# Conciliatory gestures promote forgiveness and reduce anger in humans

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**Conflict is an inevitable component of social life, and natural selection has exerted strong effects on many organisms to facilitate victory in conflict and to deter conspecifics from imposing harms upon them. Like many species, humans likely possess cognitive systems whose function is to motivate revenge as a means of deterring individuals who have harmed them from harming them again in the future. However, many social relationships often retain value even after conflicts have occurred between interactants, so natural selection has very likely also endowed humans with cognitive systems whose function is to motivate reconciliation with transgressors whom they perceive as valuable and nonthreatening, notwithstanding their harmful prior actions. In a longitudinal study with 337 participants who had recently been harmed by a relationship partner, we found that conciliatory gestures (e.g., apologies, offers of compensation) were associated with increases in victims' perceptions of their transgressors' relationship value and reductions in perceptions of their transgressors' exploitation risk. In addition, conciliatory gestures appeared to accelerate forgiveness and reduce reactive anger via their intermediate effects on relationship value and exploitation risk. These results strongly suggest that conciliatory gestures facilitate forgiveness and reduce anger by modifying victims' perceptions of their transgressors' value as relationship partners and likelihood of recidivism.**

cooperation | punishment | evolutionary psychology

Biologists interested in the evolution of social behavior, starting with Darwin himself (1), have observed that human and nonhuman primates share a propensity for seeking revenge against individuals that have harmed them. In the 140 y since Darwin published *The Descent of Man, and Selection in Relation to Sex* (1), other scientists have more systematically documented the use of revenge among humans (2, 3), nonhuman primates (4, 5), and other animals (6, 7).

However, why seek revenge? Our adaptationist analysis of human revenge (2, 3, 8) begins with the observation that revenge is often effective at deterring others from imposing fitness costs on the avenger, presumably by causing exploiters (or would-be exploiters) to (*i*) lower their estimates of the rate of return to be expected from similar exploitive behaviors against the avenger in the future or (*ii*) increase their regard for the avenger's welfare so as to avoid future punishments (3, 9, 10). We think revenge likely evolved, in part, because these deterrent effects would have had positive fitness consequences.

However, revenge creates second-order adaptive problems—specifically, the potential loss of access to downstream fitness benefits from the individual on whom retaliatory costs have been imposed if that individual were to respond to revenge by exiting the partnership entirely (3). Indeed, selection pressures for many forms of cooperative social interaction, including reciprocity (11), kin altruism (12), friendship (13), or even biparental care (14), might have favored the evolution of cognitive systems that (*i*) inhibit vengeful behavior and (*ii*) motivate behaviors that signal to the harm-doer one's readiness to resume cooperative interaction.

Following conflict, many nonhuman social vertebrates selectively increase physical proximity with their former opponents and/or engage in postconflict affiliative interaction with them, which animal behavioral researchers have labeled "reconciliation" (15–20). The relational model of aggression (21–23) posits that the evolved function of reconciliation is to restore valuable relationships. In support of this claim, the conciliatory gestures that one observes among nonhuman primates are such reliable prologues to the restoration of positive interactions that researchers were recently able to write, "...the large body of evidence about conflict management in primates is essentially unanimous in showing that primates reconcile with their opponent after a fight.... No one has thus felt the need to carry out a meta-analysis of reconciliation" (ref. 24, pp. 1207–1208).

Human forgiveness, a suite of motivational changes whereby transgression victims become less vengeful, less avoidant, and more motivated to dispense benefits rather than harms as a way of raising their transgressor's regard for their welfare (3), is clearly distinct from the reconciliation behaviors that animal behavior researchers study. Furthermore, humans are capable of forgiving transgressors without reconciling with them, and vice versa (3). Despite these distinctions, reconciliation in nonhuman animals appears to depend on relationship qualities such as value, security, and compatibility (15–20, 25–28). To the extent that the same is true of humans, the widespread prevalence of forgiveness in human societies and human interaction (2, 3) might attest to the fact that humans, like many other group-living animals, possess evolved mechanisms whose function is to inhibit revenge and restore cooperative social interaction following conflict.

Our claim that human forgiveness might result from evolved "forgiveness systems" emerges from the application of design logic to human cognition: If humans possess cognitive systems dedicated to implementing forgiveness, those systems should,

## Significance

**Conflict is a common feature of social life among group-living animals, but many social relationships often retain value even after conflicts have occurred. Consequently, natural selection has likely endowed humans and other animal species with cognitive systems that motivate reconciliation with interaction partners that they perceive as valuable and nonthreatening, notwithstanding prior conflict. In a large sample of people who had recently been harmed by an interaction partner, we found that conciliatory gestures, such as apologies and offers of compensation, accelerated forgiveness and reduced anger toward transgressors, largely by altering victims' perceptions of their transgressors' relationship value and exploitation risk. These results give insight into the design logic behind the cognitive systems that motivate human postconflict reconciliation.**

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like all biological systems that evolve by natural selection, appear well designed for that function (29–31). For evolved computational systems, good design involves applying proprietary rules to an incoming data stream that results in good (i.e., fitness-enhancing, on average) decisions in the domain of the adaptive problem for which the system was naturally selected (31). Therefore, a well-designed forgiveness system should lead to decisions that would have yielded (under ancestral conditions) suitable tradeoffs between the fitness-enhancing value of deterrence and continued access to socially mediated fitness-enhancing resources.

Following the relational model of aggression (21–23), we hypothesized here that natural selection designed human forgiveness systems to be sensitive to cues of relationship value. Information used to compute relationship value might include cues of kinship (32), memories of previous cooperative interaction (11), and shared interests or values that make individuals uniquely valuable to each other (13). We also interpret the fact that people more readily forgive transgressors whose behavior was unintentional, unavoidable, or committed without awareness of its potential negative consequences (33, 34) as evidence that forgiveness systems make use of information that reveals the harm-doer's likelihood of recidivism (8, 9).

On the basis of this reasoning, researchers have hypothesized that an evolved forgiveness system should be designed to process social information that is relevant to estimating (*i*) the probability that one will encounter fitness gains (or resources that ancestrally would have been correlated with fitness) from reestablishing a long-term association with the harm-doer (i.e., "perceived relationship value") and (*ii*) the probability that the harm-doer will impose costs upon the transgression recipient in the future (i.e., "perceived exploitation risk"). Supporting this hypothesis, results from a cross-sectional correlational study and an experiment indicated that perceived relationship value and perceived exploitation risk individually and interactively influence people's willingness to forgive transgressors (8).

**Do Conciliatory Gestures Promote Forgiveness via Their Intermediate Effects on Perceived Relationship Value and Exploitation Risk?** After transgressions, human forgiveness-seekers tend to engage in a broad range of conciliatory gestures—verbal and nonverbal as well as voluntary and involuntary—that make them seem more forgivable (2, 3). These gestures include explicit acknowledgments of wrongdoing (35), efforts to repay or undo the costs imposed upon the victim (36, 37), expressions of sympathy for a victim's suffering, explicit declarations of one's intention to refrain from harming the victim in the future (37, 38), blushing (39), and the exchange of gifts or favors (40).

Previous work (41) indicated that these conciliatory gestures facilitate forgiveness by causing transgressors to seem high on a personality trait known as agreeableness (42), which subsumes both high relationship value (e.g., helpfulness, generosity) and low exploitation risk [e.g., unselfishness, reluctance to start quarrels (43)]. However, it is not known whether conciliatory gestures specifically influence victims' perceptions of their transgressors' perceived relationship value, their perceived exploitation risk, or both. It is also not known whether the effects of conciliatory gestures on the anger people experience when they recall a transgression are also due to the intermediate effects of conciliatory gestures on changes in the transgressor's perceived relationship value and exploitation risk.

**Present Study: Overview and Predictions.** The present study, which incorporated data from the most comprehensive research project to date on the longitudinal trajectory of forgiveness following real-life interpersonal harms [previous longitudinal work of this nature is presented elsewhere (33, 44, 45)], was designed to test predictions regarding the role of conciliatory gestures on forgiveness and the possible mediation of those effects by perceptions of the transgressor's exploitation risk and relationship value. On the basis of previous research, we expected that transgressors' conciliatory gestures would be associated with steeper longitudinal declines in participants' scores on a measure of avoidant and vengeful feelings toward the transgressor, a method we have developed for operationalizing forgiveness as a process of longitudinal change (33, 44–46). We also predicted that transgressors' conciliatory gestures would be related to lower scores on several measures of reactive anger that we obtained from participants after they completed a series of laboratory tasks designed to elicit their real-time feelings toward the people who had harmed them (as in ref. 47). However, our key predictions were not about the effects of conciliatory gestures on forgiveness and anger, per se, but rather about how conciliatory gestures obtain those effects.

***Prediction 1.*** Inasmuch as conciliatory gestures emitted by transgressors appear to facilitate forgiveness by making the transgressors seem more agreeable [which subsumes components of both high relationship value and low exploitation risk (41)], we predicted that conciliatory gestures would lead to longitudinal increases in participants' perceptions of their transgressors' relationship value, as well as to longitudinal reductions in their perceptions of their transgressors' exploitation risk.

***Prediction 2.*** We predicted that the apparent longitudinal effects of conciliatory gestures on forgiveness (measured as latent change over a 3-wk period in a self-report measure of participants' vengeful and avoidant motivations toward their transgressors) and laboratory measures of reactive anger would be due, in part, to the intermediate effects of conciliatory gestures on longitudinal changes in people's perceptions of their transgressors' relationship value and exploitation risk.

## Materials and Methods

**Participants.** Participants [$n = 356$ (250 female, 94 male, and 12 unreported), mean age = 19.33 y, SD = 2.35] were University of Miami undergraduates who were recruited via weekly solicitations to the students in dozens of undergraduate psychology courses over 4.5 y (November 2005–April 2010). When participants contacted the experimenters to report that they had encountered a significant interpersonal transgression within the past week, they became eligible for enrollment. On average, participants' reported transgressions had occurred ~5 d (mean = 4.53 d; SD = 2.72) before enrollment. Participants were paid between $60 and $100 on a *pro rata* basis for completing various aspects of the study; students who enrolled through introductory psychology courses also received partial course credit. After completing all procedures, participants completed a questionnaire that asked them to indicate whether they had fabricated any aspects of what they reported over the course of the study. Participants were assured that their answers would be kept anonymous and they would suffer no consequences for reporting any fabrications. Four participants reported that they had fabricated the transgression entirely, and 15 participants reported that they either exaggerated the events or were dishonest about when the transgression occurred. These 19 participants were excluded from analyses, leaving our sample at $n = 337$. Table S1 lists the types and frequencies of the most frequently reported transgressions.

**Procedure.** ***Overview.*** Participants attended multiple laboratory visits and completed additional tasks on their own. The major elements of the study, detailed below, included (*i*) recruitment, (*ii*) face-to-face delivery of screening packets to potential participants, (*iii*) completion and return of the screening questionnaires to the investigators so potential participants' eligibility could be verified, (*iv*) return to the laboratory by eligible participants for completion of additional questionnaires and receipt of the links to 21 daily online surveys, (*v*) completion of those daily online surveys, (*vi*) three or four additional laboratory visits to complete tasks that are not relevant to the present paper, and (*vii*) completion of a final laboratory visit during which participants completed the reactivity task described below. Typically, participants' involvement in the study (from their submission of screening materials to the reactivity task visit) lasted about 25 d.

***Recruitment.*** We contacted potential participants through short presentations in their psychology courses, and through a website that introductory psychology students used to select and register for studies to complete in fulfillment of a research participation requirement. All interested potential participants then received an initial screening packet that included an informed consent form and several short screening questions. Participants whom we deemed eligible for participation on the basis of their responses to these screening questions were then enrolled in the study: Potential

participants were excluded if their transgressions involved transgressors they did not know, petty arguments or misunderstandings that were easily resolved, or transgressions that the potential participants committed. Shortly after enrollment, participants came to the laboratory to pick up an initial packet containing the relationship-specific and offense-specific measures described below (time 1). In addition, we e-mailed participants a set of 21 unique links to a brief online questionnaire, which included the 18-item form of the Transgression-Related Interpersonal Motivations Inventory (TRIM-18) for measuring forgiveness (see below), asking them to activate one of those links each day for 21 d (preferably consecutive days).

***Laboratory session.*** Approximately 25 d (mean = 24.72 d, SD = 6.43) after enrollment, participants completed a 90-min laboratory session consisting of a speech reactivity task and subsequent posttask questionnaires (time 2). Ancillary physiological parameters not relevant to the present paper were assessed for ∼29% of participants ($n$ = 99).

To bring all participants into a relaxed state, each session began by having participants watch 15 min of a relaxing videotape depicting sea life (48). Afterward, the experimenter conducted an 8-min interview [modeled after that of Lawler et al. (49)] in which participants answered a series of standardized questions about the transgression they had experienced and their feelings toward the person who had harmed them (details are provided in *SI Appendix*).

Following the interview, participants were instructed to spend 4 min preparing a short first-person speech about the transgression and the transgressor. They then delivered the speech into a videocamera as if the camera were the person who had harmed them. Participants received the following scripted instructions: "For this task, we really want you to relax and 'get into' the task so that you can express your feelings to this person without holding anything back—as if you were really talking to this person. Specifically, we would like you to spend a few minutes preparing some thoughts about what you would say to the person who hurt you, focusing on (*i*) what you would like to say about the hurtful event, (*ii*) how you are currently feeling about the individual who harmed you as a person, and (*iii*) how you feel like acting toward that individual. You will have 4 min to prepare anything that you would like. Feel free to take notes if you would be more comfortable. After the preparation time, you will be asked to give this speech into the video recorder." Following the 4-min preparation time, participants delivered the speech to the camera. After the speech task was completed, participants sat quietly for a 10-min recovery period, completed several questionnaires, and were debriefed.

**Measures.** ***Conciliatory gestures.*** We measured participants' perceptions of the extent to which their transgressors made conciliatory gestures at time 1 (α = 0.97) and time 2 (α = 0.97) with 39 items that were rated on a five-point Likert-type scale (ranging from 1 = not at all to 5 = to a great extent). These items were similar to the 19 items used by Tabak et al. (41), but our list was more comprehensive. The items all began with, "Since the offense occurred, to what extent did the person who harmed you…" and included items such as "try to compensate you or 'make up' for the bad thing he/she did to you" and "take responsibility for his/her hurtful actions."

***Perceived relationship value and perceived exploitation risk.*** Perceived relationship value was measured at time 1 (α = 0.92) and time 2 (α = 0.94) with the mean of four items that were rated on an 11-point Likert-type scale (ranging from 0 = not at all to 10 = extremely). Example items included "How important do you think this relationship is to (person who harmed you)?" and "How confident are you in the strength and stability of your relationship with (person who harmed you)?" Perceived exploitation risk was measured at time 1 (α = 0.88) and time 2 (α = 0.90) with the mean of four items that were rated on a seven-point Likert-type scale (ranging from 1 = disagree completely to 7 = agree completely). Example items included "He/she doesn't intend to wrong me again" and "He/she wants our conflict to be over."

***Forgiveness.*** We used the 18-item version of the TRIM inventory (50) to measure forgiveness. The TRIM-18 consists of self-report items to measure motivation to avoid the transgressor (e.g., "I am trying to keep as much distance between us as possible"), seek revenge against the transgressor (e.g., "I'm going to get even"), and reconcile with the transgressor (e.g., "Despite what he/she did, I want us to have a positive relationship again"). As in previous research (33), the TRIM's 18 items were combined (with the reconciliation motivation items reverse-scored) into a single unidimensional measure using the rating scale version of the Rasch model (51). As described below, and as Fig. 1 illustrates, we used an estimated (i.e., latent) rate of linear change in each participant's TRIM scores to represent the extent to which he or she forgave his or her transgressor over the period of observation. Hereafter, we use the term "forgiveness" to refer to estimated linear reductions in people's repeated TRIM scores when those scores are estimated with two-parameter models of the form:

$$\mathrm{TRIM}_{ij} = \beta_{0j} + \beta_{1j}(\mathrm{Time}_{ij}) + r_{ij}. \quad [1]$$

Eq. **1** decomposes participant $j$'s $i$th TRIM score into two components: (*i*) a latent intercept, $\beta_{0j}$, representing participant $j$'s TRIM score when time (measured in days since $j$'s transgression occurred) = 0 (i.e., immediately after the transgression) and (*ii*) a latent slope, $\beta_{1j}$, representing the linear association between all of $j$'s TRIM scores and the number of days that elapsed between the transgression and each of those respective scores. Larger negative values for $\beta_{1j}$ imply more forgiveness, because they indicate steeper declines in scores over time. Previous work suggests that this approach yields valid estimates of forgiveness (33, 45). For example, using this method, individual differences in estimated rates of change in TRIM scores have been associated with participants' ratings of transgression painfulness and severity, their attributions of transgressors' responsibility and intentionality, their empathy for transgressors, and their degree of rumination about the transgression (33, 45). Over longer spans of time (e.g., 100 d), longitudinal change in TRIM scores is better represented as a logarithmic function of time (33), but over shorter time intervals, change is reasonably well described with a simple linear model (46). Curvilinearity can be detected by adding the squared (i.e., quadratic) values of time to Eq. **1** as a third predictor of TRIM scores (33). In our data, the quadratic effect of time was not statistically significant, signaling that this third parameter did not improve upon the two-parameter linear model in Eq. **1**.

On average, participants completed 58% (mean = 12.26 d, SD = 6.68) of their TRIM questionnaires over their 21-d measurement intervals (68% of participants completed at least 10 questionnaires and 82% completed at least five questionnaires). Because participants enrolled after variable amounts of time had elapsed since their respective transgressions, a given participant's day 1 observation might have reflected his or her motivations toward his or her transgressor on posttransgression day 7, whereas another participant's first TRIM score might have reflected his or her motivations on posttransgression day 9. To render these measurements onto a common time scale, we subtracted the date of each participant's transgression from the dates on which his or her respective TRIM measurements were obtained (ratings were electronically time-stamped upon completion). Because of the time delay between the occurrence of participants' transgressions and their enrollment in the study, relatively few participants provided data before 8 d after their transgressions; thus, data were very sparse until posttransgression day 8. To aid model estimation and convergence, we modeled only the data collected 8–28 d posttransgression [as in the study by Tabak et al. (41)]. Furthermore, we modeled data from every other day to reduce autocorrelation and facilitate model convergence. Consequently, participants

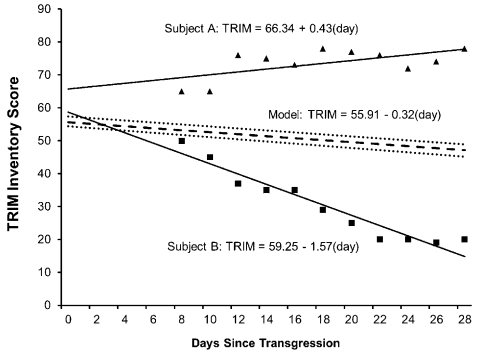


**Fig. 1.** Two subjects' scores (slightly altered to preserve anonymity) on the TRIM inventory, with least-squares lines of best fit. Slopes measure the extent to which participants forgave their transgressors over the study period, with steeper negative slopes indicating more forgiveness. Subject A's scores increased 0.43 units/d, whereas subject B's scores dropped 1.57 units/d. Thus, subject B forgave to a lesser extent than did subject A (and, in fact, because subject A's slope is positive rather than negative, subject A seemingly did not forgive at all). The broken line represents the estimated trajectory (bracketed by a 95% CI) for all subjects based on full-information maximum likelihood estimation. On average, participants forgave 0.32 units/d over the interval ranging from day 8 to day 28 posttransgression ($P < 0.001$; full model results are provided in Table S3).

contributed up to 11 observations over the 21-d posttransgression period ranging from day 8 to day 28 posttransgression.

***Self-reported affect after the interview and speech task.*** Following the speech task, participants rated how "spiteful," "hostile," "enraged," "furious," and "angry" they were on a five-point Likert-type scale (ranging from 1 = very slightly or not at all to 5 = extremely). The prompt asked them to "indicate how much you feel each emotion right now." We took the mean of these items to create a self-reported anger scale (α = 0.87).

***Proportion of anger words and swear words.*** Participants' speeches from the transgression recall task were transcribed and analyzed using LIWC2001 (Linguistic Inquiry and Word Count) software (52). The LIWC2001 software analyzes the percentage of the total number of words that fall into certain categories (74 in total). Here, we used the "anger" category (e.g., hate, kill) and the "swear words" category (e.g., damn). We took the mean of the z-scores of the two measures to form a measure of anger-related words used during the speech (α = 0.85).

***Observer-rated facial displays of anger during speech task.*** Six independent raters coded participants' facial displays of anger during the 4-min speech task. While watching video recordings of the speech task (with the sound muted), they rated 33 emotion words to indicate the extent to which participants appeared to manifest each emotion within each of eight 30-s windows. The emotion words were rated on a seven-point scale (ranging from 0 = not at all to 6 = extremely). The anger measure comprised the combined mean ratings of angry, hostile, and "mad" (α = 0.99) from the eight 30-s windows. Due to technical problems, video recordings from only 208 of the participants were usable. Three raters rated 164 of these video recordings (absolute agreement generalizability coefficient, $E\rho^2_{Abs}$ = 0.82). Three different raters rated the remaining 44 video recordings ($E\rho^2_{Abs}$ = 0.82). The pooled absolute agreement (i.e., raters assigned the same rating) across all video recordings was 0.78, which is considered "excellent" (53) and indicates that 78% of the variance in the ratings reflects true score variance. Eight percent of the total variance was attributable to rater differences, and the remaining 14% was attributable to rater * target interactions, confounded with measurement error (54).

***Control variables.*** At time 1, participants were asked to rate the extent to which they felt the offense was "serious," "severe," "harmful to them," and "morally wrong," as well as to rate "How painful was the offense to you right after it happened?" and "How painful is the offense to you right now?" on a seven-point Likert-type scale (ranging from 0 = not at all to 6 = extremely). We used these variables as control variables to evaluate the robustness of the longitudinal links between conciliatory gestures, exploitation risk, relationship value, and the various outcome measures.

**Statistical Analyses.** Analyses were conducted with Mplus version 6 (55). When applicable, we handled missing data with full information maximum likelihood estimation, which yields unbiased parameter estimates based on valid statistical inference (56).

## Results

Descriptive statistics and correlations among study variables are provided in Table S2.

**Forgiveness (Longitudinal Changes in TRIM-18 Scores).** As in Eq. **1**, we modeled each participant's forgiveness via his or her estimated rate of linear change in TRIM scores over the 21-d measurement interval via latent growth modeling (45). We specified an AR(1) autoregressive process in the data (i.e., we freed adjacent error terms to correlate), which improved model fit. In these models, and in all other models reported below, the interaction between relationship value and exploitation risk at time 2 did not significantly predict outcomes (cf. ref. 8), so we have omitted this term from the models presented.

***Baseline model.*** First, we ran a latent growth model to estimate the intercept (initial status) and slope (linear change) of the TRIM measure. According to conventional criteria (57), the model fit the data well: $\chi^2$ (51) = 112.19, $P < 0.001$; root mean squared error of approximation (RMSEA) = 0.06 [90% confidence interval (CI): 0.05–0.08], $P = 0.09$; comparative fit index (CFI) = 0.98; and standardized root mean square residual (SRMR) = 0.06. Both the intercept ($b$ = 55.91, SE = 1.03, $P < 0.001$) and slope ($b$ = −0.32, SE = 0.04, $P < 0.001$) were statistically significant. (Higher scores on the TRIM inventory indicate more negative and less positive motivation toward the transgressor, so a negative slope indicates longitudinal increases in forgiveness.) These results imply that participants generally became more forgiving over time (Fig. 1), which is typical in studies of this nature (33, 45).

***Effects of conciliatory gestures, relationship value, and exploitation risk on forgiveness.*** We added time 1 and time 2 measures of conciliatory gestures, relationship value, and exploitation risk to the model to predict the intercepts and rates of linear change in the forgiveness scores (Fig. 2). Specifically, we sought to test whether these three measures predicted the latent intercepts of participants' TRIM inventory scores and whether conciliatory gestures at time 1 predicted the linear rates of change in those scores via its intermediate effects on relationship value and exploitation risk at time 2.

The model fit the data relatively well: $\chi^2$ (114) = 246.62, $P < 0.001$; RMSEA = 0.06 (90% CI = 0.05–0.07), $P = 0.09$; CFI = 0.96; and SRMR = 0.09. All of the paths predicting the intercept and forgiveness scores were statistically significant (results are presented in Fig. 2 and Table S4). In addition, in a separate model with only conciliatory gestures at time 1 predicting both the intercept and slope, conciliatory gestures at time 1 had a statistically significant association with forgiveness, ($b$ = –0.10, SE = 0.04, $P$ = 0.031, 95% CI: –0.18 to –0.01, β = –0.16), indicating that the extent to which transgressors offered conciliatory gestures to their victims was directly proportional to the extent to which those victims forgave over time. Conciliatory gestures, as has been shown many times previously, facilitated forgiveness.

As Fig. 2 shows, conciliatory gestures at time 1 were associated positively with participants' perceptions of transgressors' relationship value at time 2, holding constant time 1 perceptions of transgressors' relationship value ($b$ = 0.58, $SE$ = 0.15, $P < 0.001$, 95% CI: 0.29–0.87, β = 0.19). Conciliatory gestures at time 1 were also associated negatively with participants' perceptions of transgressors' exploitation risk at time 2, holding constant time 1 perceptions of transgressors' exploitation risk ($b$ = –0.36, SE = 0.11, $P < 0.001$, 95% CI: –0.57 to –0.15, β = –0.20). Lagged associations of this form (i.e., in which a predictor variable at time 1 is associated with a criterion variable at time 2, holding constant the values of that criterion variable at time 1) are consistent with causal relationships (58). Thus, they lend support to the hypothesis that conciliatory gestures lead, over time, to increases in perceived relationship value and reductions in perceived exploitation risk. Therefore, prediction 1 was confirmed.

In addition, relationship value at time 2 ($b$ = –0.06, SE = 0.02, $P < 0.001$, 95% CI: –0.09 to –0.03, β = –0.34) and exploitation risk at time 2 ($b$ = 0.06, SE = 0.03, $P$ = 0.049, 95% CI: 0.00–0.11, β = 0.18) both had significant associations with forgiveness (i.e., linear changes in TRIM scores). These results indicate that increases in forgiveness (operationalized by longitudinal changes in the TRIM) were associated, as predicted, with changes in participants' perceptions of transgressors' continued value as

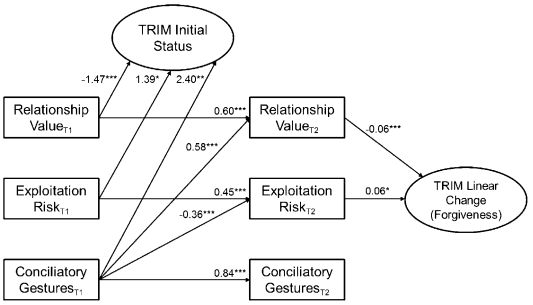


**Fig. 2.** Path model for predicting initial status and linear change (i.e., forgiveness) in participants' TRIM scores. T1 and T2 refer to time 1 and time 2. Coefficients are unstandardized. Variances, covariances, and time points are omitted for clarity (full model results are provided in Table S4). *$P < 0.05$; **$P < 0.01$; ***$P < 0.001$.

relationship partners and likelihood of harming the victim again in the future.

The total indirect effect from conciliatory gestures at time 1 to forgiveness scores was significant ($b = -0.06$, SE = 0.02, $P < 0.001$, 95% CI: −0.09 to −0.03, $\beta = -0.10$). Here and elsewhere, CIs reported for indirect effects were obtained via bias-corrected bootstrapping (59). Breaking down the so-called "total effect" (i.e., the association without mediators) into its indirect components (i.e., the proportions of the total effect attributable to intervening mediator variables) shows that the specific indirect effect from conciliatory gestures at time 1 to forgiveness, via relationship value at time 2, was significant ($b = -0.04$, SE = 0.01, $P = 0.006$, 95% CI: −0.06 to −0.02, $\beta = -0.07$), whereas the specific indirect effect via exploitation risk at time 2 was only marginally significant ($b = -0.02$, SE = 0.01, $P = 0.089$, 95% CI: −0.06–0.00, $\beta = -0.04$). These results suggest that conciliatory gestures might increase forgiveness partly by increasing participants' perceptions of their transgressors' relationship value.

When the six control variables were simultaneously added to the model as predictors of both the intercept and slope, the only qualitative change in the results was that the path from exploitation risk at time 2 to forgiveness went from $b = 0.06$ to $b = 0.047$ and went from statistically significant ($P = 0.049$) to nonsignificant ($P = 0.11$). Even so, the total indirect effect from conciliatory gestures at time 1 to forgiveness remained essentially unchanged ($b = -0.06$, SE = 0.02, $P < 0.001$, 95% CI: −0.10 to −0.03, $\beta = -0.11$). As in the model without the control variables, the specific indirect effect via perceived relationship value at time 2 was significant ($b = -0.04$, SE = 0.01, $P < 0.01$, 95% CI: −0.07 to −0.02, $\beta = -0.08$) and the specific indirect effect via exploitation risk was not ($b = -0.02$, SE = 0.01, $P = 0.14$, 95% CI: −0.06–0.00, $\beta = -0.03$), suggesting that conciliatory gestures might increase forgiveness by making transgressors seem more valuable to their victims. Thus, prediction 2 was partially confirmed with respect to forgiveness: Conciliatory gestures were associated with faster forgiveness, apparently due to their intermediate association with transgressors' perceived relationship value.

**Effects of Conciliatory Gestures, Relationship Value, and Exploitation Risk on Reactive Anger Toward the Transgressor.** Next, we ran a path model (Fig. 3) to examine the effects of conciliatory gestures, relationship value, and exploitation risk on self-reported anger, the proportion of anger and swear words in participants' speeches, and observer-rated facial anger. That is to say, these three measures of anger were used as outcome variables instead of the intercept and slope estimates derived from the latent growth model of participants' TRIM scores. Model fit was fair: $\chi^2$ (13) = 49.33, $P = <0.001$; RMSEA = 0.09 (90% CI: 0.07–0.12), $P = 0.006$; CFI = 0.96; and SRMR = 0.06. In a separate model with only conciliatory gestures at time 1 predicting the three anger measures, conciliatory gestures at time 1 did not have significant direct effects on any of the anger measures (all $P > 0.05$). However, exploitation risk at time 2 predicted self-reported anger toward the transgressor ($b = 0.13$, SE = 0.05, $P = 0.005$, 95% CI: 0.04–0.21, $\beta = 0.25$), and relationship value at time 2 predicted the number of anger-related words used during the speech task ($b = -0.09$, SE = 0.03, $P = 0.011$, 95% CI: −0.15 to −0.02, $\beta = -0.27$). Neither exploitation risk nor relationship value at time 2 predicted observer-rated facial anger (Fig. 3 and Table S5). The specific indirect effect from conciliatory gestures at time 1 to self-reported anger, via its intermediate effects on exploitation risk, was significant ($b = -0.05$, SE = 0.02, $P = 0.032$, 95% CI: −0.10–0.00, $\beta = -0.05$), as was the specific indirect effect from conciliatory gestures at time 1 to anger-related words, via its intermediate effects on relationship value ($b = -0.05$, SE = 0.02, $P = 0.035$, 95% CI: −0.11 to −0.02, $\beta = -0.05$), although, as reported above, the direct effects from conciliatory gestures at time 1 to these anger-related variables were not significant. Even when the total effect from a putative independent variable to a putative dependent variable is not statistically significant, its indirect effect via a mediator variable can be significant, and conclusions of mediation under such circumstances are statistically valid (60, 61). There were no qualitative changes to these effects as a result of adding the six control variables as predictors of the three anger outcomes.

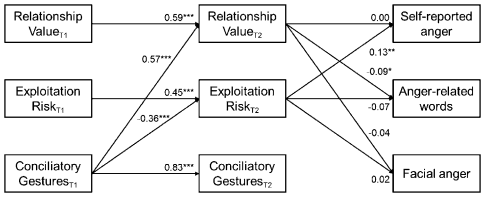


**Fig. 3.** Path model for predicting three measures of participants' anger toward their transgressors. Coefficients are unstandardized. Variances and covariances are omitted for clarity (full model results are provided in Table S5). When the six control variables were added to the model as predictors of all three outcomes, none of the displayed effects changed qualitatively. *$P < 0.05$; **$P < 0.01$; ***$P < 0.001$.

Thus, prediction 2 received partial confirmation with respect to the three anger variables: Conciliatory gestures were associated with lower state anger due, in part, to their intermediate association with lower exploitation risk, and, to a lesser extent, conciliatory gestures were associated with fewer anger-related words in the speech task due to their intermediate association with higher perceived relationship value.

## Discussion

Conciliatory gestures, such as apologies and offers of compensation, are cross-culturally pervasive (2) and are among the most robust known predictors of forgiveness (33, 34, 45). Inspired, in part, by theory and research that have illuminated the importance of relationship qualities as determinants of reconciliation in nonhuman primates (22, 23, 26), the present study evaluated with longitudinal data whether conciliatory gestures appear to increase forgiveness via their intermediate influences on people's perceptions of their transgressors' relationship value and exploitation risk. In doing so, we used a longitudinal dataset (Dataset S1) that enabled us to make stronger cause-and-effect conclusions about real-life transgressions than has been possible in previous work. The study also benefited from a large sample, advanced statistical methods for modeling forgiveness as a process of longitudinal change (33, 45), and several laboratory measures of reactive anger in response to thoughts about the transgressor.

Our first prediction was confirmed: Participants' reports of the extent to which their transgressors made conciliatory gestures in the first few days after an offense were associated with longitudinal increases in their perceptions of their transgressors' relationship value and with longitudinal reductions in their transgressors' exploitation risk.

Moreover, we found that the associations of conciliatory gestures with forgiveness and anger were partially mediated by longitudinal changes in participants' perceptions of their transgressors' relationship value (in the case of the longitudinal changes in the TRIM-18 and anger-related/swear words in the speech task) and in participants' perceptions of their transgressors' exploitation risk (in the case of self-rated anger). These results suggest that apologies, offers of compensation, and other conciliatory gestures might increase forgiveness and reduce anger by making transgressors seem less threatening to their victims and more valuable as relationship partners (8, 41).

Although our hypotheses led us to expect that these apparent effects of conciliatory gestures would be mediated by their intermediate effects on both relationship value and exploitation risk in all instances, this expectation might have been unrealistic, given the high correlations of our measures of exploitation risk and relationship value at both time 1 ($r = -0.63$) and time 2 ($r = -0.75$). These correlations are considerably higher than the correlations of the measures of exploitation risk and

relationship value that Burnette et al. (8) developed ($r = -0.33$ and $r = -0.44$ in two different studies). Although it would have been preferable to use the measures of Burnette et al. (8), they were developed well after the data analyzed here had been collected. Future work that distinguishes the effects of relationship value and exploitation risk more clearly, by either measuring them more distinctly or manipulating them experimentally, would be valuable.

In comparison to the sizeable empirical and theoretical literatures on punishment and revenge that have emerged in biology and the social sciences, the functional and proximate bases for peacemaking and reconciliation in humans and nonhuman animals have been both understudied and undertheorized (62, 63). By trying to shed light on the information-processing systems that govern humans' decisions to forgive, it is our hope that the present work might not only help to fill some of those gaps but also stimulate further work in the same vein.

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# SI Appendix

Questions asked during the anger interview

1. Take a moment to remember the specific event and then describe exactly what happened in as much detail as you can, without using any names.

2. How long ago did this happen?

3. What feelings do you remember during this event?

4. If you had to choose one emotion that best describes how you felt after this event happened to you, would it be "hurt," or "angry"? Or would it be some other feeling? Can you explain why?

5. Did you express your feelings to the other person in any way?

6. Why do you suppose they did this to you?

7. What was your relationship like with this person before this event?

8. What is it like now?

9. What would it take to be completely reconciled or for the situation to be completely resolved?

10. Can you describe for me the kinds of emotions you are feeling right now as a result of having spent these few moments talking about what happened to you?

11. From your perspective, what was the worst aspect about what they did to you?

12. Now, suppose (the person who hurt the participant) were here and I asked them to describe this event, in their own words. What would their description be like? What do you think of their view?

# Supporting Information

## McCullough et al. 10.1073/pnas.1405072111

**Table S1. Types and frequencies of transgressions**

| Transgression type | Count | % |
|---|---|---|
| Betrayals of confidence or insults by a friend | 59 | 17.5 |
| Neglect by a romantic partner, spouse, or ex-romantic partner | 17 | 5.0 |
| Infidelity by a romantic partner or spouse | 94 | 27.9 |
| Rejection, neglect, or insult by a family member | 33 | 9.8 |
| Termination of a romantic relationship | 34 | 10.1 |
| Insults by people other than family or friends | 14 | 4.2 |
| Rejection or abandonment by a friend or prospective relationship partner | 32 | 9.5 |
| Other (e.g., sexual harassment from a boss, date rape by a friend, invasion of privacy by a romantic partner) | 54 | 16.0 |
| Total | 337 | 100 |

**Table S2. Descriptive statistics and correlations among variables**

| Variable | Range | Mean | SD | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1: $CG_{T1}$ | 1.00–4.82 | 2.13 | 0.95 | | | | | | | | | |
| 2: $CG_{T2}$ | 1.00–4.85 | 2.34 | 1.02 | 0.77** | | | | | | | | |
| 3: $RV_{T1}$ | 0.00–10.00 | 3.76 | 2.90 | 0.54** | 0.52** | | | | | | | |
| 4: $RV_{T2}$ | 0.00–10.00 | 4.48 | 3.01 | 0.46** | 0.63** | 0.76** | | | | | | |
| 5: $ER_{T1}$ | 1.00–7.00 | 3.53 | 1.65 | −0.62** | −0.57** | −0.63** | −0.55** | | | | | |
| 6: $ER_{T2}$ | 1.00–7.00 | 3.47 | 1.72 | −0.45** | −0.65** | −0.57** | −0.75** | 0.62** | | | | |
| 7: Self-reported anger | 1.00–5.00 | 1.74 | 0.84 | 0.06 | −0.01 | −0.06 | −0.17** | 0.07 | 0.24** | | | |
| 8: Anger words | −0.70–6.45 | 0.00 | 0.93 | 0.10 | 0.04 | −0.10 | −0.16* | −0.04 | 0.06 | 0.24** | | |
| 9: Facial anger | 0.06–4.97 | 1.28 | 0.98 | −0.12 | −0.08 | −0.10 | −0.12 | 0.11 | 0.10 | 0.14 | 0.16* | |

CG, conciliatory gestures; ER, exploitation risk; RV, relationship value. T1 and T2 refer to time 1 and time 2, respectively. *$P < 0.05$; **$P < 0.01$.

**Table S3. Baseline growth model of TRIM forgiveness**

| Parameter | Estimate | SE | *P* |
|---|---|---|---|
| Means | | | |
| Intercept | 55.91 | 1.03 | <0.001 |
| Forgive | −0.32 | 0.04 | <0.001 |
| Variances | | | |
| Intercept | 198.94 | 25.23 | <0.001 |
| Forgive | 0.24 | 0.04 | <0.001 |
| Residual variances | | | |
| Day 8 | 48.15 | 11.02 | <0.001 |
| Day 10 | 40.06 | 7.01 | <0.001 |
| Day 12 | 35.85 | 5.89 | <0.001 |
| Day 14 | 35.58 | 4.76 | <0.001 |
| Day 16 | 27.33 | 4.06 | <0.001 |
| Day 18 | 23.47 | 3.63 | <0.001 |
| Day 20 | 29.49 | 3.89 | <0.001 |
| Day 22 | 28.48 | 3.78 | <0.001 |
| Day 24 | 21.75 | 3.92 | <0.001 |
| Day 26 | 15.90 | 4.34 | <0.001 |
| Day 28 | 18.56 | 5.23 | <0.001 |
| Covariances | | | |
| Forgive, intercept | −2.03 | 0.84 | 0.015 |
| Day 8, day 10 | 21.50 | 6.60 | 0.001 |
| Day 10, day 12 | 17.67 | 4.76 | <0.001 |
| Day 12, day 14 | 13.01 | 3.48 | <0.001 |
| Day 14, day 16 | 13.83 | 3.26 | <0.001 |
| Day 16, day 18 | 1.84 | 2.34 | 0.430 |
| Day 18, day 20 | 11.36 | 2.92 | <0.001 |
| Day 20, day 22 | 11.39 | 2.80 | <0.001 |
| Day 22, day 24 | 11.42 | 2.92 | <0.001 |
| Day 24, day 26 | 5.40 | 2.67 | 0.043 |
| Day 26, day 28 | 4.69 | 3.72 | 0.207 |

Coefficients are unstandardized. Days refer to number of days since the transgression occurred.

**Table S4. Growth model of TRIM forgiveness with covariates added**

| Parameter | Estimate | SE | *P* |
|---|---|---|---|
| Paths | | | |
| $RV_{T1}$ → intercept | −1.47 | 0.35 | <0.001 |
| $ER_{T1}$ → intercept | 1.39 | 0.61 | 0.024 |
| $CG_{T1}$ → intercept | 2.40 | 0.91 | 0.008 |
| $RV_{T2}$ → forgive | −0.06 | 0.02 | <0.001 |
| $ER_{T2}$ → forgive | 0.06 | 0.03 | 0.049 |
| $RV_{T1}$ → $RV_{T2}$ | 0.60 | 0.05 | <0.001 |
| $ER_{T1}$ → $ER_{T2}$ | 0.45 | 0.05 | <0.001 |
| $CG_{T1}$ → $CG_{T2}$ | 0.84 | 0.04 | <0.001 |
| $CG_{T1}$ → $RV_{T2}$ | 0.58 | 0.15 | <0.001 |
| $CG_{T1}$ → $ER_{T2}$ | −0.36 | 0.11 | 0.001 |
| Intercepts | | | |
| Intercept | 51.46 | 3.98 | <0.001 |
| Forgive | −0.21 | 0.16 | 0.19 |
| Means | | | |
| $RV_{T1}$ | 3.79 | 0.16 | <0.001 |
| $ER_{T1}$ | 3.50 | 0.09 | <0.001 |
| $CG_{T1}$ | 2.13 | 0.05 | <0.001 |
| Variances | | | |
| $RV_{T1}$ | 8.31 | 0.66 | <0.001 |
| $ER_{T1}$ | 2.70 | 0.22 | <0.001 |
| $CG_{T1}$ | 0.90 | 0.07 | <0.001 |
| Residual variances | | | |
| $RV_{T2}$ | 3.89 | 0.36 | <0.001 |
| $ER_{T2}$ | 1.83 | 0.17 | <0.001 |
| $CG_{T2}$ | 0.42 | 0.04 | <0.001 |
| Intercept | 151.18 | 21.57 | <0.001 |
| Slope | 0.21 | 0.04 | <0.001 |
| Day 8 | 49.13 | 11.18 | <0.001 |
| Day 10 | 38.75 | 6.83 | <0.001 |
| Day 12 | 35.18 | 5.79 | <0.001 |
| Day 14 | 35.73 | 4.73 | <0.001 |
| Day 16 | 27.52 | 4.05 | <0.001 |
| Day 18 | 23.55 | 3.61 | <0.001 |
| Day 20 | 29.20 | 3.83 | <0.001 |
| Day 22 | 28.52 | 3.79 | <0.001 |
| Day 24 | 21.57 | 3.81 | <0.001 |
| Day 26 | 17.93 | 4.58 | <0.001 |
| Day 28 | 17.30 | 5.05 | 0.001 |
| Covariances | | | |
| Intercept, slope | −2.92 | 0.82 | <0.001 |
| Intercept, $CG_{T2}$ | −0.33 | 0.55 | 0.545 |
| Slope, $CG_{T2}$ | 0.02 | 0.02 | 0.395 |
| $CG_{T1}$, $RV_{T1}$ | 1.45 | 0.17 | <0.001 |
| $CG_{T1}$, $ER_{T1}$ | −0.96 | 0.10 | <0.001 |
| $RV_{T1}$, $ER_{T1}$ | −2.96 | 0.31 | <0.001 |
| $RV_{T2}$, $ER_{T2}$ | −1.66 | 0.21 | <0.001 |
| $CG_{T2}$, $RV_{T2}$ | 0.63 | 0.09 | <0.001 |
| $CG_{T2}$, $ER_{T2}$ | −0.47 | 0.06 | <0.001 |
| Day 8, day 10 | 21.20 | 6.57 | 0.001 |
| Day 10, day 12 | 17.05 | 4.66 | <0.001 |
| Day 12, day 14 | 12.94 | 3.44 | <0.001 |
| Day 14, day 16 | 13.99 | 3.25 | <0.001 |
| Day 16, day 18 | 1.92 | 2.33 | 0.410 |
| Day 18, day 20 | 11.39 | 2.90 | <0.001 |
| Day 20, day 22 | 11.08 | 2.78 | <0.001 |
| Day 22, day 24 | 11.31 | 2.89 | <0.001 |
| Day 24, day 26 | 6.11 | 2.73 | 0.025 |
| Day 26, day 28 | 5.24 | 3.76 | 0.163 |

Coefficients are unstandardized. Days refer to number of days since the transgression occurred.

**Table S5. Path model predicting anger during the laboratory session**

| Parameter | Estimate | SE | *P* |
|---|---|---|---|
| Paths | | | |
| $RV_{T1} \rightarrow RV_{T2}$ | 0.59 | 0.04 | <0.001 |
| $ER_{T1} \rightarrow ER_{T2}$ | 0.45 | 0.05 | <0.001 |
| $CG_{T1} \rightarrow CG_{T2}$ | 0.83 | 0.05 | <0.001 |
| $CG_{T1} \rightarrow RV_{T2}$ | 0.57 | 0.15 | <0.001 |
| $CG_{T1} \rightarrow ER_{T2}$ | −0.36 | 0.11 | 0.001 |
| $RV_{T2} \rightarrow$ self-reported anger | 0.00 | 0.03 | 0.873 |
| $ER_{T2} \rightarrow$ self-reported anger | 0.13 | 0.05 | 0.005 |
| $RV_{T2} \rightarrow$ anger words | −0.09 | 0.03 | 0.011 |
| $ER_{T2} \rightarrow$ anger words | −0.07 | 0.06 | 0.203 |
| $RV_{T2} \rightarrow$ facial anger | −0.04 | 0.04 | 0.277 |
| $ER_{T2} \rightarrow$ facial anger | 0.02 | 0.06 | 0.797 |
| Intercepts | | | |
| $RV_{T2}$ | 1.09 | 0.31 | <0.001 |
| $ER_{T2}$ | 2.68 | 0.37 | <0.001 |
| $CG_{T2}$ | 0.60 | 0.10 | <0.001 |
| Self-reported anger | 1.28 | 0.26 | <0.001 |
| Anger words | 0.65 | 0.34 | 0.056 |
| Facial anger | 1.37 | 0.36 | <0.001 |
| Means | | | |
| $RV_{T1}$ | 3.79 | 0.16 | <0.001 |
| $ER_{T1}$ | 3.50 | 0.09 | <0.001 |
| $CG_{T1}$ | 2.13 | 0.05 | <0.001 |
| Variances | | | |
| $RV_{T1}$ | 8.42 | 0.68 | <0.001 |
| $ER_{T1}$ | 2.72 | 0.22 | <0.001 |
| $CG_{T1}$ | 0.91 | 0.07 | <0.001 |
| Residual variances | | | |
| $RV_{T2}$ | 3.89 | 0.36 | <0.001 |
| $ER_{T2}$ | 1.84 | 0.17 | <0.001 |
| $CG_{T2}$ | 0.42 | 0.04 | <0.001 |
| Self-reported anger | 0.66 | 0.06 | <0.001 |
| Anger words | 0.83 | 0.09 | <0.001 |
| Facial anger | 0.93 | 0.10 | <0.001 |
| Covariances | | | |
| $CG_{T1}$, $RV_{T1}$ | 1.48 | 0.18 | <0.001 |
| $CG_{T1}$, $ER_{T1}$ | −0.98 | 0.10 | <0.001 |
| $RV_{T1}$, $ER_{T1}$ | −3.01 | 0.32 | <0.001 |
| $RV_{T2}$, $ER_{T2}$ | −1.67 | 0.21 | <0.001 |
| $CG_{T2}$, $RV_{T2}$ | 0.64 | 0.09 | <0.001 |
| $CG_{T2}$, $ER_{T2}$ | −0.48 | 0.06 | <0.001 |
| $CG_{T2}$, self-reported anger | 0.05 | 0.03 | 0.098 |
| $CG_{T2}$, anger words | 0.01 | 0.04 | 0.879 |
| $CG_{T2}$, facial anger | 0.04 | 0.04 | 0.336 |
| Self-reported anger, anger words | 0.18 | 0.05 | 0.001 |
| Self-reported anger, facial anger | 0.09 | 0.06 | 0.110 |
| Anger words, facial anger | 0.09 | 0.07 | 0.182 |

Coefficients are unstandardized.

## Other Supporting Information Files

SI Appendix (PDF)
Dataset S1 (XLSX)