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The function of love: A signaling-to-alternatives account of the commitment device hypothesis

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ABSTRACT

Love is commonly hypothesized to function as an evolved commitment device, disincentivizing the pursuit of romantic alternatives and signaling this motivational shift to a partner. Here, we test this possibility against a novel signaling-to-alternatives account, in which love instead operates by dissuading alternatives from pursuing oneself. Overall, we find stronger support for the latter account. In Studies 1 and 2, we find that partner quality

Close relationships
Signaling theory

relative to alternatives positively predicts feelings of love, and love fails to mitigate the negative effects of desirable alternatives on relationship satisfaction—contradicting the classic commitment device account. In Study 3, using a longitudinal design, we replicate these effects and find that changes in partner quality relative to alternatives predict changes in love over time. In Study 4, we replicate the relationship between love and relative partner quality across 44 countries. In Study 5, we find a nearly one-to-one correspondence between the extent to which partner-directed actions are diagnostic of love and reductions in romantic alternatives' attraction to the actor. These results suggest that love may not act as a commitment device in the classic sense by disincentivizing the pursuit of alternatives but by disincentivizing alternatives from pursuing oneself.

Unlike all other great apes, humans engage in long-term pair bonding, remaining with the same mate for years or decades at a time (Gavrilets, 2012). Romantic love clearly plays an important role in the proximate development of long-term romantic relationships and has likely done so both across cultures and throughout recorded history (Gottschall, 2008; Jankowiak & Fischer, 1992). Nonetheless, the ultimate function of love remains unclear: What problems, if any, was romantic love designed to solve, and how has this function shaped its design?

To date, the literature on the evolved function of love has been dominated in large part by a single account, commonly referred to as the commitment device hypothesis (Bode & Kushnick, 2021; Campbell & Loving, 2016; Frank, 1988; Gonzaga, Haselton, Smurda, Sian Davies, & Poore, 2008). According to this view, as originally articulated by Frank (1988), love is designed to operate as a *commitment device* which stabilizes romantic relationships by disincentivizing the pursuit of romantic alternatives and signaling this motivational shift to a partner.

Here, using tests across five studies, we suggest that love may not function as a commitment device in this traditional sense. We begin by offering a summary of the commitment device hypothesis and the corresponding evidence for and against it. We go on to describe a novel commitment device account and suggest that romantic love, rather than disincentivizing one's own pursuit of alternatives, may disincentivize alternatives from pursuing oneself.

1. Frank (1988)'s classic commitment device hypothesis

Romantic love has been defined in a wide variety of ways by both theorists and poets since antiquity. Here, we adopt a broad definition in line with both Frank (1988) and psychological theorists (Sternberg, 1997) of romantic love as a positive emotion toward partners characterized, in part, by feelings of passion, intimacy, and/or commitment.

According to the classic commitment device hypothesis, love is an adaptation designed, in part, for motivating complete or partial foreclosure on romantic alternatives (Campbell & Loving, 2016; Frank, 1988). Frank (1988) illustrated the commitment device hypothesis with an analogy to a rental market. If both tenants and property owners could search the rental market optimally, finding an apartment would be relatively easy; each tenant would choose to rent from the best available property owner who considers them the best tenant in return, and both tenants and property owners would be content in the knowledge that no superior alternatives were available. In the real world, however, search is constrained: Markets are often too large to search exhaustively, prices may change, and the desirability of any given option may shift over time.

These constraints on search create a *commitment problem*. For example, it is in the property owner's best interest, all else equal, to rent their apartment to the highest-paying tenant available, and to evict their current tenant once a sufficiently higher-paying offer comes along. Similarly, it is in a tenant's best interest, all else equal, to select an apartment at the best available price, and to move once a sufficiently more affordable option of similar quality becomes available. Consequently, a rental market in which everyone doggedly pursued their own self-interest would ultimately collapse because neither tenants nor property owners could trust one another to commit long enough to make a rental relationship worthwhile.

This crisis is averted by the rental lease. Upon finding a suitable match, the property owner and tenant sign a mutually binding contract locking them into a rental relationship at a fixed price and for a fixed duration—a contract which, if broken, carries hefty fees and penalties. In this way, the lease solves the commitment problem by operating as a *commitment device*, raising the costs of pursuing alternative rental relationships.[1] In so doing, the lease ensures commitment, behaviorally, to the rental relationship by forcing each party to foreclose on available alternatives.

What does any of this have to do with love? According to Frank (1988), rental markets and mating markets pose similar challenges. On the mating market, it is in each person's self-interest to remain with a partner only so long as they are the highest quality partner available to them. A rational agent would dissolve their relationship each and every time a superficially superior and mutually interested alternative became available (after factoring in exit costs). Yet, people in a market full of self-interested partners would have no reason to take on the risks inherent in starting a relationship. Frequently being forced to switch from one long-term relationship to another wastes valuable resources, such as the time involved in search, the investment needed in each partner, and so on. Why begin a long-term relationship if your partner will leave you as soon as they discover a marginally superior romantic alternative? In this way, long-term mating markets, like long-term rental markets, would likely collapse in the absence of a commitment device locking partners together—regardless of whether the relationship turned out to be optimal.

According to Frank (1988), love operates as this commitment device, motivating commitment to a partner on an *irrational* basis by decreasing motivations to pursue alternatives. By hypothesis, a person motivated by love may more easily establish a relationship because their prospective partners can trust them to remain committed even in the face of temptation from alternatives. That is, an individual who decides to commit to a partner solely because that person is the rationally superior option in the moment cannot be trusted to remain committed. However, an individual whose decision is irrationally rooted in love can be trusted to remain committed even if a partner's relative desirability changes. As Frank (1988) writes: "If your wife married you merely because you offered the most favorable exchange possibilities, she would quickly leave you if Tom Selleck bought the house next door and announced his availability…But if she married you because she loved you, there would be at least a reasonable chance she would remain" (p. 196).

Some evidence is, indeed, consistent with the hypothesis that love acts as a commitment device in this classic sense. For instance, Gonzaga et al. (2008) found that participants primed with feelings of romantic

[1] For something to qualify as a commitment device, it must disincentivize or directly prevent the pursuit of alternatives to align behavior with a target outcome (Bryan, Karlan, & Nelson, 2010). For instance, a fridge lock with a hard-to-reach key operates as a commitment device by disincentivizing (or, in some cases, entirely preventing) the consumption of unhealthy alternatives, "committing" an individual, behaviorally, to their diet. Importantly, a commitment device may or may not be associated with subjective feelings of commitment—a point on which Frank (1988)'s commitment device hypothesis is silent.

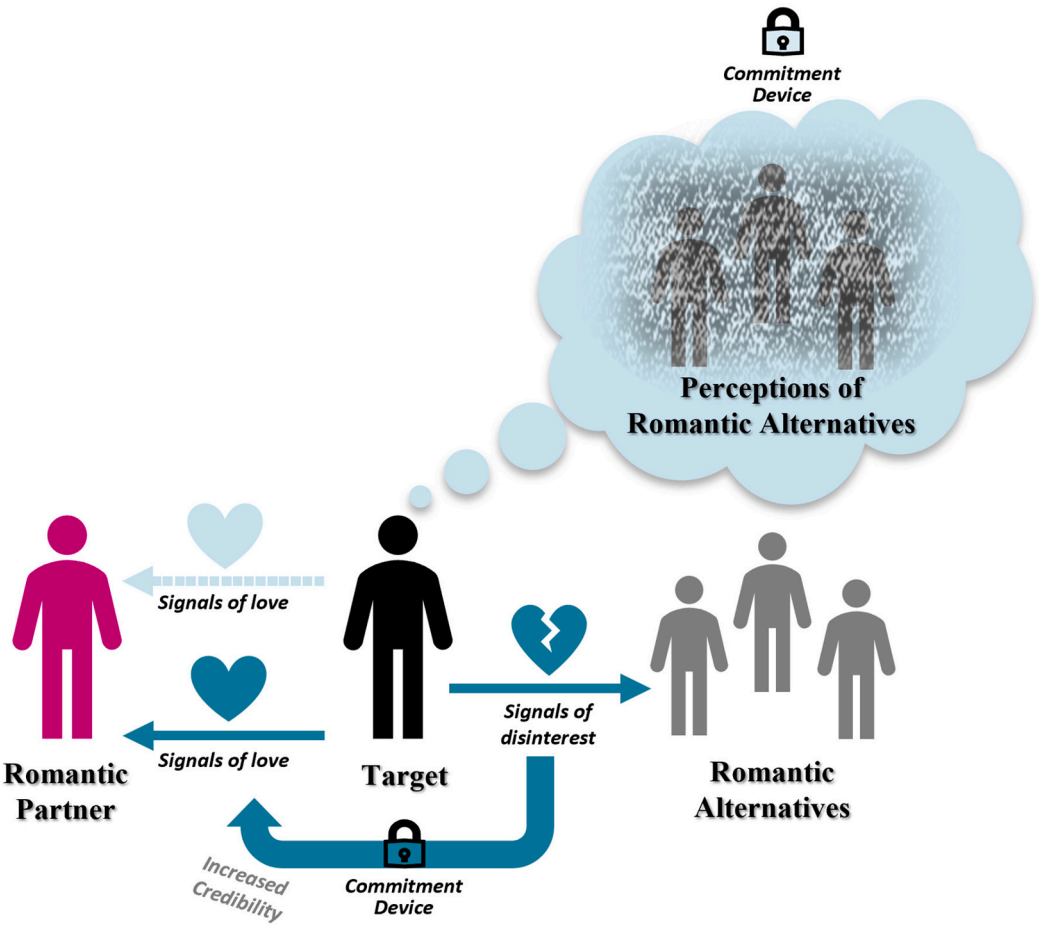

Fig. 1. Two variations of the commitment device hypothesis.
Note. Frank (1988)'s classic commitment device hypothesis (shown in light blue and dotted lines) suggests that love operates as a psychological commitment device, distorting perceptions of romantic alternatives (or otherwise disincentivizing *one's own* pursuit of these alternatives) and signaling this motivational shift to a partner through acts of love. The signaling-to-alternatives commitment device hypothesis (shown in dark blue and solid lines) suggests that love operates as a commitment device by signaling to these alternatives directly, disincentivizing *their* pursuit of oneself to more credibly signal commitment to a partner.

love more successfully suppressed thoughts of an attractive alternative than control participants. In a similar vein, Maner, Rouby, and Gonzaga (2008) found that participants primed with feelings of love showed reductions in attention to attractive, opposite-sex photographs in a visual dot-probe task. And in studies of "love acts," Buss (1988) found that participants nominated behaviors such as "*She [he] gave up going out with other guys [girls]*" as central to, and indicative of, someone being in love.

2. Alternatives and relationship (dis)satisfaction

These lines of work lend some support to Frank (1988)'s original commitment device hypothesis. Nonetheless, a critical line of evidence casts doubt on the possibility that romantic love disincentivizes the pursuit of alternatives directly: Namely, those with higher-quality alternatives report lower satisfaction in their relationships (Conroy-Beam, Goetz, & Buss, 2016; Le & Agnew, 2003; Rusbult, Martz, & Agnew, 1998), and satisfaction appears to show a moderate-to-high to correlation with love across studies (Masuda, 2003). Importantly, low levels of relationship satisfaction also appear to motivate the pursuit of these alternatives, predicting infidelity (Shackelford, Besser, & Goetz, 2008), flirtation with others (O'Farrell, Rosenthal, & O'Neal, 2003), and increased interest in relationship termination (LeBel & Campbell, 2009). Put differently, as romantic alternatives become more appealing, people become both less satisfied with their relationships and more willing to abandon them in favor of these alternatives.

On its face, this collection of facts suggests a potential contradiction: Whereas Frank's classic commitment device hypothesis of love predicts that love disincentivizes the pursuit of alternatives, research suggests that relationship satisfaction—a construct well-known to be correlated with love—is acutely sensitive to the quality of alternatives and motivates their pursuit. Understanding the state of the commitment device hypothesis, and the ultimate function of romantic love, requires resolving this apparent contradiction. Here, we consider two hypotheses that may potentially do so.

3. Romantic love as a moderator

One possible resolution, consistent with Frank (1988)'s original commitment device hypothesis, is that the known relationship between the quality of alternatives and relationship satisfaction is attenuated by romantic love. That is, if love is a commitment device as described by Frank (1988), it may "shield" relationship satisfaction against the psychological allure of high-quality alternatives; consequently, satisfaction may remain high among those most in love even in the face of appealing alternatives. Although this moderation account was not specified by Frank (1988) directly, it would successfully reconcile the claim that love functions to decrease interest in alternatives with the existing body of research on the negative association between the quality of available alternatives and relationship satisfaction.

4. The signaling-to-alternatives commitment device hypothesis

A more radical possibility is that love does not disincentivize one's pursuit of romantic alternatives in the first place. Importantly, Frank (1988)'s classic commitment device hypothesis implies multiple subsidiary hypotheses about love's functional design. In particular, the commitment device hypothesis suggests that love (A) helps to stabilize commitment to romantic relationships by (B) operating as a psychological commitment device, decreasing internal motivations to pursue romantic alternatives, and (C) signaling this decreased motivation to a partner (for a discussion, see Gonzaga & Haselton, 2008).[2]

One possibility, then, is that love may fulfill (A) and (C)—stabilizing commitment and signaling commitment intent to a partner—without intervening on internal motivations to pursue alternatives (B). An adaptation which motivated commitment primarily by regulating intrapsychic responses to alternatives and communicating this purely internal shift to partners could be susceptible to cheaters who might later change their minds. However, love could still successfully stabilize commitment, without producing any psychological changes in responses to alternatives, if the behaviors it elicits carried real-world costs—that is, if acts of love could serve as *credible* signals of commitment intentions.

Signaling theory suggests that signals may attain credibility by producing a cost which only honest signalers can afford (Roberts, 2020). For instance, some prey animals engage in stotting behavior, jumping in the air when a predator is nearby to signal their ability to run (Fitzgibbon & Fanshawe, 1988). Although many unhealthy animals could engage in stotting, doing so would be extremely risky in the event that a predator is undeterred; only a truly healthy animal could afford to waste energy immediately before they may need to escape.

In a similar vein, signals of love could attain credibility by producing costs which only those who are genuinely committed to a relationship could afford to pay. For instance, love could motivate the production of a high, initial cost—such as a lavish gift (e.g., Roberts, 2020)—or continually ongoing costs, such as repeated selfless investments in a partner's welfare (e.g., Quillien, 2020). In either case, only an individual who genuinely intends to remain in the long-term could expect to reap maximal returns on these investments (Quillien, 2020). Indeed, any behavior that imposes a cost affordable only by those genuinely interested in commitment could serve as a credible signal of commitment intent and therefore help to solve the commitment problem.

However, a signal of long-term interest is not the same as a signal of long-term *exclusivity:* An expensive gift given in private, for example, provides little guarantee that one's interests are exclusive. Even an individual who genuinely intends to remain with one partner could still pursue additional partners on the side (e.g., through affairs). Here, we propose one class of signals which might be particularly useful for ensuring exclusive long-term commitment: signals of commitment to both a partner *and alternatives*.

Consider, for instance, a recent real-world example: At the 2024 Paris Olympics, former Olympian Liu Yuchen publicly proposed to his romantic partner. Not only was this a very public gesture broadcast, quite literally, to the entire world, but Yuchen proposed with a ring from Darry Ring—a company which allows customers to purchase only one engagement ring in their lifetime. This gesture provides a credible signal of Yuchen's commitment intent not because it changes Yuchen's internal psychological motivations (it does not), but because everyone now knows that they can never receive such a ring from Yuchen. Only a person truly interested in committing to a partner over alternatives could afford to foreclose on these alternatives in such a drastic manner. Even if Yuchen decides later that he would rather pursue someone else, he has nonetheless made it harder for himself to do so by broadcasting his singular interest in his current partner over everyone else. And if Yuchen attempts to tip off an alternative by explaining that his signal was disingenuous, the commitment problem simply re-emerges: His chosen alternative is unlikely to pursue him in return because they now know that his professions of commitment can no longer be trusted.

Importantly, by hindering his ability to pursue anyone else, Yuchen has also made himself *rationally* more valuable to his partner. Over time, as signals of love and disinterest in alternatives mutually escalate between Yuchen and his partner, both partners may become uniquely valuable to one other, rendering each party the rationally superior choice for the other relative to available alternatives. Irrational psychological shifts in how Yuchen or his partner evaluate alternatives—though predicted by Frank (1988)'s classic commitment device hypothesis—may not actually be necessary.

In short, then, love may serve a commitment device function by motivating the production of signals which reduce alternatives' interest in pursuing oneself, and, in so doing, need not intervene on internal motivations at all. In this view, the causal arrow through which love motivates commitment is directly reversed: Rather than disincentivizing one's own pursuit of alternatives, love may disincentivize these alternatives from pursuing oneself. To distinguish this possibility from the classic commitment device hypothesis, we refer to it as the *signaling-to-alternatives commitment device hypothesis* (or simply the *signaling-to-alternatives hypothesis*; see Fig. 1).

If, in fact, this signaling-to-alternatives hypothesis were true, and love honestly signaled commitment to both one's partner and alternatives, it suggests a critical prediction: The more strongly an action is diagnostic of love for one's partner, the more strongly it should dissuade romantic alternatives from pursuing oneself. We return to this possibility in Study 5.

5. The relationship between love and high-quality alternatives

In addition to these specific predictions unique to each hypothesis, Frank (1988)'s classic commitment device hypothesis and the signaling-to-alternatives commitment device hypothesis make competing predictions about the association between romantic love and high-quality romantic alternatives relative to one's partner.

If, as the classic commitment device hypothesis suggests, romantic love is an adaptation well-designed for reducing the temptations posed by high-quality alternatives, it should increase, or at least hold constant, as higher-quality alternatives become available. Just as a fridge lock which became easier to open when the fridge was full of high-calorie foods would not reduce temptations to cheat on one's diet, a love adaptation designed to weaken in intensity precisely when high-quality alternatives are more readily available would not reduce temptations to pursue them. Although a commitment device need not prevent all temptation in order to be effective, a well-designed commitment device should not decrease interest in alternatives *only* when these alternatives are already unappealing.[3]

By contrast, the signaling-to-alternatives account proposes that rational disinterest in romantic alternatives motivates honest signals of love. If, as the signaling-to-alternatives hypothesis suggests, love

[2] From Gonzaga and Haselton (2008): "By this account, love acts as a commitment device (e.g., Frank, 1988; Sternberg, 1986) motivating individuals to remain committed to the relationship, signaling this intention between romantic partners, and helping individuals avoid the temptation of attractive alternatives."

[3] Although Frank (1988) did not specify this prediction directly, it follows naturally from his claim that romantic love is an adaptation well-designed for reducing interest in romantic alternatives. Adaptationist perspectives suggest that one may attempt to identify adaptations by testing for evidence that a trait in question performs its hypothesized function improbably well—too well, in fact, to have arisen by chance alone (e.g., Tooby & Cosmides, 1992). If love decreases precisely when it is needed most, this would not be consistent with Frank (1988)'s claim that it operates as an adaptation for preventing temptations to defect to these alternatives.

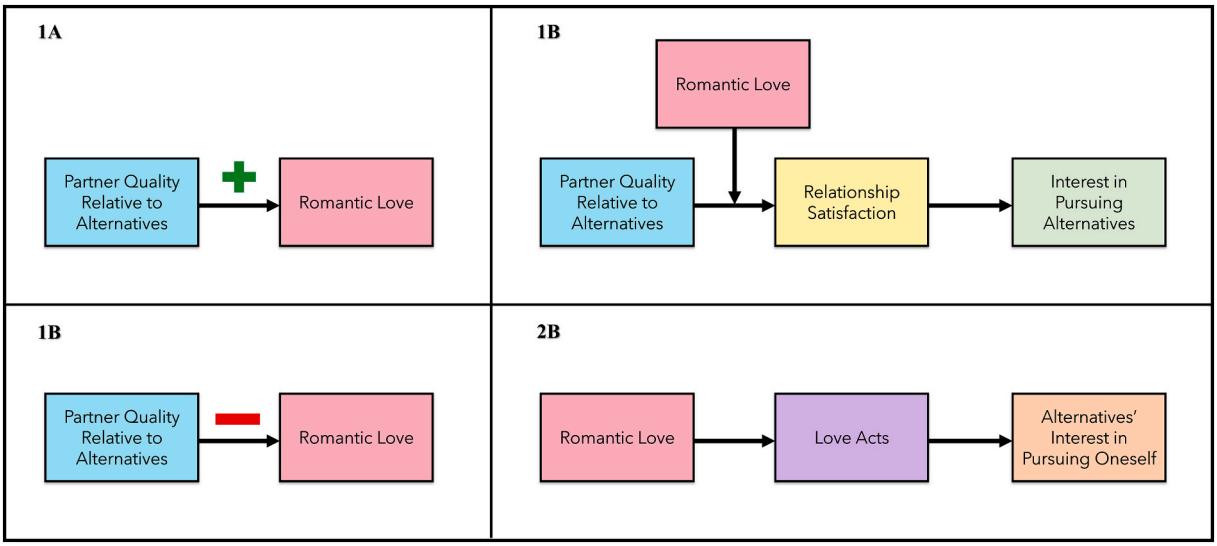

Fig. 2. Predictions of Frank (1988)'s classic commitment device hypothesis and the signaling-to-alternatives hypothesis.
Note. A depiction of the key predictions made by the classic commitment device hypothesis (1) and the signaling-to-alternatives hypothesis (2).

motivates signals of commitment on a purely rational basis, it should decrease in intensity as more high-quality alternatives become available. That is, when one's partner is the rationally superior option relative to available alternatives, love may be expected to increase, honestly signaling commitment to this partner and signaling disinterest to these lower-quality alternatives. The predictions associated with each of these hypotheses are shown in Fig. 2.

6. The present studies

Here, we use measures of partner quality relative to alternatives, relationship satisfaction, and romantic love to compare the classic commitment device hypothesis and the signaling-to-alternatives hypothesis across five studies. These two accounts make several divergent predictions.

First, the classic commitment device hypothesis and the signaling-to-alternatives commitment device hypothesis make competing predictions about the effect of high-quality alternatives on feelings of romantic love. The classic commitment device hypothesis suggests that love is designed to protect against the temptations posed by high-quality alternatives. If love is to perform this function improbably well, levels of love should increase (or hold constant) as the number of appealing alternatives to one's partner increases. By contrast, the signaling-to-alternatives hypothesis suggests that those in love rationally signal their interest in committing to a relationship. If so, love should *decrease* as the number of high-quality alternatives relative to one's partner increases.

Second, Frank (1988)'s classic commitment device hypothesis would seem to make a specific prediction about the role of love in the well-established negative association between relationship satisfaction and the quality of available alternatives. In particular, this hypothesis suggests that the relationship between the quality of available alternatives and relationship satisfaction may be weaker among those most in love. Finally, the signaling-to-alternatives hypothesis makes a specific prediction about how acts of love will be perceived by romantic alternatives: Actions thought to be more diagnostic of love should more strongly reduce alternatives' interest in pursuing the actor.

In Studies 1 and 2, we compared the classic commitment device and the signaling-to-alternatives commitment device accounts across two large samples of romantic dyads. In Study 3, we examined changes in love, changes in satisfaction, and changes in partner quality relative to alternatives using a longitudinal design. In Study 4, we examined the generalizability of the relationship between alternatives and romantic love by examining participants across 44 countries around the world. And in Study 5, we tested the signaling-to-alternatives commitment device account more directly by examining interest in potential mates who appear to be signaling love toward someone else.

7. Study 1

In Study 1, we used measures of love and relationship satisfaction to compare the classic commitment device hypothesis and the signaling-to-alternatives commitment device hypothesis in a dyadic sample. To assess the quality of one's partner relative to alternatives, we also included a series of questions assessing each participant's ideal partner across 20 traits, their own standing on each trait, and their partner's standing on each trait. We used these scales to compute partner-potential mate value discrepancies (MVDPP), a measure assessing the proportion of alternatives who fit one's preferences less effectively than one's actual partner (for details, see Conroy-Beam, Goetz, & Buss, 2015).

To adjust for the potentially confounding effect of partner idealization (e.g., Murray, Holmes, & Griffin, 1996), we computed MVDPP in two ways. First, we computed MVDPP when averaging between self and partner ratings of a partner's traits. Second, we computed MVDPP when relying exclusively on a *partner's ratings* of their own traits. If the relationship between MVDPP and love remains when relying exclusively on a partner's own ratings of the traits they possess, this relationship is unlikely to be explained entirely by an idealizing effect of love on perceptions of a partner relative to alternatives.

7.1. Method

7.1.1. Participants

Participants were $n = 382$ people who were members of $k = 191$ committed, romantic, heterosexual dyads recruited through Qualtrics's survey panel service. A sensitivity analysis indicated that this sample size gave us 80 % power to detect a correlation of $r = 0.14$. Participants were $M = 49.86$ years old on average ($SD = 14.48$) and had been in their relationships for $Mdn = 13$ years at the time of participation. Participants were removed if they did not indicate that they were in a relationship, if their partner was unavailable to take the survey, if they completed the survey too quickly, or if one or both members of the dyad did not indicate that they were heterosexual. These data were used previously in Conroy-Beam (2021).

7.1.2. Materials

Mate Preferences, Self Traits, and Partner Traits. Participants completed a 20-item mate preference questionnaire on a 7-point scale with bipolar adjectives at each endpoint (e.g., "Very Unkind" and "Very Kind"). Participants used this questionnaire to rate their ideal partner (e.g., "How much should your ideal partner like kids?"), themselves (e.g., "How much do you like kids?"), and their actual romantic partner (e.g., "How much does your romantic partner like kids?").

Relationship Quality. As measures of relationship satisfaction, participants completed the Quality of Marriage Index (Norton, 1983) and the satisfaction subscale of the Perceived Relationship Quality Components questionnaire (Fletcher, Simpson, & Thomas, 2000). These scales were averaged together to create a composite measure of relationship satisfaction ($\alpha = 0.96$). To assess romantic love, participants completed a version of the Triangular Love Scale (Sternberg, 1997), which assesses romantic love across three dimensions: passion, intimacy, and commitment. Due to a clerical error, we administered the 36-item version of the Triangular Love Scale ($\alpha = 0.99$; Sternberg, 1997; see Study 1), rather than the 45-item version (Sternberg, 1997; see Study 2). Because the Triangular Love Scale also measures commitment, analyses across individual subscales and analyses omitting the commitment subscale are included in sections 3 and 6, respectively, of the supplemental materials. The overall pattern of results remained the same.

7.1.3. Data processing

To compute MVDPPs, we first computed mate preference fulfillment as the Euclidean distance between each participant's preferences and each opposite-sex participant's traits. MVDPP was computed for each participant as the percentile rank of their actual romantic partner within this mate preference fulfillment vector (for details, see Conroy-Beam et al., 2016). MVDPP therefore provides an estimate of the proportion of people who would fulfill a given participant's mate preferences more poorly than their current romantic partner. Because both members of the dyad rated their own traits and their partner's traits, we computed these values by averaging self and partner trait ratings. To address the possible confounding effect of idealization on perceptions of one's partner, we also re-fit both models when computing MVDPP exclusively on the basis of a partner's own ratings of their traits.

7.1.4. Data analysis

All variables were standardized prior to running analyses. To directly test the relationship between love and MVDPP, we fit a multilevel model, with participants nested within dyads. The model predicted love from MVDPP, with a random intercept term.

The prediction of Frank (1988)'s classic commitment device moderation hypothesis was also tested using a multilevel model nesting within dyads. This multilevel model predicted relationship satisfaction from MVDPP, love, and their interaction, with a random intercept term.

7.1.5. Results

Descriptive statistics and correlation coefficients are shown in Supplemental Table 1. Because all variables were standardized prior to analyses, coefficient estimates can be interpreted comparably to standardized effect sizes.

First, we examined the relationship between love and MVDPP. Higher values of MVDPP denote fewer high-quality alternatives. MVDPP was a significant positive predictor of love ($\beta = 0.21$, $SE = 0.04$, $p < .001$), supporting the signaling-to-alternatives commitment device hypothesis. More specifically, those participants with higher-quality alternatives reported lower levels of romantic love.

Next, we tested the possibility, suggested by Frank (1988)'s classic commitment device hypothesis, that love moderates the relationship between partner quality relative to alternatives and relationship satisfaction. In this moderation model, love and MVDPP significantly interacted to predict feelings of relationship satisfaction, $\beta = -0.05$, $SE = 0.02$, $p = .013$. Thus, in keeping with the classic commitment device account, love significantly attenuated the relationship between MVDPP and relationship satisfaction. However, a visual inspection of Fig. 3 suggested that, because of the positive correlation between MVDPP and love, few participants experienced both high levels of romantic love and low levels of MVDPP simultaneously. Only 16 % of participants reporting above-mean levels of love also reported below-mean levels of MVDPP. Thus, MVDPP may be unable to predict relationship satisfaction among those high in love because of insufficient variation in MVDPP.

The above analyses relied on a measure of MVDPP which averaged self and partner ratings of a partner's traits. To test against the possibility that the relationship between love and MVDPP is attributable to those in love idealizing the traits of their partner, we re-examined this relationship when computing MVDPP exclusively using a partner's own ratings of their traits. MVDPP once again positively predicted romantic love, $\beta = 0.13$, $SE = 0.04$, $p = .002$. In the classic commitment device moderation model, love did not significantly interact with MVDPP to predict feelings of relationship satisfaction when MVDPP was based on partner ratings, $\beta = -0.02$, $SE = 0.02$, $p = .283$. Thus, these results suggest that the positive relationship between MVDPP and romantic is unlikely to be entirely attributable to a blinding effect of love on perceived partner quality relative to alternatives.

7.1.6. Discussion

In Study 1, we found consistent support for the signaling-to-alternatives commitment device hypothesis and only mixed support for the classic commitment device hypothesis. In particular, feelings of romantic love were *lower* among participants with higher-quality alternatives—precisely those participants whose relationships would most benefit from disinterest in alternatives. Although love did moderate the relationship between the quality of alternatives and satisfaction, this moderation effect was weaker when MVDPP was computed exclusively on the basis of a partner's own ratings of their traits. This pattern of mixed support for the commitment device hypothesis was echoed in two additional studies of individual participants using the same measure of love (for details, see supplementary materials, section 4).

Additionally, using the dyadic nature of Study 1, we also provided some evidence against the possibility that the relationship between MVDPP and love stems exclusively from those in love idealizing the traits of their partner. The relationship between MVDPP and romantic love remained significant even when computing MVDPP on the basis of a partner's own ratings of their standing on each trait. As a result, this relationship appears to be attributable to an effect of relative partner quality on feelings of romantic love—rather than an effect of love on perceptions of relative partner quality.

Overall, Study 1 provided strong support for the signaling-to-alternatives commitment device hypothesis and mixed support for the classic commitment device hypothesis. However, this study relied on a specific measure of love: the Triangular Love Scale. Study 2 was therefore conducted to assess the generalizability of these results to another operationalization of romantic love.

8. Study 2

Given the mixed results for the classic commitment device hypothesis in Study 1, Study 2 examined love using an alternative measure: the love subscale of the Perceived Relationship Quality Components (PRQC) Inventory (Fletcher et al., 2000). Doing so allowed us to examine whether evidence for the two hypotheses generalized across multiple measures of love.

8.1. Method

8.1.1. Participants

Participants were $n = 1044$ people who were members of $k = 522$ committed, heterosexual, romantic dyads recruited through Qualtrics's

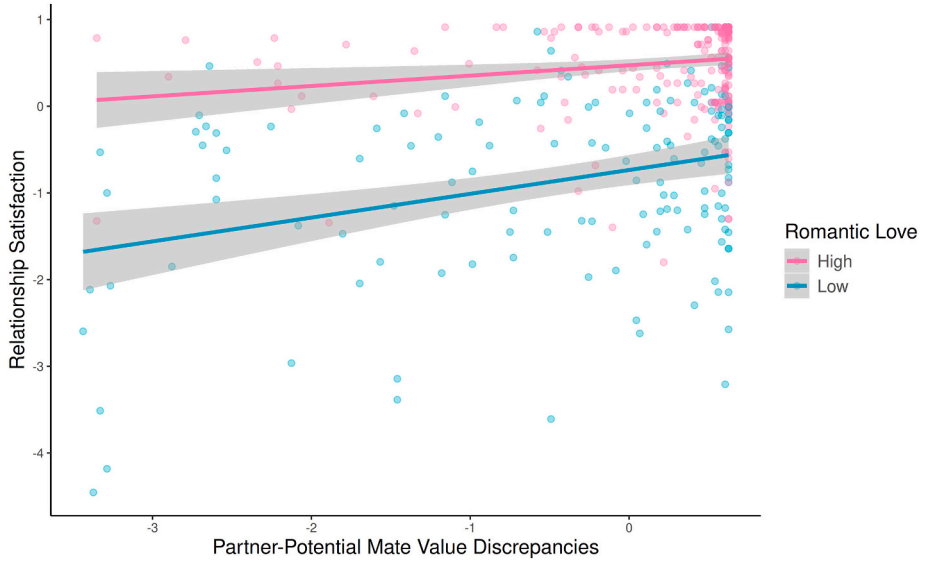

Fig. 3. Love, relationship satisfaction, and partner-potential mate value discrepancies (MVDPP).
Note. Relationship satisfaction as a function of partner-potential mate value discrepancies (MVDPP) and romantic love in the commitment device hypothesis. Responses above the mean are shown in pink, and responses below the mean are shown in blue.

survey panel service. A sensitivity analysis indicated that this sample size gave us 80 % power to detect a correlation of $r = 0.09$. Participants were $M = 56.9$ years old on average ($SD = 14$) and had been in their relationship for $Mdn = 27$ years at the time of their participation. Participants were removed because they were not in a heterosexual relationship, because their partner was unavailable to take the survey, because they failed an attention check, or because they completed the survey too quickly.

8.1.2. Measures

Partner, Self, and Ideal Partner Traits. Participants completed a 31-item mate preference questionnaire. This questionnaire assesses 15 traits, each assessed with two questions, and preferred partner age. As in Study 1, participants rated themselves, their actual mate, and their ideal mate along each trait dimension.

Relationship Quality. The love subscale of the PRQC was used as a measure of romantic love (Fletcher et al., 2000). This is a brief, 3-item measure assessing how much one loves, cherishes, and adores their partner ($\alpha = 0.94$). Relationship satisfaction was measured using the same materials as those used in Study 1 ($\alpha = 0.98$).

8.1.3. Data processing

As in Study 1, MVDPP values were calculated using a Euclidean distance function.

8.1.4. Data analysis

Analyses performed were identical to those performed in Study 1. All variables were standardized prior to running analyses.

8.1.5. Results

Descriptive statistics and correlation coefficients are shown in Supplemental Table 3. Because all variables were standardized prior to analyses, coefficient estimates can be interpreted comparably to standardized effect sizes.

As in Study 1, we first examined the relationship between love and MVDPP. MVDPP was a significant and positive predictor of love ($\beta = 0.19$, $SE = 0.02$, $p < .001$), supporting the signaling-to-alternatives commitment device hypothesis. Participants with higher-quality alternatives reported lower levels of romantic love.

Next, we examined the moderation account predicted by the classic commitment device hypothesis. In this model, contrasting with the results found in Study 1, love and MVDPP did not significantly interact to predict relationship satisfaction, $\beta = -0.01$, $SE = .01$, $p = .226$. The relationship between satisfaction and MVDPP was not significantly weaker among those more in love with their partner.

To fully replicate Study 1 and rule out the potentially confounding effects of partner idealization, we re-ran these analyses when relying exclusively on partners' own ratings of their traits to compute MVDPP. The direct effect of MVDPP on romantic love remained significant ($\beta = 0.09$, $SE = 0.02$, $p < .001$). We also used partners' ratings of MVDPP to re-examine the moderation model predicted by the classic commitment device hypothesis. Once again, love did not significantly interact with MVDPP to predict feelings of relationship satisfaction, $\beta = -0.001$, $SE = 0.01$, $p = .957$.

8.1.6. Discussion

In Study 2, using an alternative operationalization of love, MVDPP was once again positively associated with love—contradicting the predictions of Frank (1988)'s classic commitment device hypothesis. This effect remained even when computing MVDPP exclusively on the basis of a partner's own ratings of the traits they possess. Also in contrast with Frank (1988)'s hypothesis, love did not significantly interact with MVDPP in predicting satisfaction (though we do note that the p-value was 0.064—close to the arbitrary cutoff of 0.05). Taken together, the results of Studies 1 and 2 more strongly supported the signaling-to-alternatives hypothesis.

Nonetheless, despite the consistency across Studies 1 and 2, these studies looked only at the association between love and MVDPP at a single timepoint. In Study 3, we used a longitudinal design to test the possibility that changes in MVDPP across time are associated with changes in feelings of love.

9. Study 3

Study 3 sought to test the predictions of Frank (1988)'s classic commitment device hypothesis and the signaling-to-alternatives commitment device hypothesis using a longitudinal, dyadic design.

9.1. Method

9.1.1. Participants

Data were collected online from $n = 332$ participants who were

members of $k = 166$ committed, heterosexual, romantic dyads recruited through Qualtrics's survey panel service. Participants were $M = 65.45$ years old on average ($SD = 10.19$) and had been in their relationship for $Mdn = 40$ years at the time of their participation. Participants were removed because they were not in a heterosexual relationship, because their partner was unavailable to take the survey, because they failed an attention check, because they did not complete the survey at both time points, because their relationship ended, or because they finished the survey too quickly. Participants completed the survey at the second timepoint approximately 1 year after the first.

9.1.2. Measures

Participants rated themselves, their partner, and their ideal mate, as well as their feelings of love and satisfaction, at both timepoints using the same materials included in Study 2.

9.1.3. Data processing

As in prior studies, MVDPP values were calculated using a Euclidean distance function. An MVDPP difference score was computed by taking Time 2 MVDPP – Time 1 MVDPP.

9.1.4. Data analysis

All variables were standardized prior to running analyses. Across all analyses, we used multilevel models in which participants were nested within dyads and included a random intercept term.

To examine the relationship between love and MVDPP, we predicted Time 2 love from Time 1 love and the MVDPP difference score. To test the main effect of MVDPP change on satisfaction change, we predicted Time 2 satisfaction from Time 1 satisfaction and the MVDPP difference score. To test the moderation account entailed by the classic commitment device hypothesis, we refit this model in two ways. In the first model, we added Time 1 love as an interaction term with the MVDPP difference score. In the second model, we repeated this analysis with Time 2 love. Both models were examined separately because it is not obvious which measure of love should be expected to moderate the effect of MVDPP on satisfaction. It could be that love at Time 1 has a protective effect, mitigating the effects of subsequent changes in MVDPP. Alternatively, current feelings of love (i.e., love at Time 2) could shield satisfaction from recent decreases in MVDPP. For this reason, we fit two separate models.

9.1.5. Results

Descriptive statistics and correlation coefficients are shown in Supplemental Table 5. All variables were standardized prior to analyses, and, as a result, coefficient estimates can be interpreted comparably to standardized effect sizes.

We began by examining the relationship between love and MVDPP. In contrast with the classic commitment device hypothesis, increases in MVDPP between Times 1 and 2 were associated with increases in love, $\beta = 0.11$, $p < .001$ (Fig. 4). This held true even when using a mate's own ratings of their traits to compute MVDPP, $\beta = 0.14$, $p < .001$. This result indicates that, in keeping with the signaling-to-alternatives hypothesis, participants felt *less* love as their alternatives rose in quality over time relative to their partner.

To examine the classic commitment device's moderation model, we first examined the main effect of change in MVDPP on change in satisfaction. As expected, change in MVDPP was a significant positive predictor of change in satisfaction, $\beta = 0.14$, $p < .001$. However, this relationship was not moderated by feelings of love at Time 1, $\beta = -0.05$, $p = .127$, nor by feelings of love at Time 2, $\beta = 0.01$, $p = .866$. Once again, this remained true even when relying on a partner's own ratings of their traits to compute MVDPP (all $ps > 0.140$).

At the request of a reviewer, we also examined the classic commitment device model when pooling the data across Studies 1–3 to maximize our power to detect an effect. We ran a multilevel model nesting within dyads in which we examined love, MVDPP, and their interaction as predictors of satisfaction, controlling for the love scale used. Because Study 3 was longitudinal, and Studies 1 and 2 were not, we re-ran the analysis when relying on data from Wave 1 and when relying on data from Wave 2. The results of these pooled analyses revealed that the interaction between love and MVDPP did not reach conventional cutoffs for statistical significance even when pooling the data across Studies 1–3—whether using the data from Wave 1 of Study 3, $\beta = -0.02$, $p = .090$, or Wave 2, $\beta = -0.01$, $p = .283$. Thus, even when maximizing our power to detect an interaction, the moderation account predicted by the classic commitment device hypothesis was supported only weakly.

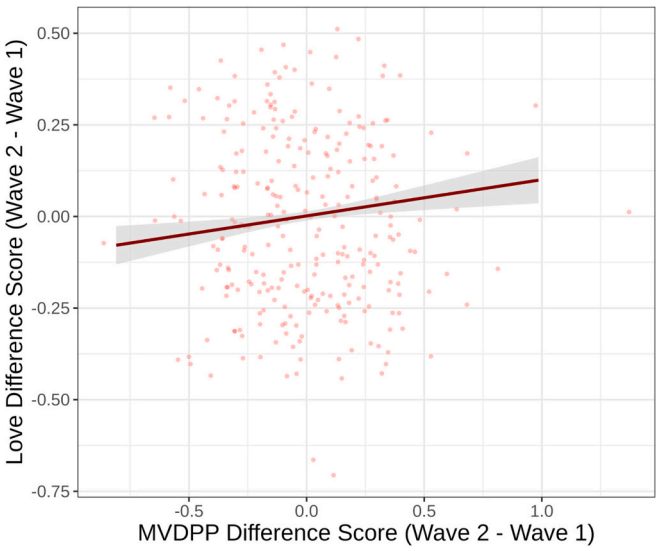

Fig. 4. Changes in romantic love as a function of changes in partner-potential mate value discrepancies (MVDPP).
Note. The relationship between changes in MVDPP and changes in romantic love over the course of a year-long longitudinal study. Data shown in the graph are unstandardized.

9.1.6. Discussion

In Study 3, the classic commitment device hypothesis was once again not supported; changes in MVDPP did not interact with love to predict changes in relationship satisfaction. Moreover, those whose partners went down in quality relative to alternatives over time—who needed a commitment device most urgently—reported *decreases* in romantic love over time. Even when pooling all the data across Studies 1–3 (using only Wave 1 or only Wave 2 measures from Study 3), the interaction predicted by the commitment device model did not reach conventional cutoffs for statistical significance (although it was close). Overall, these results were more consistent with the possibility, suggested by the signaling-to-alternatives hypothesis, that love rationally tracks the quality of a partner relative to available alternatives.

Nonetheless, despite the consistent support for the association between partner quality relative to alternatives and romantic love provided in Studies 1–3, all of these studies were conducted exclusively in the United States. In Study 4, we tested the generalizability of this relationship around the world.

10. Study 4

If the observed relationship between MVDPP and romantic love reflects the operation of systems designed for rationally selecting the highest quality partner, this relationship should generalize across cultures. To this end, Study 4 examined the relationship between MVDPP and romantic love across 44 countries around the world. Due to space limitations, we were unable to include relationship satisfaction in the survey. As a result, the moderation model examined previously could

not be tested in this study.

10.1. Method

10.1.1. Participants

The final sample included $n = 8805$ (4913 female) participants[4] taking part in-person (not online) across 44 countries. Participants were excluded for indicating an age younger than 18 ($n = 369$), not indicating that they are dating or in a relationship ($n = 5924$), residing in a country that did not administer the mate preference questionnaire or the Triangular Love Scale or voluntarily leaving these questions blank ($n = 1346$), or indicating a sex other than male or female ($n = 22$). Each study site collected data from both university and community samples. Due to a lack of records from about half of the sites, there is incomplete information about the percentage of each type of sample. From those sites that did keep records ($n = 3824$, 43.4 %), a little over half of participants were students ($n = 2142$, 56 %). Age of participants ranged from 18 to 87 years old ($Mdn = 27$, $M = 30.6$, $SD = 11$). These data have been used in other work published previously (Conroy-Beam et al., 2019; Conroy-Beam et al., 2019; Kowal et al., 2020; Kowal et al., 2024; Sorokowski et al., 2021; Sorokowski et al., 2023; Walter et al., 2020; Walter et al., 2021). A map of the countries included in this study is depicted in Fig. S1.

10.1.2. Measures

Partner, Self, and Ideal Partner Traits. Participants completed a 5-item questionnaire on their actual long-term mate, their ideal long-term mate, and themselves. Specifically, participants rated themselves and their actual and ideal mates on five traits: kindness, intelligence, health, physical attractiveness, and good financial prospects. All items were rated on bipolar adjective scales ranging from 1 (e.g., very unintelligent) to 7 (e.g., very intelligent).

Love. Participants completed the 45-item version of Sternberg (1997)'s Triangular Love Scale ($\alpha = 0.96$).[5] Analyses which omit the commitment subscale are included in section 6 of the supplemental materials.

10.1.3. Data processing

MVDPP and preference fulfillment were computed using a Euclidean distance function, in keeping with the procedures described in Studies 1 and 2. However, two additional changes were made. First, because the data were collected across cultures, MVDPP was computed exclusively on the basis of potential partners within one's own country. Second, because the data were not dyadic, MVDPP was computed exclusively using one's own ratings of their partner's traits.

10.1.4. Data analysis

Data were analyzed using a multilevel model, with participants nested within country. This multilevel model predicted romantic love from participant MVDPP, with random slope and intercept terms. Romantic love and MVDPP were standardized across countries.

10.1.5. Results

Because all variables were standardized prior to analyses, coefficient estimates can be interpreted comparably to standardized effect sizes. Across cultures, MVDPP positively predicted feelings of love, $\beta = 0.21$, $SE = 0.02$, $p < .001$ (see Fig. 5). Those participants whose partners were higher in quality relative to alternatives reported significantly greater levels of love. The random slope terms ranged from $\beta = 0.08$ in Malaysia to $\beta = 0.34$ in Russia, and the random intercept terms ranged from −0.79 in Pakistan to 0.34 in Slovakia (see Fig. 6). Unstandardized mean levels of romantic love across countries are shown in Fig. S1.

Fig. 5. Romantic love as a function of partner-potential mate value discrepancies (MVDPP).
Note. The relationship between MVDPP and romantic love, aggregating across 44 countries.

10.1.6. Discussion

The key finding from Studies 1 through 3—that the quality of one's partner relative to alternatives is positively associated with romantic love—replicated across 44 countries. Those individuals with more high-quality alternatives reported lower levels of love in every country around the world. This would be a peculiar design feature if, as suggested by Frank (1988), love stabilized commitment by decreasing internal motivations to pursue alternatives. These results are consistent with the suggestion that love rationally tracks the quality of a partner relative to alternatives—rather than altering one's perception of these alternatives through an artificial psychological shift.

11. Study 5

Across Studies 1–4, we did not find strong support for the classic view that love acts as a commitment device by disincentivizing the pursuit of attractive alternatives. Contrary to the hypothesis, those with more high-quality alternatives reported lower levels of both love and satisfaction. Do these findings suggest that love is not, in fact, a commitment device?

Study 5 explored the possibility that behavioral signals of love may stabilize commitment indirectly—without the need for additional adjustments to one's perceptions of, or reactions to, available alternatives. In this view, signals of love reduce the interest of romantic alternatives, honestly signaling one's commitment to a partner. Thus, under this signaling-to-alternatives account, love may not act as a commitment device in the traditional sense—by disincentivizing *one's own* pursuit of romantic alternatives—but by motivating the production of behavioral signals which disincentivize *these alternatives* from pursuing oneself.

To test this possibility, Study 5 asked single participants to evaluate a series of behaviors potentially associated with love in a between-

[4] Because an MVDPP score could not be computed for those participants who skipped all questions pertaining to their own traits or all questions pertaining to their partner's traits, an additional 441 participants were excluded from analyses involving MVDPP values. Love means shown in Fig. S1 include the complete sample ($n = 8805$).

[5] The instructions used in this study asked participants to consider one person they "love or care for deeply," but did not specify that this person had to be a romantic partner. Nonetheless, only $n = 241$ participants rated their relationship with the loved individual as "not at all romantic;" the pattern of results remained unchanged when these participants were excluded.

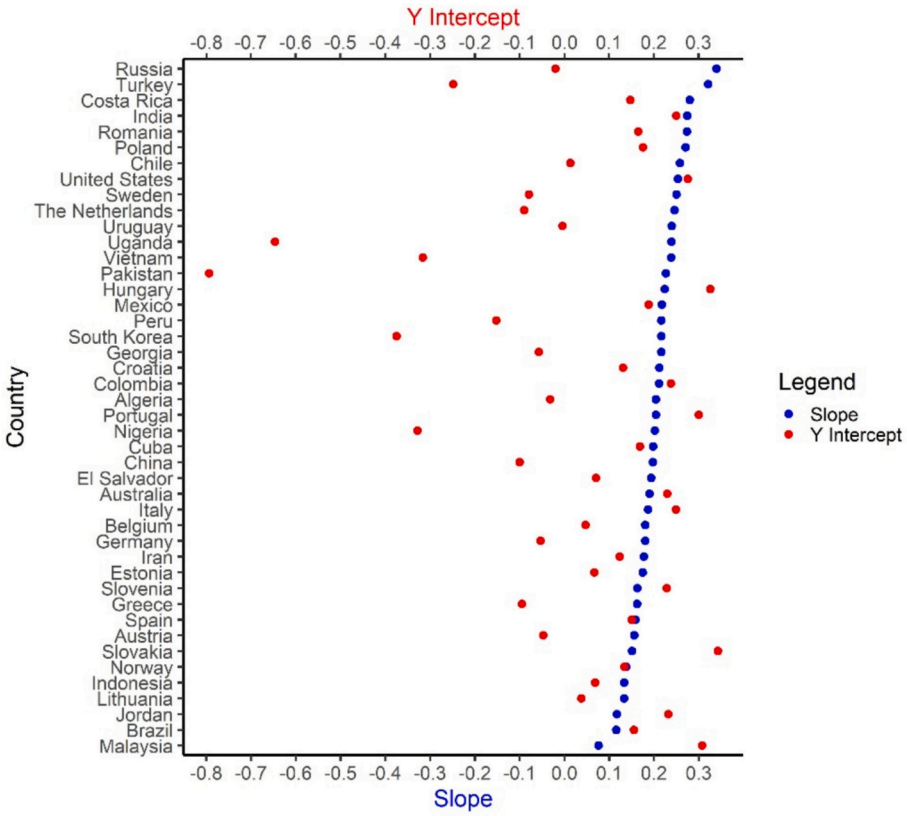

Fig. 6. MVDPP as a function of romantic love in Study 3.
Note. Results of a multilevel model examining the effect of MVDPP on romantic love nested within each country. Countries with low slopes, such as Malaysia, tended to also have high intercepts. One possible explanation for this pattern is that low slopes are attributable to ceiling effects.

subjects design. In the *love condition*, participants rated the extent to which each of these actions communicated feelings of love. In the *attraction* and *pursuit conditions*, participants rated the extent to which each of these acts, when directed toward someone else, would affect their attraction toward, or pursuit of, the target in question. We predicted a close correspondence between the extent to which an action is diagnostic of love and the extent to which that action, when directed toward someone else, would reduce observers' attraction toward, and pursuit of, the target in question.

11.1. Method

11.1.1. Participants

Data were collected online from $n = 253$ single participants (146 female, 5 nonbinary, 2 who preferred not to say) recruited through Prolific. On average, participants were $M = 41.62$ years of age ($SD = 15.39$). Because our analyses only required an average love diagnosticity rating for each item (rather than individual responses from each participant), we recruited fewer participants in the love condition ($n = 53$) than in the attraction condition ($n = 102$) or pursuit condition ($n = 98$). Participants were removed if they failed to correctly complete an attention check, if they did not indicate being single, or if they failed to answer any of the core questions in the condition to which they were assigned.

11.1.2. Measures

Behaviors Associated with Love. To measure behavioral signals of love, we adapted 22 of the items from Buss (1988)'s 40-item scale of love acts. One additional item, writing a song for the target, was created by the authors.

Love, Attraction, and Interest in Pursuit. Participants were randomly assigned to one of three conditions in a between-subjects design. In the love condition, participants considered a target named Alex performing each behavior toward a potential love interest named Taylor. For each behavior, participants rated their confidence that Alex was in love with Taylor given that Alex performed the behavior in question toward Taylor. In the attraction condition, participants rated the extent to which their attraction toward a romantic interest would change if that person performed the behavior in question toward Taylor. In the pursuit condition, participants rated the extent to which their interest in pursuing a romantic interest would change if that person performed the behavior in question toward Taylor. All behaviors were rated on a bipolar scale from 1 (e.g., "I would be extremely confident that Alex is NOT in love with Taylor") to 7 (e.g., "I would be extremely confident that Alex is in love with Taylor).

11.1.3. Data processing and analysis

Data were analyzed using multilevel models nesting within subjects. The multilevel models predicted attraction to the target and interest in pursuing the target across each love act from mean love ratings for each item computed from participants in the love condition, with random intercept terms. For each love act, we computed the mean love rating across subjects. Mean love ratings, attraction ratings, and pursuit ratings were standardized prior to analyses. However, because all conditions used a 7-point scale, we also report the unstandardized slopes in the interest of transparency.

11.1.4. Results

In keeping with a signaling-to-alternatives account of love, the results revealed that love was a significant negative predictor of both attraction to the target, $\beta = -0.30$, $p < .001$, and interest in pursuing the target, $\beta = -0.34$, $p < .001$ (see Fig. 7). When the data were left

unstandardized, the results revealed slopes approaching −1 for both attraction ($b = -0.93$) and pursuit ($b = -1.08$). Thus, these analyses suggest that each 1-point increase in the love conveyed by a given item was associated with an approximately 1-point decrease, on average, in others' pursuit of, and attraction toward, targets performing that behavior toward someone else. In fact, despite the use of a between-subjects design, the item-level correlation between ratings of love and ratings of pursuit and attraction were nearly perfect: $r = -0.91$ for pursuit ratings and $r = -0.85$ for attraction ratings.

11.1.5. Discussion

The results revealed a nearly one-to-one relationship between the perceived magnitude of love conveyed by a given behavior and changes in one's interest in, and attraction toward, a target performing that behavior toward someone else. Specifically, behaviors seen as more strongly diagnostic of love were associated with precise decreases in participants' attraction toward, and interest in pursuing, a target displaying these behaviors toward someone else. In this way, Study 5 provides strong support for the signaling-to-alternatives commitment device hypothesis: love motivates honest signals of commitment to one's partner—and thereby operates as a commitment device—by decreasing the interest of romantic alternatives.

12. General discussion

What is love designed to do? Despite the importance and widespread interest in love and romantic relationships, this question has been surprisingly neglected. To date, the primary hypothesis in the literature has been Frank (1988)'s classic commitment device hypothesis. Borrowed from economics, this hypothesis proposes that love acts as an evolved commitment device, psychologically disincentivizing the pursuit of romantic alternatives (and signaling this motivational change to a partner). While the classic commitment device hypothesis has received some empirical support (e.g., Gonzaga et al., 2008), tests of its predictions are relatively rare. Furthermore, possessing a partner low in quality relative to available romantic alternatives has been repeatedly shown to reduce relationship satisfaction—a construct closely associated with romantic love—and motivate the pursuit of these alternatives (e.g., Rusbult et al., 1998). At first blush, this collection of findings appears inconsistent with the claim that love operates as a psychological commitment device which disincentivizes the pursuit of romantic alternatives.

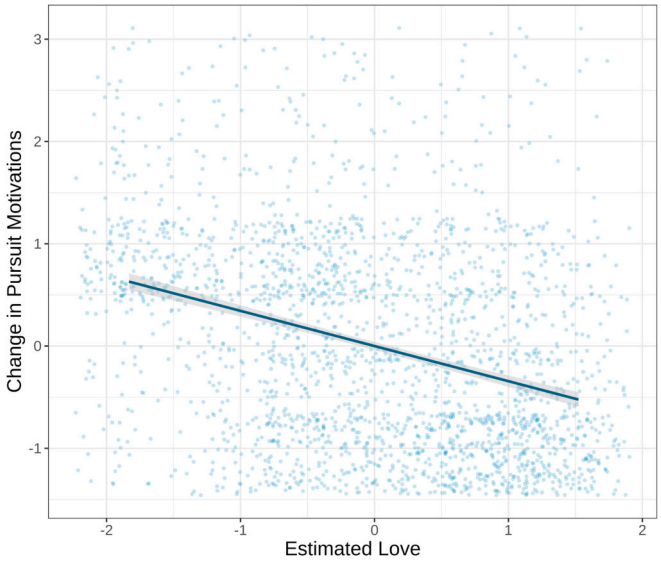

Fig. 7. Motivations to pursue a target as a function of estimated love in another person.

Note. Results of a scatterplot depicting the relationship between ratings of the extent to which one's interest in a target would change if they performed a given love act toward someone else and the estimated magnitude of love conveyed by each act. In keeping with the signaling-to-alternatives hypothesis, the results suggest that behaviors thought to be more diagnostic of love were associated with reductions in the desire to pursue a target when the target directed these behaviors toward someone else.

Here, we tested two possible resolutions of this apparent conflict. One possibility, in keeping with Frank (1988)'s classic commitment device hypothesis, is that love moderates the known relationship between the quality of one's partner relative to alternatives and feelings of relationship satisfaction. A second possibility, which we refer to as the signaling-to-alternatives commitment device hypothesis, suggests that love stabilizes commitment not by disincentivizing one's own pursuit of alternatives but by disincentivizing these alternatives from pursuing oneself.

Across a series of studies, we found stronger support for the latter account. Studies 1 and 2 revealed that, in contrast with Frank (1988)'s classic commitment device hypothesis, the relationship between the partner quality relative to alternatives and relationship satisfaction was not consistently attenuated by romantic love.[6] In Study 3, using a longitudinal design, we again found no evidence of moderation and found that those whose partners decreased in quality relative to alternatives over time reported lower levels of love. Importantly, these effects did not appear to be attributable to a power issue; even when pooling the data across Studies 1–3, the moderation effect predicted by the classic commitment device hypothesis remained non-significant.

In Study 4, using a cross-cultural sample, we found that those whose partners were low in quality relative to alternatives reported lower levels of love across all of the 44 countries in the sample, providing cross-cultural evidence against the classic commitment device hypothesis and supporting the view—suggested by the signaling-to-alternatives commitment device hypothesis—that love rationally tracks the quality of one's partner relative to alternatives. And in Study 5, we found that the extent to which a given behavior was diagnostic of love predicted loss of interest in, and reduced attraction toward, a target directing that behavior toward someone else; this latter phenomenon was not predicted by the classic commitment device hypothesis but directly supports the signaling-to-alternatives commitment device hypothesis introduced here.

Importantly, these effects do not appear to be attributable exclusively to partner idealization. We assessed relative partner quality by computing partner-potential mate value discrepancies (MVDPP), a value which reflects the proportion of romantic alternatives who fit one's preferences less optimally than one's actual partner. In Studies 1 and 2, we found that the positive relationship between partner quality relative to alternatives and romantic love remained even when relying on partner A's ratings of their traits to compute MVDPP and partner B's ratings of love. And in Study 3, using a longitudinal dyadic design, we found that *changes* in partner A's ratings of their quality over time predict *changes* in partner B's feelings of love. Thus, partner idealization did not appear to fully explain the results observed in the present investigation.

In summary, evidence across five studies revealed only mixed support for the classic commitment device hypothesis but strong support for the signaling-to-alternatives commitment device hypothesis: Those with more high-quality alternatives relative to their partner report decreases in love, and acts of love appear to serve as honest signals of commitment

[6] Though Studies 1–4 all tested the moderation relationship predicted by the classic commitment device hypothesis, this relationship was supported only in Study 1 (when using a conventional cutoff for statistical significance); even in this case, it was not clear whether this reflected a true moderation effect or a restriction of range owing to the strong correlations between satisfaction, love, and relative quality of alternatives.

by dissuading alternatives from pursuing oneself. Thus, in contrast with Frank (1988)'s classic commitment device account—suggesting that love may disincentivize one's own pursuit of romantic alternatives—the results of the present studies suggest that, consistent with the signaling-to-alternatives commitment device hypothesis, love may disincentivize alternatives from pursuing oneself.

12.1. A new solution to the commitment problem

This hypothesized shift in the causal arrow of the commitment device hypothesis raises a key, unanswered question: How, under a signaling-to-alternatives account, could the commitment problem be solved? If love does not promote irrational changes in one's evaluations of alternatives, why would a rational agent honestly signal their intention to remain in a relationship in the first place?

Here, we have suggested that mutual signaling may render both partners increasingly valuable to one other over time. Just as many researchers have suggested feedback cycles in partner value and investment (Conroy-Beam, 2021; Murray, Holmes, & Collins, 2006; Tooby & Cosmides, 1996), acts of love could promote commitment through an iterative process of mutual signaling. For instance, partner A's signals of love may honestly signal commitment to B, increasing A's value to B relative to available alternatives. Partner B may now be rationally more inclined to signal love to A, further increasing their value to A and motivating still more signaling from A in return. Through this iterative process, two partners may become increasingly locked in over time, with each party increasingly less likely to succeed in attracting a rival and, as a consequence, increasingly valuable to their partner relative to alternatives. Because each partner genuinely increases in value over time, love may produce signaling and subsequent changes in commitment on a purely rational basis; an irrational, lease-like psychological shift may not be necessary. In this way, love under the signaling-to-alternatives account could solve the commitment problem without requiring artificial shifts in one's evaluations of romantic alternatives.

12.2. Limitations and future directions

Despite the strengths of this research, there were several limitations worth noting. One methodological challenge inherent in testing these models is that the relationship between self-reports of love and partner quality relative to alternatives poses a directionality issue: Love could decrease perceptions of partner quality relative to alternatives, or partner quality relative to alternatives could calibrate love. In Studies 1 and 2, using dyadic datasets, we found that *self*-ratings of one's quality across traits predicted *partner*-ratings of love—suggesting that idealization, though potentially still affecting the ratings of some traits, cannot fully account for the effects observed here.

Additionally, it is possible that the psychological effects suggested by Frank (1988)'s classic commitment device hypothesis do exist in the early stages of relationship formation but wane as commitment is further stabilized by other processes. Such effects would not be observable in the relatively established couples we sampled here, but could be apparent in more nascent relationships. Future research is needed to explore the dynamics of love and commitment over time.

In Study 5, we found promising evidence for a signaling-to-alternatives account of romantic love: The extent to which a behavior was diagnostic of love predicted reductions in attraction toward, and interest in pursuing, a romantic alternative directing these behaviors toward someone else. Although these results are highly suggestive, they represent only a preliminary step in this direction, and more research in this area is needed. For instance, although high-cost signals, such as writing a love ballad, may rarely be performed except by those in love, even those very deeply in love may not always need a signal which is maximally costly. Future research should investigate when those in love are most likely to employ high-cost signals such as these and when lower-cost signals may instead be preferred.

Moreover, whereas we have focused on the potential for *broadcast* signals to stabilize commitment, these need not be the only behaviors motivated by love. For instance, even relationship-internal love acts, such as obsessively doting over a partner, could signal commitment: One cannot be seriously interested in pursuing alternatives when devoting nearly all their time and energy on their beloved. In a similar vein, offers to "run away" with a partner could serve as honest signals of commitment in that a person willing to separate themselves from available alternatives is unlikely to pursue them.

Nonetheless, the possibility remains that some acts of love may arise for reasons not due to signaling. For instance, in a perfectly monogamous relationship, one's own reproductive success is directly tied to the reproductive success of a partner (for a discussion, see Conroy-Beam et al., 2015; Aktipis et al., 2018). Consequently, acts of love which benefit a partner offer indirect fitness benefits to oneself—even when these acts go unnoticed by a partner. Indeed, these shared fitness payoffs could also help to explain the observed association between love and the relative quality of alternatives: As alternatives become harder to attract, acts of love which benefit a partner become increasingly beneficial to oneself. Future research should examine those acts of love unlikely to be explained by signaling alone.

Furthermore, although we have suggested that an artificial psychological shift in one's evaluation of alternatives may not be necessary under a signaling-to-alternatives account, the present results did not test this possibility directly. Consequently, it remains possible that both phenomena—signals directed toward alternatives and artificial psychological shifts in evaluations of these alternatives—may still be occurring.

Finally, whereas we focused our analysis on relationship satisfaction—in light of the large literature on quality of alternatives and satisfaction (e.g., Rusbult et al., 1998)—there also exists a substantial literature on subjective feelings of commitment (e.g., Crawford, Feng, Fischer, & Diana, 2003). Future research would benefit from exploring the relationship between the subjective sense of commitment and putative commitment device adaptations. As a preliminary step in this direction, we examined the commitment device moderation model exploratorily when replacing relationship satisfaction with subjective commitment (see supplementary materials, section 5); the overall pattern of results remained the same.

12.3. Conclusion

The evolved function of romantic love is a surprisingly underexplored question. Here, we compared Frank (1988)'s classic commitment device hypothesis with a novel, signaling-to-alternatives commitment device hypothesis. In contrast with the classic commitment device hypothesis, a positive association emerged between the quality of one's partner relative to alternatives and romantic love across 44 countries and three dyadic samples from the United States. Also in keeping with the signaling-to-alternatives commitment device hypothesis, the extent to which a behavior was diagnostic of love correlated with changes in alternatives' interest in pursuing the performer. These results raise the intriguing possibility that romantic love may not operate as a commitment device in the classic sense: Rather than disincentivizing one's *own* pursuit of alternatives, acts of love may disincentivize *alternatives* from pursuing oneself.

Data availablity

All analyses were conducted using R version 4.1.2. The data, processing scripts, analysis scripts, and survey materials associated with this research are available on the Open Science Framework: https://osf.io/gfeqr/?view_only=16ef6d1cdb5a4dd2bf32d33114830b48.

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The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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Appendix A. Supplementary data

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References

Aktipis, A., Cronk, L., Alcock, J., Ayers, J. D., Baciu, C., Balliet, D., … Winfrey, P. (2018). Understanding cooperation through fitness interdependence. *Nature Human Behaviour, 2*(7), 429–431. https://doi.org/10.1038/s41562-018-0378-4

Bode, A., & Kushnick, G. (2021). Proximate and ultimate perspectives on romantic love. *Frontiers in Psychology, 12*, 1088. https://doi.org/10.3389/fpsyg.2021.573123

Bryan, G., Karlan, D., & Nelson, S. (2010). Commitment devices. *Annual Review of Economics, 2*, 671–698. https://doi.org/10.1146/annurev.economics.102308.124324

Buss, D. M. (1988). Love acts. The evolutionary biology of love. In R. J. Sternberg, & M. L. Barnes (Eds.), *Psychology of love* (pp. 100–118). New Haven: Yale University Press.

Campbell, L., & Loving, T. J. (2016). Love and commitment in romantic relationships. In *The handbook of evolutionary psychology* (pp. 1–17). John Wiley & Sons, Ltd.. https://doi.org/10.1002/9781119125563.evpsych118

Conroy-Beam, D. (2021). Couple simulation: A novel approach for evaluating models of human mate choice. *Personality and Social Psychology Review, 25*(3), 191–228. https://doi.org/10.1177/1088868320971258

Conroy-Beam, D., Buss, D. M., Asao, K., Sorokowska, A., Sorokowski, P., Aavik, T., … Zupančič, M. (2019). Contrasting computational models of mate preference integration across 45 countries. *Scientific Reports, 9*(1), 1–13. https://doi.org/10.1038/s41598-019-52748-8

Conroy-Beam, D., Goetz, C. D., & Buss, D. M. (2015). Why do humans form long-term mateships? An evolutionary game-theoretic model. In , *Vol. 51. Advances in experimental social psychology* (pp. 1–39). Academic Press.

Conroy-Beam, D., Goetz, C. D., & Buss, D. M. (2016). What predicts romantic relationship satisfaction and mate retention intensity: Mate preference fulfillment or mate value discrepancies? *Evolution and Human Behavior, 37*(6), 440–448. https://doi.org/10.1016/j.evolhumbehav.2016.04.003

Conroy-Beam, D., Roney, J. R., Lukaszewski, A. W., Buss, D. M., Asao, K., Sorokowska, A., … Zupančič, M. (2019). Assortative mating and the evolution of desirability covariation. *Evolution and Human Behavior, 40*(5), 479–491. https://doi.org/10.1016/j.evolhumbehav.2019.06.003

Crawford, D. W., Feng, D., Fischer, J. L., & Diana, L. K. (2003). The influence of love, equity, and alternatives on commitment in romantic relationships. *Family and Consumer Sciences Research Journal, 31*(3), 253–271. https://doi.org/10.1177/0095399702250182

Fitzgibbon, C. D., & Fanshawe, J. H. (1988). Stotting in Thomson's gazelles: An honest signal of condition. *Behavioral Ecology and Sociobiology, 23*, 69–74.

Fletcher, G. J., Simpson, J. A., & Thomas, G. (2000). The measurement of perceived relationship quality components: A confirmatory factor analytic approach. *Personality and Social Psychology Bulletin, 26*(3), 340–354. https://doi.org/10.1177/0146167200265007

Frank, R. H. (1988). *Passions within reason: The strategic role of the emotions*. WW Norton &Co.

Gavrilets, S. (2012). Human origins and the transition from promiscuity to pair bonding. *Proceedings of the National Academy of Sciences, 109*(25), 9923–9928. https://doi.org/10.1073/pnas.1200717109

Gonzaga, G. C., & Haselton, M. G. (2008). The evolution of love and long-term bonds. In *Social relationships* (pp. 39–53). Psychology Press.

Gonzaga, G. C., Haselton, M. G., Smurda, J., Sian Davies, M., & Poore, J. C. (2008). Love, desire, and the suppression of thoughts of romantic alternatives. *Evolution and Human Behavior, 29*(2), 119–126. https://doi.org/10.1016/j.evolhumbehav.2007.11.003

Gottschall, J. (2008). Romantic love: A literary universal? In J. Gottschall (Ed.), *Literature, science, and a new humanities. Cognitive studies in literature and performance*. Palgrave Macmillan. https://doi.org/10.1057/9780230615595_8.

Jankowiak, W. R., & Fischer, E. F. (1992). A cross-cultural perspective on romantic love. *Ethnology, 31*(2), 149–155. https://doi.org/10.2307/3773618

Kowal, M., Sorokowski, P., Dinić, B. M., Pisanski, K., Gjoneska, B., Frederick, D. A., … Sternberg, R. J. (2024). Validation of the short version (TLS-15) of the triangular love scale (TLS-45) across 37 languages. *Archives of Sexual Behavior, 53*(2), 839–857. https://doi.org/10.1007/s10508-023-02702-7

Kowal, M., Sorokowski, P., Sorokowska, A., Dobrowolska, M., Pisanski, K., Oleszkiewicz, A., … Zupančič, M. (2020). Reasons for Facebook usage: Data from 46 countries. *Frontiers in Psychology, 11*, 711. https://doi.org/10.3389/fpsyg.2020.00711

Le, B., & Agnew, C. R. (2003). Commitment and its theorized determinants: A meta–analysis of the investment model. *Personal Relationships, 10*(1), 37–57. https://doi.org/10.1111/1475-6811.00035

LeBel, E. P., & Campbell, L. (2009). Implicit partner affect, relationship satisfaction, and the prediction of romantic breakup. *Journal of Experimental Social Psychology, 45*(6), 1291–1294. https://doi.org/10.1016/j.jesp.2009.07.003

Maner, J. K., Rouby, D. A., & Gonzaga, G. C. (2008). Automatic inattention to attractive alternatives: The evolved psychology of relationship maintenance. *Evolution and Human Behavior, 29*(5), 343–349. https://doi.org/10.1016/j.evolhumbehav.2008.04.003

Masuda, M. (2003). Meta-analyses of love scales: Do various love scales measure the same psychological constructs? *Japanese Psychological Research, 45*(1), 25–37. https://doi.org/10.1111/1468-5884.00030

Murray, S. L., Holmes, J. G., & Collins, N. L. (2006). Optimizing assurance: The risk regulation system in relationships. *Psychological Bulletin, 132*(5), 641–666. https://doi.org/10.1037/0033-2909.132.5.641

Murray, S. L., Holmes, J. G., & Griffin, D. W. (1996). The benefits of positive illusions: Idealization and the construction of satisfaction in close relationships. *Journal of Personality and Social Psychology, 70*(1), 79. https://doi.org/10.1037/0022-3514.70.1.79

Norton, R. (1983). Measuring marital quality: A critical look at the dependent variable. *Journal of Marriage and the Family, 45*, 141–151. https://doi.org/10.2307/351302

O'Farrell, K. J., Rosenthal, E. N., & O'Neal, E. C. (2003). Relationship satisfaction and responsiveness to nonmates' flirtation: Testing an evolutionary explanation. *Journal of Social and Personal Relationships, 20*(5), 663–674. https://doi.org/10.1177/0265407503020500

Quillien, T. (2020). Evolution of conditional and unconditional commitment. *Journal of Theoretical Biology, 492*, Article 110204. https://doi.org/10.1016/j.jtbi.2020.110204

Roberts, G. (2020). Honest signaling of cooperative intentions. *Behavioral Ecology, 31*(4), 922–932.

Rusbult, C. E., Martz, J. M., & Agnew, C. R. (1998). The investment model scale: Measuring commitment level, satisfaction level, quality of alternatives, and investment size. *Personal Relationships, 5*(4), 357–387. https://doi.org/10.1111/j.1475-6811.1998.tb00177.x

Shackelford, T. K., Besser, A., & Goetz, A. T. (2008). Personality, marital satisfaction, and probability of marital infidelity. *Individual Differences Research, 6*(1), 13–25.

Sorokowski, P., Kowal, M., Sternberg, R. J., Aavik, T., Akello, G., Alhabahba, M. M., & Sorokowska, A. (2023). Modernization, collectivism, and gender equality predict love experiences in 45 countries. *Scientific Reports, 13*(1), 773.

Sorokowski, P., Sorokowska, A., Karwowski, M., Groyecka, A., Aavik, T., Akello, G., … Sternberg, R. J. (2021). Universality of the triangular theory of love: Adaptation and psychometric properties of the triangular love scale in 25 countries. *The Journal of Sex Research, 58*(1), 106–115. https://doi.org/10.1080/00224499.2020.1787318

Sternberg, R. J. (1997). Construct validation of a triangular love scale. *European Journal of Social Psychology, 27*(3), 313–335. https://doi.org/10.1002/(SICI)1099-0992(199705)27:3<313::AID-EJSP824>3.0.CO;2-4

Tooby, J., & Cosmides, L. (1992). The psychological foundations of culture. *The Adapted Mind: Evolutionary Psychology and the Generation of Culture, 19*(1), 1–136.

Tooby, J., & Cosmides, L. (1996, January). Friendship and the banker's paradox: Other pathways to the evolution of adaptations for altruism. In *, Vol. 88. Proceedings-British Academy* (pp. 119–144). Oxford University Press.

Walter, K. V., Conroy-Beam, D., Buss, D. M., Asao, K., Sorokowska, A., Sorokowski, P., … Zupančič, M. (2020). Sex differences in mate preferences across 45 countries: A large scale replication. *Psychological Science, 31*(4), 408–423. https://doi.org/10.1177/0956797620904154

Walter, K. V., Conroy-Beam, D., Buss, D. M., Asao, K., Sorokowska, A., Sorokowski, P., … Zupančič, M. (2021). Sex differences in human mate preferences vary across sex ratios. *Proceedings of the Royal Society B, 288*(1955), 20211115. https://doi.org/10.1098/rspb.2021.1115