). And yet, these relationships typically endure, continuing past such transgressions. One important way they do so is through the power of forgiveness.

But what leads to forgiveness? Is it the result of one's ability to understand and experience the feelings of others? Or does it emerge instead from the story that we construct by which to understand the offense? More specifically, what are the psychological processes that underlie, and give rise to, interpersonal forgiveness? The goal of this article is to deepen our understanding of these processes by more thoroughly testing the recently proposed (and empirically supported) Model of Motivated Interpersonal Forgiveness (Donovan and Priester, 2017) in comparison to the empathy model of interpersonal forgiveness (McCullough et al., 1997, 1998).

The Model of Motivated Interpersonal Forgiveness was advanced to understand when, why, and how interpersonal forgiveness unfolds. In brief, the Model of Motivated Interpersonal Forgiveness hypothesizes a sequential mediation model. Interpersonal forgiveness occurs when one feels close to a transgressor because such closeness leads to a desire to maintain the relationship, which leads to motivated reasoning. And it is motivated reasoning that fosters forgiveness. In this article, we provide an explanation and review evidence in support of the Model of Motivated Interpersonal Forgiveness, examine two concerns stemming from the Donovan and Priester (2017) studies, and report the results of an empirical study that explores these questions.

THE SCIENTIFIC STUDY OF INTERPERSONAL FORGIVENESS

Prior to the 1990s, the majority of published work on forgiveness was within the domains of religion, philosophy, and psychiatry. Thanks to the seminal work of the pioneering researchers Michael McCullough, Carol Rusbult, and Everett Worthington (among others), interpersonal forgiveness came into prominence as a topic of scientific study and has grown since (e.g., Rusbult et al., 1991; McCullough et al., 1997, 1998, 2013). For example, a search on the Web of Science reveals that prior to 1990 there were fewer than 125 articles published that touched upon forgiveness. Since 1991, more than 5,000 such articles have been published[1].

The psychological research on interpersonal forgiveness has generally fallen within one of two theoretical perspectives. While both perspectives posit the critical importance of relationship closeness in forgiveness, they differ as to the hypothesized process that underlies the influence of relationship closeness on forgiveness. The more dominant perspective conceptualizes interpersonal forgiveness as the result of an individual's empathy for the person who transgressed (McCullough et al., 1997, 1998). The other perspective conceptualizes forgiveness to be the result of the story that one constructs to make sense of a transgression, a process referred to as motivated reasoning (Donovan and Priester, 2017).

[1]Web of science search on December 30, 2019 with topic equal to forgiveness.

ANTECEDENTS OF INTERPERSONAL FORGIVENESS

Relationship Closeness

What is known from the literature on forgiveness? Relationship closeness matters! Relationship closeness, in its various conceptualizations and operationalizations, is the most robust and frequently explored antecedent of interpersonal forgiveness (Fehr et al., 2010). The more committed (e.g., Finkel et al., 2002), satisfied (e.g., Allemand et al., 2007), trusting (e.g., Rempel et al., 2001), and connected (e.g., McCullough et al., 1998) a relationship, the more likely that one is to forgive a transgression by that partner. But what underlies relationship closeness's influence on forgiveness? This is the question about which the two theoretical perspectives differ.

Empathy

Beginning in the 1990s, empathy came to be perceived as a critical psychological component in interpersonal relationships. Empathy was implicated in a variety of prosocial behaviors (e.g., Eisenberg and Miller, 1987; Batson, 1990, 1991; Eisenberg and Fabes, 1990), as well as relationship well-being (e.g., Davis and Oathout, 1987; Rusbult et al., 1991). Empathy has been defined in a number of ways (Kunyk and Olson, 2001; Cuff et al., 2016), but all rely upon the notion that empathy is an emotion toward another, typically associated with such feelings as sympathy, compassion, and tenderness (McCullough et al., 1997).

One of the first and arguably most influential programs of research to explore interpersonal forgiveness was developed by McCullough and Worthington (1994) and McCullough et al. (1997, 1998). This model posits that interpersonal forgiveness comes about because of empathy for the transgressor: The more one feels empathy for another, the more one is likely to forgive. Indeed, empathy is inextricably linked to forgiveness in this model, in which interpersonal forgiveness is defined as an empathy-facilitated set of motivational changes (p. 321, McCullough et al., 1997). Indeed, empathy is hypothesized to be the most powerful antecedent of interpersonal forgiveness. It is hypothesized that although other variables (such as relationship closeness and motivated reasoning) may be associated with interpersonal forgiveness, "the associations of such variables with forgiving tend to be relatively small after controlling the indirect effects that they have on forgiving by means of their effects on empathy" (p. 1588, McCullough et al., 1998). In other words, empathy should mediate the influence of other constructs on interpersonal forgiveness. As such, empathy is conceptualized to be the most proximal mediator of interpersonal forgiveness (p. 1587, McCullough et al., 1998). Support for this model has been provided across many studies and articles, conducted both by McCullough et al. (1997, 1998) and others (Zechmeister and Romero, 2002; Paleari et al., 2005). This model is presented in **Figure 1A**.

Motivated Reasoning

At the most basic, Kunda (1990) argued that one's wish, desire, or preference can bias cognitive processes such that one's

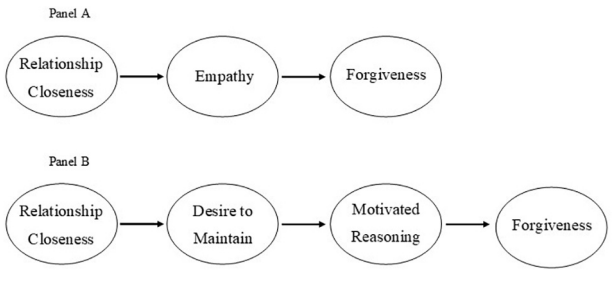

FIGURE 1 | The Empathy Model pf Int erpersonal Forgiveness **Panel A** and the Model of Motivated Interpersonal Forgiveness **Panel B**.

understanding of a person, event, or object are consistent with one's desire. The more one desires, the more one is likely to retrieve memories and/or construct beliefs that align with one's desired outcome. Thus, desire may lead to a distorted understanding of the nature, causes, and likelihood of various events. That is, one constructs a story that allows oneself to arrive at the desired outcome.

At the same time as the emergence of the empathy model of interpersonal forgiveness, several different research programs began to provide evidence for the importance of motivated reasoning in interpersonal relationships. One such program, spearheaded by Carol Rusbult and her students, examined the influence of relationship commitment on accommodation (how an individual responds to a partner's "breaches of good behavior," p. 53; Rusbult et al., 1991). This research found, in part, that relationship commitment influenced accommodation because of a person's explanation for a partner's behavior. For example, Finkel et al. (2002) found that one's attributions (i.e., motivated reasoning) following a transgression mediate the influence of relationship commitment on forgiveness (see also, Fehr et al., 2010). Independent of Rusbult et al. (1991) found robust evidence that one's interpretation of a partner's behavior is critical in relationship maintenance. For example, they found that individuals are able to cognitively transform a partner's negative actions into positive narratives. Murray and Holmes referred to this process as "positive illusions." Positive illusions lead to greater relationship resilience, which in turn leads to stronger positive illusions, thus creating a virtuous cycle[2].

Forgiveness

What is forgiveness? Although seemingly a basic question, there is not a single agreed upon definition of forgiveness (Worthington, 1998). The closest to such a definition would be that forgiveness occurs within the context of a relationship following a transgression (Fincham, 2000; Kearns and Fincham, 2004; Hannon et al., 2010) and is a process that takes place over time from which a "suite of prosocial changes" toward the transgressor emerges (491; McCullough et al., 2007; Fehr et al., 2010).

[2]Other research has found evidence consistent with the notion that motivated reasoning as instantiated by perception of a transgressor mediates forgiveness (e.g., Hook et al., 2015).

These changes are often defined in terms of revenge and avoidance (McCullough et al., 2007)[3]. That is, forgiveness is evidenced by reduced feelings of revenge and/or avoidance. Of note is that researchers typically include a measure of an individual's own understanding of forgiveness by including a question as to whether that person has forgiven the transgressor (e.g., Girard and Mullet, 1997; Berry et al., 2001; Fincham and Beach, 2002; Karremans et al., 2003, 2005; Exline et al., 2004; Zechmeister et al., 2004; Kearns and Fincham, 2005; Finkel et al., 2007; Green et al., 2008; Hannon et al., 2010).

THE MODEL OF MOTIVATED INTERPERSONAL FORGIVENESS

Given the independence of these two research streams, it is not surprising that few studies compared the two explanations for interpersonal forgiveness. And yet the question remained, did empathy and/or motivated reasoning underlie interpersonal forgiveness? To directly test this question, Donovan and Priester (2017) integrated an additional antecedent with motivated reasoning in order to derive the Model of Motivated Interpersonal Forgiveness. This additional antecedent is the desire to maintain the relationship.

Desire to Maintain the Relationship

In much of their research, Rusbult and colleagues used interpersonal commitment as their focal construct. In one study, Finkel et al. (2002) explored the bases of such commitment and their relative influence on forgiveness. They found that both psychological attachment, which represents the extent to which one feels connected to another (and to which we refer as relationship closeness), and intent to persist, which represents the extent to which one desires and intends to maintain the relationship (and to which we refer as desire to maintain the relationship), both significantly predicted forgiveness individually. However, simultaneous analyses provided evidence that the influence of relationship closeness on forgiveness was mediated by the desire to maintain the relationship.

Desire to maintain the relationship provides a potentially critical step in the interpersonal forgiveness process in that it may help elucidate *why* relationship closeness fosters interpersonal forgiveness. Relationship closeness may foster forgiveness precisely because of one's desire to maintain the relationship. If so, then desire to maintain the relationship may provide the underlying power of relationship closeness. However, although one may forgive because of one's desire to maintain the relationship, such forgiveness requires justification. Lack of such justification would lead to a threat to the self and feelings of discomfort (viz., cognitive dissonance; see, for example,

[3]Specifically, McCullough et al. (1997) define forgiveness: We define *interpersonal forgiving* as the set of motivational changes whereby one becomes (a) decreasingly motivated to retaliate against an offending relationship partner, (b) decreasingly motivated to maintain estrangement from the offender, and (c) increasingly motivated by conciliation and goodwill for the offender, despite the offender's hurtful actions.

Aronson, 1969). Fortunately, motivated reasoning can provide such justification. One can continue a transgressed relationship one desires to maintain without threat to the self because of the story that one constructs to understand the transgression. That is, motivated reasoning provides the *how* (or process) by which one can justify continuing a relationship with the person who has harmed us yet with whom we desire to maintain the relationship.

Desire to Maintain the Relationship and Motivated Reasoning as a Process Underlying Interpersonal Forgiveness

Donovan and Priester (2017) integrated the desire to maintain the relationship and motivated reasoning to arrive at the Model of Motivated Interpersonal Forgiveness. This model hypothesizes that (a) relationship closeness leads to a desire to maintain the relationship, (b) desire to maintain the relationship leads to motivated reasoning, and (c) motivated reasoning leads to interpersonal forgiveness. Such a model addresses *when* (close interpersonal relationships), *why* (desire to maintain the relationship), and *how* (motivated reasoning) interpersonal forgiveness may emerge. This model is depicted in **Figure 1B**.

Empirical Support

Donovan and Priester (2017) examined the relative efficacy of the empathy model and the Model of Motivated Interpersonal Forgiveness across three studies. Two of the studies relied upon the individual's recollection of a specific transgression, and the third used a hypothetical scenario in which that person is let down by another. Studies 2 and 3 measured relationship closeness, empathy, desire to maintain the relationship, motivated reasoning, and forgiveness.

In order to test between the two perspectives, Donovan and Priester (2017) simultaneously estimated a combination of possible mediational paths by bootstrap OLS regression analyses (Hayes, 2013). The estimation allowed for the possibility that the influence of relationship closeness on forgiveness was mediated by (a) desire to maintain the relationship through motivated reasoning (representing the Model of Motivated Interpersonal Forgiveness), and/or (b) empathy (representing the empathy model of forgiveness). The specific ordering of the mediators allowed for empathy to serve as the most proximal mediator of forgiveness, as suggested by McCullough et al. (1998). This estimation allowed for one, both, or neither of the paths to emerge as significant. The estimation is presented in **Figure 2**. The paths relevant to the two models are depicted by the arrows among the key variables. Of note, however, is that all possible paths (e.g., relationship closeness to desire to maintain the relationship to forgiveness) were simultaneously tested in this order.

Across all three studies, the results revealed that the Model of Motivated Interpersonal Forgiveness was able to significantly predict interpersonal forgiveness, whereas the empathy model of forgiveness was not. Specifically, the analyses revealed that the mediational path of relationship closeness → desire to maintain the relationship → motivated reasoning → forgiveness emerged as significant, whereas the other possible paths did not. None of the paths that included empathy emerged as significant when simultaneously estimated with the Model of Motivated Interpersonal Forgiveness[4]. These results provide support for the notion that the psychological processes underlying interpersonal forgiveness are better explained by the Model of Motivated Interpersonal Forgiveness than by an empathy model.

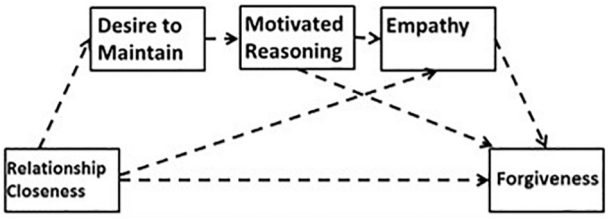

FIGURE 2 | Analytic estimation used in Donovan and Priester (2017).

This investigation also shed light on the nature of motivated reasoning. In the third study, a wide array of questions was used in order to capture motivated reasoning. When all of the questions were combined to create one measure, that measure emerged as the most proximal antecedent to forgiveness. Additional analyses revealed that the influence of this measure of motivated reasoning was driven by one's perception of the transgressor and one's expectation of future behavior.

REMAINING QUESTIONS

Motivated Reasoning and Forgiveness

Recall that Donovan and Priester (2017) found that motivated reasoning was the proximal influence on forgiveness. This proximal role is reflected in the intercorrelations among the different constructs with forgiveness. In all three studies, motivated reasoning is more closely associated with forgiveness than relationship closeness, desire to maintain the relationship, and empathy[5].

These correlations provide empirical support for motivated reasoning's mediational role. They also, however, raise the possibility that motivated reasoning and forgiveness are measures of a single, rather than two different, factors. This is an important point. If these measures are tapping into a single factor, motivated reasoning represents an aspect, rather than an antecedent, of forgiveness (see Fiedler et al., 2011). An inspection of the specific items used to measure motivated reasoning suggests that such an alternative explanation is possible. For example, one of the two motivated reasoning measures used in Study 3 was the extent to which one sees the transgressor in a positive light. It is possible that such perception is an aspect of forgiveness.

To summarize, an alternative explanation to the finding that motivated reasoning, rather than empathy, underlies forgiveness

[4]These paths included (a) relationship → empathy → forgiveness, (b) relationship → desire to maintain the relationship → empathy → forgiveness, (c) relationship → motivated reasoning → empathy → forgiveness, and (d) relationship → desire to maintain the relationship → motivated reasoning → empathy → forgiveness.

[5]The correlations between motivated reasoning and forgiveness range from $r = 0.67$ (study 1), $r = 0.89$ (study 2), to $r = 0.45$ (study 3).

is that the items used to measure motivated reasoning are capturing forgiveness. And as such, proximal mediation is an artifact of the items measuring one construct rather than two distinct constructs.

To best address this alternative explanation, it is ideal to utilize a divergent measure of motivated reasoning that differs sufficiently from the measure of forgiveness so as to provide convergent evidence for the proximal mediational role of motivated reasoning. Recall that motivated reasoning predicts that one's thoughts, feelings, and reactions are shaped by one's desire to maintain a relationship; the greater the desire, the more positive and/or less negative the thoughts, feelings, and reactions.

Motivated reasoning, then, is reflected in the valence (i.e., the positivity and/or negativity) of one's thoughts toward the transgressor and/or the transgression. As such, the valence of thoughts, feelings, and reactions provides a potentially divergent measure of motivated reasoning. That is, instead of (or in addition to) measuring such thoughts, feelings, and reactions through questionnaire items as is typically done, one could have participants provide their own thoughts, feelings, and reactions[6]. Motivated reasoning should be reflected in greater overall positivity and lower overall negativity of such thoughts, feelings, and reactions.

It is worth reflecting upon the use of thoughts as a measure of motivated reasoning. Kunda (1990) clearly conceptualized motivated reasoning as the result of (1) selective retrieval of memories and/or (2) the construction of beliefs. Underlying both of these processes are an individual's thoughts. As such, a measure of thoughts should reflect the nature of the retrieval and construction processes. And such a measure of thought is provided by the elicitation and measure of cognitive responses (henceforth referred to as thoughts; see Cacioppo et al., 1981). We are not the first to use thoughts as a measure of motivated reasoning (e.g., Harkness et al., 1985; Tetlock and Kim, 1987). Indeed, Murray and Holmes (1997) use such an approach in order to understand the motivated reasoning underlying close relationships.

Based on the conceptualization of and the past use of thoughts to assess motivated reasoning, we adopt such an approach in the present research in order to operationalize motivated reasoning with a measure that differs from the approach used in Donovan and Priester (2017). If such a divergent measure exhibits a similar pattern of proximal mediation, the concern that the results for motivated reasoning are due to it being part of the same construct as forgiveness is mitigated. And as such, support is provided for the influence of motivated reasoning on forgiveness.

In addition to providing a divergent measure, the use of thoughts as a measure of motivated reasoning provides an opportunity for an analysis of the valence of the thoughts. Motivated reasoning might operate by increasing the positive thoughts that one has in reaction to a transgression. Or alternatively, motivated reasoning might operate by decreasing the negative thoughts. Or it may operate by both decreasing negativity and increasing positivity. The use of thoughts to operationalize motivated reasoning allows for an examination of the nature of motivated reasoning in interpersonal forgiveness.

Analytic Estimation

Although of less concern, a question does exist regarding how to best estimate the two models. The estimation approach used in Donovan and Priester (2017) estimated all possible paths simultaneously. This decision was based in part on the exploratory nature of the research. The research was designed to provide an initial test of the Model of Motivated Interpersonal Forgiveness in addition to comparing its ability to account for interpersonal forgiveness to the empathy model. Since this was the first test between the models, it was possible that other paths might emerge as significant. For example, empathy might have mediated the influence of motivated reasoning on forgiveness, a possibility tested but not supported by the data.

One drawback of such an approach in which all possible paths are estimated, however, is that it potentially decreases the ability to detect mediational influences. That is, estimating nonessential paths can decrease the power to detect significance of the essential paths. Such a dilution of power may have contributed to the lack of support for the empathy model of forgiveness. In order to overcome this possibility, a more specific analytic approach was adopted herein, in which only the essential paths associated with each of the two perspectives were tested. This estimation is presented in **Figure 3**.

Inspection of the figure reveals it tests for the ability of the Model of Motivated Interpersonal Forgiveness and the empathy model without the addition of nonessential paths[7]. Given the importance of desire to maintain the relationship as the process that drives the effect of relationship closeness on forgiveness,

[6]We base our approach upon that used within the field of attitudes and persuasion. In these studies, the idiosyncratic cognitive responses of individuals are often assessed. Individuals are asked to write their thoughts and feelings toward an attitude object, after which participants code their own thoughts and feelings, typically as to whether the thoughts are positive, negative, or neutral (see Cacioppo and Petty, 1982).

[7]The specific paths not tested are as follows: relationship closeness → desire to maintain the relationship → forgiveness, relationship closeness → motivated reasoning → empathy → forgiveness, and relationship closeness → desire to maintain the relationship → motivated reasoning → empathy → forgiveness.

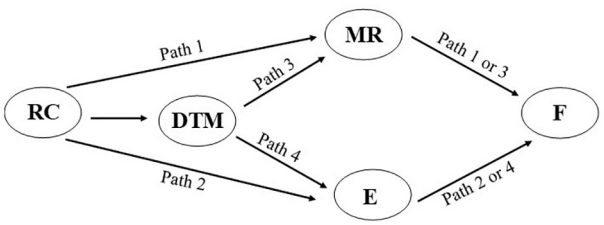

FIGURE 3 | Estimation model specifying the four possible mediational path; Relationship closeness - Motivated Reasoning → Forgiveness (path 1), Relationship closeness → Empathy → Forgiveness (path 2), Relationship closeness → Desire to maintain the Relationship → Motivated Reasoning → Forgiveness (path 3), Relationship closeness → Desire to maintain the Relationship → Empathy → Forgiveness (path 4). RC equals Relationship Closeness, DTM equals Desire to Maintain the Relationship, MR equals Motivated Reasoning, E equals Empathy, and F equals Forgiveness.

it is included as a possible path in the empathy model. As such, the analytic estimation used tests the ability of empathy to play a mediational role for both the influence of relationship closeness on forgiveness (path 2), as well as for the influence of desire to maintain the relationship on forgiveness (path 4). At the same time, the analytic estimation used tests the ability of motivated reasoning to play a mediational role for both the influence of relationship closeness on forgiveness (path 1), as well as for the influence of desire to maintain the relationship on forgiveness (path 3). Again, note that all four of these paths were tested in Donovan and Priester (2017), and only path 3 was found to be significant. However, the current, more focused test allows for greater power to detect the role of empathy in the forgiveness process.

To test these questions, we employed bootstrap OLS regression analyses using a customized mediational model (process v3.4, Hayes, 2018)[8]. The model allows for tests of four possible mediation paths (see **Figure 3**). The influence of relationship closeness on forgiveness could be mediated by (a) motivated reasoning absent desire to maintain the relationship (path 1), (b) empathy absent desire to maintain the relationship (path 2), (c) desire to maintain the relationship through motivated reasoning (path 3), and/or (d) desire to maintain the relationship through empathy (path 4). In this analysis, it is possible for more than one mediational path to emerge as significant. It is also possible for no mediational paths to emerge as significant.

STUDY

The present study was conducted in order to address two concerns. First, and of greatest relevance, are the findings of Donovan and Priester (2017) the result of the motivated reasoning items being conflated with forgiveness? To address this concern, the thoughts, feelings, and reactions during and following the transgression were used to operationalize motivated reasoning in addition to the questionnaire items used in Donovan and Priester (2017). This measure also allows the opportunity to examine whether motivated reasoning operates by reducing the negativity of the thoughts, feelings, and reactions and/or increasing the positivity. Second, and of less relevance, are the results of Donovan and Priester (2017) replicated when a more focused analytic estimation is used to test the relative ability of the two models to explain forgiveness?

Methods

Participants and Procedure

One hundred seven undergraduate students from a West Coast university participated in exchange for partial fulfillment of course credit[9]. Participants were instructed to recall an instance in which a person let them down. Specifically, participants read, "Sometimes people we know let us down. For this study, we would like you to remember a time that a person failed you. Please recall a specific incident when a person hurt and/or disappointed you. This incident can be anything. For example, your friend forgets about an activity you had planned or your significant other cheats on you." Participants then wrote the name of and relationship with the person. Participants provided a brief description of the incident. Participants then completed two thought-listing tasks and answered a series of questions designed to assess their relationship with the person, desire to maintain the relationship, motivated reasoning, empathy, and forgiveness[10]. This procedure follows that used by Donovan and Priester (2017), the only difference being the inclusion of the thought listing measure.

Independent and Mediating Variables

Relationship Closeness

Relationship closeness has been conceptualized and measured from different perspectives. Perhaps the most commonly used measure for relationship closeness is the Inclusion of the Self in Other Scale (IOS, described below, Aron et al., 1991). We use this measure in the present study. A second approach commonly used is to measure an individual's feelings of relationship quality and closeness [using measures such as commitment (Rusbult et al., 1991; Arriaga and Agnew, 2001; Tran and Simpson, 2009), loyalty (Fehr, 1988; Fehr and Harasymchuk, 2005), love (Byrne, 1997), and trust (e.g., Luchies et al., 2013)]. We collected and combined these four measures to create a measure of relationship feelings of quality and closeness. The strategy of using two such different measures of relationship closeness was to provide convergent evidence for the influence of relationship closeness. Analyses revealed that the results for the IOS and the second measure were statistically identical. As such, we combined the two measures in order to create an overall relationship closeness measure.

As done in Donovan and Priester (2017), pre-transgression relationship closeness was assessed by these two methods. The first approach utilized the Inclusion of the Other in Self scale (IOS; Aron et al., 1991). The IOS is a scale that comprised seven pairs of circles, which vary in the extent by which they overlap, from only the boundaries touching (equal to one) to complete overlap (equal to seven). Participants were instructed to indicate which pair of circles best represented their relationship. The second approach utilized four items designed to assess relationship feelings of relationship quality and closeness. These items were "I feel that I am committed to this person," "I consider myself to be highly loyal to this person," "I love this person," and "I trust this person." These four items used 11-point scales anchored with zero equal to "not at all" and 10 equal to "completely." The four were averaged to create a relationship closeness subscale (α = 0.91). The feelings of relationship quality and closeness

[8]To construct this estimation, the bmatrix was set to 1 1 1 1 1 0 1 0 1 1.

[9]Sample size was determined prior to data collection, and no additional data were collected following analyses. Sample size was based on the sample sizes used in Donovan and Priester (2017). Specifically, study 2 of Donovan and Priester collected data from 120 participants. We attempted to collect data from the same number.

[10]Other, nonfocal questions were also assessed. Of particular interest, we collected the tendency to forgive scale (Brown, 2003). Tendency to forgive was associated with greater forgiveness (b = 0.73, $F(1,105)$ = 7.9, p = 0.0058). However, it did not interact with any other variables and is thus not considered further.

measure and the IOS scale were standardized and averaged to create an overall relationship closeness measure (α = 0.83).

Desire to Maintain the Relationship

The three items used in Donovan and Priester (2017) were used to measure desire to maintain the relationship. These items were "How motivated were you to restore your relationship with this person?" "I would be really sad if I stopped spending time with this person," both anchored with zero equal to "not at all" and 10 equal to "completely"; and "I intend to continue interacting with this person," anchored with zero equal to "disagree" and 10 equal to "agree." These items were combined in order to create one measure (α = 0.91). Note that the three items reflect (1) motivational, (2) emotional, and (3) intentional components. Results using only the motivational measure provide statistically equivalent results to those obtained using all three.

Motivated Reasoning

Motivated reasoning was captured by two methods: thought listings and questionnaire items. For the first, participants listed and coded their own thoughts and feelings related to the transgression. For the second, participants answered motivated reasoning questionnaire items from Donovan and Priester (2017), study 3.

Thoughts

In order to elicit a broad profile of thoughts, participants completed two different thought-listing tasks. Each task presented the participants with the instructions at the top of the page, below which were 10 boxes. The first task instructed:

> Now, we would like you to take a minute to think about the time the person let you down. We want you to remember how you felt at the time of the incident. What were your thoughts when the person let you down? How did you react? Please answer the following questions:
>
> First, what were your thoughts and feelings when this happened? Please tell us all you can about the incident and how you felt when the incident happened. In each box below, please write one thought or feeling. So, if you have one reaction (thought or feeling), you would use one box. If you have three reactions, you would use three boxes. Use only as many boxes as reactions that you have. You don't need to use all the boxes. Don't worry about grammar or complete sentences. Just write enough that it makes sense.

The second task instructed:

> In the boxes below, please provide us with your reactions toward this incident. How did you feel about the person following the incident? How did you react? What did you do? Again, use as many boxes as you have reactions.

After writing their thoughts, participants coded each thought as to whether it was positive, negative, or neutral. To assess the extent to which motivated reasoning influenced forgiveness, two measures were constructed. The first examined the degree to which motivated reasoning buffered against negative interpretation of the incident. To do so, a measure was created by summing the negative thoughts from each thought-listing task. A second measure examined the degree to which motivated reasoning created a positive interpretation of the incident. To do so, a measure was created by summing the positive thoughts from each thought-listing task.

Motivated Reasoning Questionnaire Items

The two items used in Donovan and Priester (2017) were used to operationalize motivated reasoning[11]. These items were "I believe that the next time I interact with this person, they will live up to my expectations" and "I view this person in a positive light." Both items were measured on 11-point scales anchored with zero equal to "not at all" and 10 equal to "completely." These two items were averaged to create the motivated reasoning measure (α = 0.78).

Empathy

Empathy was measured using two items from the index of empathetic concern (Coke et al., 1978; Exline and Zell, 2009; Fehr et al., 2010): "I felt empathetic toward the person following the incident" and "I felt compassionate toward the person following the incident." Both items were assessed by 11-point scales, anchored with zero equal to "not at all" and 10 equal to "completely." These two items were averaged in order to create a measure of empathy (α = 0.80).

Dependent Variable

Forgiveness

Forgiveness was assessed by three items: "I have forgiven the person following the incident," "I want to avoid the person" (reverse coded), and "I want to take revenge on the person" (reverse coded). The three items were assessed by 11-point scales anchored with zero equal to "not at all" and 10 equal to "completely." The items were averaged to create a measure of forgiveness (α = 0.70)[12].

RESULTS

Univariate Statistics and Relationships Among Variables

The univariate statistics for each variable and the correlations among the variables are presented in **Table 1**. Of note is that the measures of skewness and kurtosis skewness reflect that the variables are normally distributed as they fall within the range of −1 and 1. This was not the case, however, for positive thoughts[13]. Upon the recommendation of a reviewer, the data for positive

[11] As was done in Study 3 of Donovan and Priester, an array of additional motivated reasoning items was collected. The results using a measure of motivated reasoning created by combining these items replicated the results of Donovan and Priester (2017) and were statistically equivalent to the results reported herein. As such, they are not discussed further.

[12] The results of using just the single-item measure and just the revenge/avoidance scale were statistically identical. That is, the results using either approach by itself produced results similar to each other, as well as to the results using the combined measure.

[13] For positive thoughts, the uncorrected univariate measures are mean = 0.67, SD = 1.27, skewness = 3.0943, and kurtosis = 12.6885.

TABLE 1 | Univariate statistics and correlations.

Item	Measures	Mean	Skewness	Kurtosis	1	2	3	4	5	6	7
1	Forgiveness	6.59	−0.63	−0.26	–						
2	Closeness	0.00	0.02	−0.95	0.48 [<0.0001]	–					
3	DTM	5.33	−0.25	−1.21	0.64 [<0.0001]	0.83 [<0.0001]	–				
4	MR Negative Thoughts	4.87	−0.03	0.12	−0.33 [0.0005]	−0.08 [0.43]	−0.21 [0.03]	–			
5	MR Positive Thoughts	0.67	3.09	12.69	0.1 [0.31]	−0.07 [0.5]	0.01 [0.88]	−0.3 [0.002]	–		
6	MR Questionnaire Items	5.30	−0.27	−0.91	0.72 [<0.0001]	0.69 [<0.0001]	0.79 [<0.0001]	−0.31 [0.0013]	0.1 [0.3262]	–	
7	Empathy	2.89	0.57	−0.14	0.22 [0.02]	0.31 [0.001]	0.28 0[.004]	−0.1 [0.29]	0.19 [0.05]	0.29 [0.003]	–

thoughts were corrected by removing three responses that were beyond two standard deviations (SDs) of the mean[14]. The results using the corrected positive measure are reported. Use of the uncorrected positive measure reveals a non-significant influence of positive thoughts on forgiveness.

Independent Predictors of Forgiveness

Forgiveness (F) was regressed on relationship closeness (RC), desire to maintain the relationship (DTM), thought negativity, thought positivity, motivated reasoning questionnaire items (MRQI), and empathy (E). Replicating prior empirical results, relationship closeness, desire to maintain the relationship, and empathy all significantly predicted forgiveness: $b = 1.48$, $F(106) = 30.60$, $p < 0.0001$ (RC); $b = 0.53$, $F(106) = 71.37$, $p < 0.0001$ (DTM); $b = 0.66$, $F(106) = 115.00$, $p < 0.0001$ (MRQI); $b = 0.25$, $F(106) = 5.66$, $p = 0.02$ (E). Analyses of the thought listing data revealed that both thought negativity ($b = -0.49$, $F(106) = 13.11$, $p = 0.0005$) and positivity ($b = 0.84$, $F(106) = 6.03$, $p = 0.0158$) significantly predicted forgiveness.

Model Analysis Strategy

Recall that the present study was conducted to replicate and extend the results of Donovan and Priester (2017). The first extension concerns the nature of motivated reasoning: Do the results extend to a divergent measure of motivated reasoning? The second extension concerns the nature of the estimation used to test the two models: Do the results extend to an estimation in which just the focal paths are estimated, or instead does empathy emerge as a significant mediator of forgiveness?

As explicated above, we employed bootstrap OLS regression analyses using a customized mediational model (process v3.4, Hayes, 2018)[15]. Such a model allows for the test of four possible mediation paths (**Figure 3**). The results of such an analysis produce an upper and lower confidence interval for each of the four possible mediational paths. Paths in which the confidence intervals do not include zero indicate that the path is significant. The confidence intervals for all possible paths are included in **Table 2**, and the results are depicted in **Figure 4**. For ease of representation, the significant paths are designated in bold in both the table and figure.

Thoughts

We conducted two analyses for thoughts as a potential mediator: one using thought positivity and one using thought negativity.

Motivated Reasoning Thought Negativity

The use of thought negativity as an operationalization of motivated reasoning replicated and extended past results. Specifically, the mediation path in which relationship closeness → desire to maintain the relationship → thought negativity → forgiveness (path 3) did not include zero (lower confidence interval = 0.06, upper confidence interval = 0.88), and as such, is significant. In contrast, none of the other three mediational paths is significant, in that their confidence intervals all include zero: path 1 (lower confidence interval = −0.83, upper confidence interval = 0.03), path 2 (lower confidence interval = −0.13, upper confidence interval = 0.23), and path 4 (lower confidence interval = −0.07, upper confidence interval = 0.15). These results are presented in **Figure 4A** and **Table 2A**.

Motivated Reasoning Thought Positivity

The use of thought positivity as an operationalization of motivated reasoning yielded no significant mediation paths.

Motivated Reasoning Questionnaire Item

The use of questionnaire items to operationalize motivated reasoning replicated the results of Donovan and Priester (2017). Specifically, the mediation path in which relationship closeness → desire to maintain the relationship → questionnaire items → forgiveness (path 3) did not include zero (lower confidence interval = 0.68, upper confidence interval = 1.93), and as such, is significant. In contrast, none of the other three mediational paths is significant, in that their confidence intervals all include zero: path 1 (lower confidence interval = −0.27,

[14]These responses were 4, 6, and 8.

[15]To construct this estimation, the bmatrix was set to 1 1 1 1 1 0 1 0 1 1.

TABLE 2 | Model estimation and comparison results.

Mediation models	Estimate	SE	Bootstrap 95% CI	
			Lower CI	Upper CI
Paths Panel a, MR = Thought Negativity				
RC → Thought Negativity → F	−0.29	−0.22	−0.83	0.03
RC → CE → F	0.05	0.09	−0.13	0.23
RC → DTM → Thought Negativity → F	**0.36**	**0.21**	**0.06**	**0.88**
RC → DTM → CE → F	0.01	0.05	−0.07	0.15
Paths Panel b, MR = Questionnaire Items				
RC → Questionnaire Items → F	0.27	0.29	−0.27	0.89
RC → CE → F	0.02	0.08	−0.14	0.18
RC → DTM → Questionnaire Items → F	**1.35**	**0.32**	**0.68**	**1.93**
RC → DTM → CE → F	0.01	0.04	−0.08	0.09

Bold is significant.

upper confidence interval = 0.89), path 2 (lower confidence interval = −0.14, upper confidence interval = 0.18), and path 4 (lower confidence interval = −0.08, upper confidence interval = 0.09). These results are presented in **Figure 4B** and **Table 2B**.

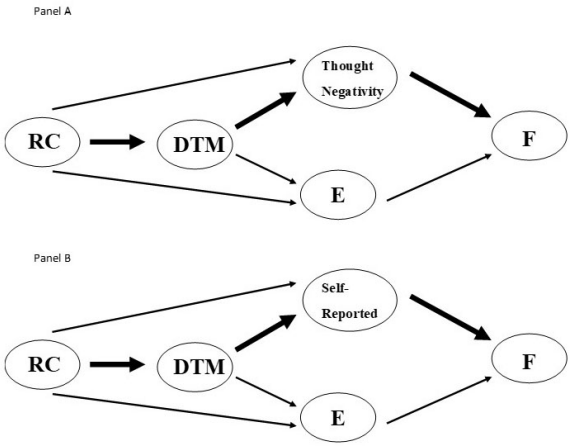

FIGURE 4 | Estimation results. **Panel A** Depicts the model using thought negativity for Motivated Reasoning. **Panel B** Depicts the models using self-reported Motivated Reasoning. RC equals Relationship Closeness, DTM equals Desire to Maintain the Relationship, MR equals Motivated Reasoning, E equals Empathy, and F equals Forgiveness.

GENERAL DISCUSSION

The present study was conducted in order to explore two questions that emerged from the empirical support for the Model of Motivated Interpersonal Forgiveness. Both concerns, at the most basic, were to what extent the measures and analyses used by Donovan and Priester (2017) reduced the ability to detect the mediational influence of empathy on interpersonal forgiveness. The present study was conducted in order to address these questions in order to better be able to find a possible mediational role of empathy on interpersonal forgiveness.

Addressing the Two Questions

Analytic Estimation

One question emerged from consideration of the analytic estimation used to test between the two models. In short, did the inclusion of nonfocal paths reduce the power to observe the mediational influence of empathy on forgiveness? To address this concern, a more focused estimation was used, in which only the focal paths were estimated. The Model of Motivated Interpersonal Forgiveness was replicated using this modified estimation approach. No paths that included empathy emerged as significant, suggesting that the analytic estimation used in Donovan and Priester (2017) did not account for the lack of support for the empathy model of forgiveness. While empathy was a significant independent predictor of forgiveness, even with the estimation of only essential paths, it did not emerge as a significant mediator of forgiveness. The analytic estimation used tests the ability of empathy to play a mediational role for both the influence of relationship closeness on forgiveness (path 2), as well as for the influence of desire to maintain the relationship on forgiveness (path 4), and neither emerged as significant. Thus, empathy is related to forgiveness, but it is does not mediate between relationship closeness, or relationship closeness and desire to maintain the relationship, and forgiveness.

Measure of Motivated Reasoning

A second question emerged from consideration of the measure used to capture motivated reasoning. Specifically, did the measure tap into forgiveness as well as motivated reasoning? The current research operationalized motivated reasoning by measuring the thoughts, feelings, and reactions that individuals had in relation to a relationship transgression through a thought-listing procedure, in addition to using more standard questionnaire items. The Model of Motivated Interpersonal Forgiveness was replicated using negative thoughts as a measure of motivated reasoning. No paths that included empathy

emerged as significant, suggesting that the specific measure of motivated reasoning used in Donovan and Priester (2017) did not account of the lack of support for the empathy model of forgiveness.

The Nature of Motivated Reasoning

The use of thoughts as an operationalization of motivated reasoning also allowed for insight into the nature of motivated reasoning in interpersonal forgiveness. *A priori*, it was unknown as to whether motivated reasoning would consist of fewer negative thoughts and/or more positive thoughts. Although both thought positivity and negativity significantly predicted forgiveness, only thought negativity served as the most proximal mediator to forgiveness.

These results suggest that the power of motivated reasoning, at least within the context of interpersonal forgiveness, comes from a less negative, rather than a more positive, interpretation of the transgression.

Such a finding may help to integrate interpersonal motivated reasoning within a broader theoretical framework. In general, it has been found that negative information and events have a more powerful influence on physiological, cognitive, emotional, and social responses than positive events (see, for example, Taylor, 1991; Ito et al., 1998). Interestingly, the current findings suggest that motivated reasoning shapes the perception of transgressions to be less negative by buffering the negative resulting thoughts. And as such, understanding a transgression to be less negative may be an especially powerful process by which to foster forgiveness.

This finding raises intriguing questions regarding motivated reasoning processes. One conceptualization of motivated reasoning used in the present research (as well as Donovan and Priester, 2017) is positive illusions (e.g., Murray and Holmes, 1997, 1999; Carswell et al., 2019). The conceptualization of motivated reasoning as positive illusions leads to an intuition that such illusion emerges through increases in positivity by means of increased positive thoughts. However, the current finding suggests that positive illusions may well emerge through decreases in negativity by means of fewer negative thoughts. The partners are still perceived to be relatively more positive. It is just that this occurs because they are perceived less negatively, rather than more positively. Of course, we find this reduction of negative thoughts in the domain of interpersonal forgiveness. An interesting question arises as to whether this buffering effect is restricted to instances of transgressions or instead extends to other interpersonal interactions and outcomes.

The Importance of Desire to Maintain a Relationship

The present research reaffirms the importance of desire to maintain the relationship. Desire to maintain the relationship consistently mediates the influence of relationship closeness on the downstream variables of motivated reasoning and forgiveness. Two theoretical questions emerge. First, to what extent does desire to maintain the relationship mediate the effects of relationship closeness beyond interpersonal forgiveness? For example, is it desire to maintain a relationship that mediates the influence of relationship closeness on other relationship processes and outcomes? Second, to what extent might desire to maintain the relationship provide a common causal mechanism (i.e., act as a mediator) for relationship constructs beyond relationship closeness, such as commitment, satisfaction, trust, and love. The present research raises the question of whether these disparate constructs may all share the property of operating through desire to maintain the relationship. If so, such desire may provide a unifying lens through which to conceptualize relations in general.

FUTURE RESEARCH AND LIMITATIONS

However, the current results should be generalized with caution. This is the first finding to suggest that thought negativity is a more powerful aspect of motivated reasoning than positivity in influencing forgiveness. And given that both thought negativity and positivity significantly influenced forgiveness, it is possible that, with a more powerful study, thought positivity might begin to exhibit a mediational influence similar to negativity. As such, further investigation is warranted before making definitive inferences as to the relative role of negative versus positivity thoughts.

Consider that forgiveness has been shown to be positively associated with many beneficial constructs: psychological well-being (Karremans et al., 2003; Pareek et al., 2016; Akhtar and Barlow, 2018; Barcaccia et al., 2019), physical health (Lee and Enright, 2019), decreased blood pressure for both victim and perpetrator (Hannon et al., 2010), greater health resilience (Worthington and Scherer, 2004), increased longevity [e.g., Barcaccia et al. (2020); see Witvliet et al. (2001)], and reduced depression (Toussaint et al., 2012). It is also important to consider, however, that forgiveness may not always be the ideal outcome following a transgression. Consider spousal abuse. Victims of such abuse could forgive, only to re-experience similar, or worse, abuse in the future (Miller and Porter, 1983; Shaver and Drown, 1986; Kearns and Fincham, 2004). In the future, researchers could explore the implications of a reduction in negative thoughts across different relationship dynamics to better understand when and why partners remain in abusive relationships.

A limitation and concern that could be explored in future research is that these models have been tested on both recall and hypothetical scenarios (Donovan and Priester, 2017), which ameliorate the concerns of either method on its own. However, a longitudinal study would allow measurement of the constructs across time, which would afford the opportunity to better test the sequential order hypothesized by the model (e.g., Murray and Holmes, 1997; Finkel et al., 2002; Orth et al., 2008).

SUMMARY

The current research provides additional support for the Model of Motivated Interpersonal Forgiveness. The present research suggests that the findings of Donovan and Priester (2017) do not appear to be the result of analytic estimation or measurement issues. Rather, the Model of Motivated Interpersonal Forgiveness appears to provide a compelling framework by which to understand the psychological process through which interpersonal forgiveness emerges. Specifically, the model provides answers to when, why, and how interpersonal forgiveness emerges.

DATA AVAILABILITY STATEMENT

The datasets generated for this study are available on request to the corresponding author.

ETHICS STATEMENT

All data collection involving human participants were reviewed and approved by Institutional Review Board of University of Southern California. The participants provided their written informed consent to participate in this study.

AUTHOR CONTRIBUTIONS

Both authors listed have made a substantial, direct and intellectual contribution to the work, and approved it for publication.

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