How both partners' individual differences, stress, and behavior predict change in relationship satisfaction: Extending the VSA model

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We pooled data from 10 longitudinal studies of 1,104 married couples to test the Vulnerability-Stress-Adaptation (VSA) model of change in relationship satisfaction. Studies contained both spouses' self-reports of neuroticism, attachment anxiety, and attachment avoidance; observational measures of engagement and opposition during problem-solving discussions at baseline; and repeated reports of both spouses' stress and marital satisfaction over several years. Consistent with the VSA model, all three individual and partner qualities predicted changes in marital satisfaction that were mediated by observations of behavior and moderated by both partners' experiences with stress. In contrast to the VSA model, however, rather than accentuating the association between individual differences and behavior, both partners' stress moderated the strength, and even direction, of the association between behavior and changes in marital satisfaction over time. Taken together, these findings indicate that 1) qualities of both couple members shape their behavioral exchanges, 2) these behaviors explain how individuals and their partners' enduring qualities predict relationship satisfaction, and 3) stress experienced by both couple members strongly determines how enduring qualities and behavior predict changes in relationship satisfaction over time. The complex interplay among both partners' enduring qualities, stress, and behavior helps explain why studies may fail to document direct main effects of own and partner enduring qualities and behavior on changes in relationship satisfaction over time.

marriage | stress | interpersonal communication | personality | attachment security

Most newlyweds report high levels of relationship satisfaction and optimism about their future. Nevertheless, many couples experience declines in relationship satisfaction over time (1), and, as a consequence, between 30% and 50% of marriages in many Western countries end in divorce (2, 3). Such marital dysfunction has deleterious implications for the mental and physical health of the two spouses involved (4, 5) as well as their children (6). Thus, explaining how initially high levels of relationship satisfaction decline over time has been an enduring question, and perhaps the central question, for relationship science.

Several influential theories have attempted to answer this question, each highlighting a different source of influence on intimate relationships. Interdependence theory (7, 8), for example, focuses on how dyad members affect one another through their behaviors. In their seminal analysis, Kelley et al. (9) argued that 1) the behaviors of each partner toward the other "comprise the reality of the relationship," 2) any variables that affect a relationship do so "*only* as they affect the[se] events," and thus 3) dyadic interaction "must be, explicitly or implicitly, the focus of any analysis of the close relationship" (pp. 42–43). Other perspectives, in contrast, emphasize individual differences such as attachment security (10, 11) and personality (12, 13). Attachment theory, for example, posits that infants' early interpersonal experiences lead them to develop relatively enduring mental models of themselves and their caregivers, which guide their interpersonal relationships throughout the remainder of their lives. Whereas infants with responsive caregivers develop secure mental models that benefit subsequent relationships, infants with unresponsive caregivers develop insecure mental models that undermine subsequent relationships. Finally, social ecological models draw attention to contextual and environmental factors, such as sources of stress outside of the relationship and coping resources (14, 15). According to these perspectives, physical and psychological demands on couples undermine healthy relationship functioning whereas coping resources promote it.

Twenty-five years ago, the Vulnerability-Stress-Adaptation (VSA) model (16) attempted to integrate these perspectives to develop a more comprehensive explanation of how relationship satisfaction changes over time (Fig. 1). In line with attachment and personality perspectives, the model notes that each member of a couple brings to their relationship a set of enduring vulnerabilities (V), or individual differences, that can undermine their own and their partner's relationship satisfaction and lead to eventual relationship dissolution. Echoing the classic writings of Kelley et al. (9), however, the VSA model argues that these individual and partner qualities do not affect relationship satisfaction directly; rather, the VSA model posits that enduring qualities affect satisfaction indirectly through their direct effects on adaptive processes (A), which include the behavioral exchanges that occur between dyad members. Finally, as highlighted by socioecological models, the VSA model also acknowledges circumstances outside the relationship, most notably the stressors (S) faced by each member of the dyad (e.g., demands at work, financial strain),

Significance

Understanding the factors that explain declines in marital satisfaction is one of the most pressing challenges for relationship science. Yet, several lines of recent research relying on singular theoretical models have questioned our ability to do so. The current research pooled data from 10 independent longitudinal studies of married couples to test a theoretical model that integrates multiple perspectives spanning numerous disciplines. Findings support and extend this model to indicate that both partners' interpersonal behaviors interact with both partners' experiences with stress over time to mediate the implications of both partners' enduring qualities for changes in marital satisfaction. Accordingly, understanding one source of influence on relationships requires acknowledging the independent and interactive effects of the other sources of influence.

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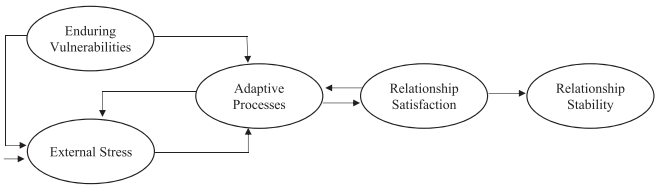

Fig. 1. The original VSA model (16).

suggesting such circumstances independently predict relationship outcomes through their direct effects on adaptive processes such as behavior.

By drawing explicit links between the socioecological perspective and theories of relationships that focus exclusively on individual differences and dyadic behaviors, the VSA model gives rise to several novel predictions. First, the model predicts that couples' experience of external stress is not only a function of exogenous factors but also the result of partners' own enduring vulnerabilities (a stress generation hypothesis). Second, the model predicts that enduring vulnerabilities and external stress interact to account for subsequent adaptive processes, such that enduring vulnerabilities more strongly predict adaptive processes when spouses experience more stress and stress more strongly predicts adaptive processes among spouses possessing more enduring vulnerabilities (a moderation hypothesis). Third, the model predicts that the direct effects of enduring vulnerabilities and stress on couples' adaptive processes account for the influence of those qualities on changes in relationship satisfaction over time (a mediation hypothesis). Finally, the model predicts that the enduring vulnerabilities and stress of both partners shape their interactions and, through these interactions, their relationship satisfaction and relationship dissolution (a dyadic hypothesis).

Although the stress generation hypothesis has received extensive empirical support over the years (17–20), support for the other hypotheses has been inconsistent. For example, although several studies support the VSA model's mediational prediction by showing that couples' behavior mediates the association between enduring qualities and relationship satisfaction concurrently (21, 22), other research questions the possibility that behavior mediates the link between enduring qualities and changes in satisfaction over time. Specifically, not only have several studies failed to document associations between people's enduring characteristics and changes in their relationship satisfaction over time (23–25), several other studies have failed to provide evidence that couples' behaviors have implications for changes in relationship satisfaction (for a review, see ref. 26). Other research raises questions about the VSA model's moderation hypothesis. Whereas the VSA model predicts that stress interacts with enduring characteristics to predict adaptive processes, several studies have found that stress interacts with adaptive processes to predict relationship satisfaction (27–29). Finally, some research has questioned the dyadic hypothesis. Most notably, a team of 86 relationship scientists recently pooled data on up to 200 variables from 43 longitudinal data sets comprising 11,196 romantic couples to show that enduring qualities and adaptive processes reported by an individual's partner accounted for no unique variance in that individual's relationship satisfaction, either concurrently or over time (24). Together, these lines of research undermine support for the current version of the VSA model.

Yet before discarding the VSA model entirely, it is important to note that none of these studies fully tested the model. For example, studies demonstrating that stress interacts with behavior to predict relationship satisfaction (27–29) failed to simultaneously test whether stress also interacts with enduring vulnerabilities to predict behavior. Given that the VSA model posits that enduring qualities are a distal source of behavior, any interactions observed between stress and behavior may reflect uncontrolled interactions between stress and enduring qualities that are mediated by behavior, as specifically predicted by the VSA model.

Similarly, studies revealing that partners' and individuals' enduring qualities fail to predict changes in relationship satisfaction over time (23–25) have not considered the role of couples' experiences with stress over that same period of time. Couples' experiences with stress can change over time, and any variation in stress over the course of a study may play an important role in explaining how enduring qualities are associated with change in satisfaction over the course of that study. Although vulnerabilities may play little role in predicting how satisfaction changes for couples who face very little stress over time, such vulnerabilities may begin to have implications when individuals or partners encounter more stress over time (17), even if that stress is not present initially. Although enduring qualities and behavioral tendencies can also change to some extent, they are relatively more stable (see refs. 30, 31), which may make variation in stress particularly important for explaining change in satisfaction. Indeed, the authors of the VSA model highlight the critical role of stress in accounting for change in relationship satisfaction by stating, "given that a couple's level of enduring vulnerabilities is expected to remain relatively stable, variation in a couple's experiences of stress over the course of their marriage should predict the timing of declines in marital satisfaction" (ref. 16, pp. 25).

Finally, research failing to offer evidence that individuals' partners' enduring qualities play a substantial role in shaping individuals' relationship satisfaction (24) did not test the VSA model's prediction that enduring qualities predict satisfaction through adaptive processes, such as the behavioral exchanges that occur between partners. In fact, the 43 data sets included in that analysis relied almost exclusively on self-report measures of behavior. Because self-report measures of behavior can be biased by "sentiment override" (32) [i.e., the tendency for partners' global feelings about their relationship to color their reports of relationship processes like behavior (33–35)], it is difficult to draw strong conclusions about how partners influence one another from research that relies exclusively on such measures. For this reason, researchers since the 1970s have relied on observational measures to assess communication in close relationships (36) (for reviews, see refs. 37–39).

Taken together, these limitations mean that some of the central predictions of the VSA model have never been tested directly, leaving several open questions. First, does stress accentuate the association between enduring qualities and relationship behavior, or does stress moderate the association between behavior and changes in relationship satisfaction? Second, does behavior mediate the effects of enduring vulnerabilities on subsequent changes in relationship satisfaction over time, or does this mediational relationship only emerge concurrently? Third, do individuals' partners' qualities predict changes in individuals' relationship satisfaction through those partners' behavior, or are changes in relationship satisfaction determined solely by intrapersonal factors?

The Current Research

We drew upon 10 existing longitudinal studies of 2,208 members of 1,104 different-sex, newly married couples to formally test the VSA model and thereby clarify the role of enduring qualities, adaptive processes, and stress in predicting change in marital satisfaction over time. None of these studies were included in the research bearing on the VSA model described so far. All studies spanned between 2 and 4 y and involved between 5 and 10 waves of data, offering 12,486 assessments of marital satisfaction across the early years of marriage. Details about each study appear in *SI Appendix*.

Each study was designed with the VSA model in mind, and thus each study contained several of the same predictors and outcomes. All 10 studies obtained both spouses' baseline self-reports of three enduring vulnerabilities (V) highlighted in prior

work: neuroticism (23) (for review, see ref. 40), attachment anxiety, and attachment avoidance (41) (for review, see ref. 10). All 10 studies also contained baseline observational measures of behavioral exchanges between spouses—the key mechanism through which the VSA model suggests individuals' enduring qualities and stress influence their own and their partners' relationship satisfaction. In all studies, couples attended a baseline laboratory session where they engaged in either two or four recorded problem-solving discussions that lasted either 8 or 10 min. Recent theoretical frameworks identify two orthogonal dimensions of dyadic behavior during such discussions: levels of opposition to (versus cooperation with) one another's perspectives and goals (i.e., opposition) (39) and levels of engagement in (versus withdrawal from) the discussion (i.e., engagement) (42). All 10 studies obtained observer ratings of oppositional behavior for each partner, and 9 of the 10 studies obtained observer ratings of engagement for each partner. Although couples' behavioral tendencies can change over time, particularly in response to intervention (43), behaviors like those measured here have demonstrated modest test-retest correlations in prior research (30). Finally, all studies obtained repeated measures of both spouses' reports of external stress (S) over time. Specifically, spouses rated their levels of stress experienced over each assessment period (e.g., past 6 mo) in 11 domains (e.g., work, family, health, extended family, friends, and finances) that we averaged to form a measure of stress experienced outside the relationship at each assessment. Spouses also reported on their levels of relationship stress, but these reports were excluded a priori to minimize the possibility of overlap between the stress measure and the relationship outcome assessments.

We pooled across all 10 studies to conduct a series of integrative data analyses (44) to address questions regarding the VSA model. Given idiosyncratic differences in measurement across studies, all variables were standardized within each study. Correlations among all predictors appear in *SI Appendix*. All analyses included dummy codes to account for the differences between samples.

Results

Do Enduring Qualities Predict Initial Stress? We began by testing the VSA model's stress generation hypothesis that enduring vulnerabilities predict higher levels of individuals' experiences of stress outside the relationship at baseline as well as the dyadic version of this hypothesis that individuals' partners' enduring vulnerabilities uniquely predict higher levels of individuals' stress at baseline. To do so, we estimated a single multilevel model that contained fixed estimates that collapsed across husbands and wives and a single random intercept. Specifically, we regressed baseline reports of stress onto individuals' and partners' reports of the three enduring qualities, controlling for sex (effects-coded). Final results appear in Table 1. Consistent with the VSA model and prior research on the stress generation hypothesis (17–20), all three of individuals' own enduring qualities as well as partner attachment anxiety were associated with reporting more stress. These results not only further support the VSA model's stress generation hypothesis but also highlight the importance of considering dyadic effects when examining these processes.

Do Initial Stress and Enduring Qualities Interact to Predict Behavior? Next, we tested the VSA model's moderation hypothesis that stress interacts with enduring vulnerabilities to predict behavior as well as the dyadic version of this hypothesis that partner stress interacts with partner enduring vulnerabilities to uniquely predict individuals' own behavior. Specifically, we estimated two additional multilevel models that contained fixed estimates collapsed across husbands and wives and a random intercept. The first model regressed individuals' opposition onto sex, individuals' and partners' stress reported at baseline, individuals' and partners' reports of the three enduring qualities, and interactions between each enduring quality and stress, whereas the second model regressed individuals' engagement onto these same variables. Given opposition and engagement were correlated ($r = -0.25$), each model also controlled for the other form of behavior to ensure independent effects. Note that these analyses can be understood as a test of the first path of the VSA model's mediational prediction that behavior mediates the effects of stress and vulnerabilities on marital satisfaction, which we directly address in a later section. For these and all analyses, we dropped all nonsignificant interactions not involved in significant higher-order interactions. For all analyses, full-model results appear in *SI Appendix*.

Table 1. Associations between individuals' and partners' enduring qualities and individuals' stress

Predictor	*b*	SE	*P*
Intercept	**−0.079**	**0.022**	**<0.001**
Own sex (−1 = men; 1 = women)	**−0.039**	**0.019**	**0.038**
Own neuroticism	**0.220**	**0.021**	**<0.001**
Own attachment anxiety	**0.145**	**0.022**	**<0.001**
Own attachment avoidance	**0.141**	**0.022**	**<0.001**
Partner neuroticism	0.018	0.021	0.400
Partner attachment anxiety	**0.084**	**0.022**	**<0.001**
Partner attachment avoidance	0.019	0.022	0.391

Bold entries highlight associations that are statistically significant.

Final results appear in Table 2. With respect to oppositional behavior, none of the three interactions involving own stress reached significance. One of the three interactions involving partner stress reached significance—the interaction between partner neuroticism and partner stress. Although this interaction is consistent with the VSA model's dyadic hypothesis that partner qualities and stress interact to predict individuals' own behavior, the direction of the interaction was opposite of that proposed by the VSA model's moderation hypothesis. Whereas the model suggests that stress exacerbates the effects of vulnerabilities on behavior, simple effects tests indicated that individuals married to partners higher in neuroticism exhibited more opposition when those partners experienced low stress (−1 SD, $b = 0.078$, SE = 0.030, $P = 0.010$), whereas partner neuroticism was unassociated with individuals' opposition when partners experienced high stress (+1 SD, $b = 0.001$, SE = 0.031, $P = 0.984$). Furthermore, and also in contrast to the VSA model, neither own stress nor partner stress directly predicted opposition. Instead, own attachment anxiety and own attachment avoidance were directly associated with individuals engaging in more oppositional behavior regardless of individuals' own levels of stress.

With respect to predictors of engagement, once again, none of the three interactions involving enduring qualities and own stress reached significance. Two of the three interactions involving partner enduring qualities and partner stress reached significance—the interaction between partner stress and partner attachment anxiety and the interaction between partner stress and partner attachment avoidance—which provides additional support for the VSA model's dyadic hypothesis. Nevertheless, the pattern of these interactions was also in contrast to the VSA model prediction that stress accentuates the association between enduring vulnerabilities and behavior. Partner attachment anxiety was significantly associated with individuals being more engaged when those partners experienced low levels of stress ($b = 0.071$, SE = 0.033, $P = 0.032$), but partner attachment anxiety was not significantly associated with individuals' engagement when those partners experienced high levels of stress ($b = -0.048$, SE = 0.031, $P = 0.120$). Likewise, partner attachment avoidance was associated with individuals being less engaged when those partners experienced low stress ($b = -0.104$, SE = 0.032, $P = 0.001$), but attachment avoidance was not significantly associated with engagement when those partners experienced high stress ($b = 0.016$, SE = 0.032, $P = 0.620$). Moreover, neither own nor partner

Table 2. Associations between individuals' and partners' enduring qualities and individuals' behavior

	Opposition			Engagement		
Predictor	*b*	SE	*P*	*b*	SE	*P*
Intercept	0.002	0.026	0.610	0.032	0.082	0.700
Engagement	**−0.171**	**0.022**	**<0.001**			
Opposition	–	–	–	**−0.170**	**0.022**	**<0.001**
Own sex (−1 = men; 1 = women)	**0.090**	**0.017**	**<0.001**	**0.129**	**0.017**	**<0.001**
Own neuroticism	0.004	0.024	0.876	**−0.071**	**0.024**	**0.003**
Own attachment anxiety	**0.091**	**0.025**	**<0.001**	**0.069**	**0.025**	**0.005**
Own attachment avoidance	**0.069**	**0.024**	**0.004**	**−0.085**	**0.024**	**<0.001**
Own initial stress	0.036	0.023	0.127	−0.010	0.023	0.663
Partner neuroticism	0.039	0.024	0.110	−0.036	0.024	0.133
Partner attachment anxiety	0.040	0.025	0.104	0.012	0.025	0.615
Partner attachment avoidance	0.032	0.024	0.182	−0.044	0.024	0.065
Partner initial stress	−0.001	0.023	0.982	−0.022	0.023	0.348
Partner neuroticism × partner stress	**−0.039**	**0.019**	**0.037**	–	–	–
Partner attachment anxiety × partner stress	–	–	–	**−0.060**	**0.020**	**0.004**
Partner attachment avoidance × partner stress	–	–	–	**0.060**	**0.022**	**0.005**

Bold entries highlight associations that are statistically significant.

stress was directly associated with individuals' levels of engagement. Instead, own attachment anxiety was associated with individuals being more engaged, whereas own neuroticism and own attachment avoidance were associated with individuals being less engaged.

Of note, the pattern of interactions was the same in a set of supplemental analysis that did not include the main effects of own and partner stress, ensuring they were not due to multicollinearity. Likewise, given conceptual overlap between neuroticism and attachment anxiety, we also confirmed through another set of supplemental analyses that all effects involving own and partner neuroticism were the same when own and partner attachment anxiety were excluded from the model and vice versa.

In sum, these analyses failed to support the VSA model's moderation prediction that enduring vulnerabilities are more strongly associated with behavior when couples are under greater stress: None of the six possible interactions involving own stress and own enduring qualities were significant. Although three of the six interactions involving partner stress and enduring qualities were significant, all three interactions were in the direction opposite of that suggested by the VSA model. Rather than being more strongly associated with behavior under conditions of high stress, individuals' partners' qualities were only associated with individuals' behaviors when those partners experienced low stress. Low partner stress may be a context that is particularly conducive to responding to partners in a way that is targeted to that partners' qualities, whereas high partner stress may undermine such tailored responsiveness. In total, every enduring quality was associated with at least one form of behavior, but all associations were either direct or emerged only under conditions of low stress.

Do Enduring Qualities Predict the Trajectory of Marital Satisfaction? Before turning to the alternative possibility that stress moderates the association between behavior and marital satisfaction to account for indirect effects of enduring qualities on changes in marital satisfaction, we tested whether own and partner enduring qualities predicted the trajectory of individuals' marital satisfaction directly. Specifically, we conducted a single growth curve analysis that regressed individuals' marital satisfaction reported at each wave of data collection onto: time of assessment (years since baseline), individuals' and partners' enduring qualities reported at baseline, and the interaction between each individual and partner quality and time. The model estimated fixed estimates collapsed across husbands and wives but separate random intercept and time effects for husbands and wives. We again dropped nonsignificant interactions not involved in significant higher-order interactions.

Results appear in Table 3. As can be seen, all three individual and partner qualities were negatively associated with individuals' initial satisfaction. Controlling for these associations, only own and partner attachment anxiety were directly associated with steeper declines in marital satisfaction. Although these analyses provide only some support for the idea that individuals' and partners' qualities help determine how relationship satisfaction changes over time, it is important to note that they ignore the role of behavior in potentially mediating such effects. Indeed, the analyses in the prior section revealed that every enduring individual and partner quality was associated with individuals' behaviors. In the next section, we test whether individuals' and partners' behaviors interacted with stress to predict the trajectory of satisfaction.

Do Stress and Behavior Interact to Predict the Trajectory of Marital Satisfaction? We tested the interactive effects of stress and behavior on the trajectory of marital satisfaction by conducting a single growth curve analysis that regressed individuals' marital satisfaction reported at each wave of data collection onto sex, time of assessment, observations of individuals' and partners' behavior at baseline, individuals' and partners' reports of stress at each wave of data collection, the interactions between individuals' stress

Table 3. Associations between individuals' and partners' enduring qualities and the trajectory of individuals' marital satisfaction

Predictor	*b*	SE	*P*
Intercept	**0.162**	**0.023**	**<0.001**
Own sex (−1 = men; 1 = women)	0.034	0.025	0.163
Own neuroticism	**-0.050**	**0.017**	**0.004**
Own attachment anxiety	**−0.085**	**0.018**	**<0.001**
Own attachment avoidance	**−0.133**	**0.017**	**<0.001**
Time	**−0.187**	**0.012**	**<0.001**
Time × own attachment anxiety	**−0.030**	**0.009**	**0.001**
Partner neuroticism	**−0.042**	**0.017**	**0.014**
Partner attachment anxiety	**−0.055**	**0.018**	**0.002**
Partner attachment avoidance	**−0.061**	**0.017**	**<0.001**
Time × partner attachment anxiety	**−0.026**	**0.009**	**0.006**

Bold entries highlight associations that are statistically significant.

and individuals' behavior, the interactions between partners' stress and partners' behavior, and the three-way interactions between each one of these effects and time. In this model, three-way interactions between stress, behavior, and time estimate whether changes in satisfaction over time vary as a function of the behavioral tendencies exhibited at baseline and average levels of stress experienced across the study. Given that own and partner enduring qualities were directly associated with individuals' stress and behavior in prior analysis, we additionally controlled for the six enduring qualities reported by individuals and their partners, thereby allowing this analysis to serve as an estimate of the second path of the VSA model's prediction that behavior mediates the effects of vulnerabilities on marital satisfaction. We directly test mediation in the next section. We also allowed own and partner enduring qualities to predict changes in marital satisfaction directly to examine whether they exerted any effects beyond the interactive effects of behavior and stress. The model estimated fixed estimates collapsed across husbands and wives but separate random effects for husbands and wives of the intercept, time, stress, and partner stress. We again dropped nonsignificant interactions not involved in significant higher-order interactions.

Results appear in Table 4. As in the previous analyses, all three of individuals' own enduring qualities were negatively associated with initial levels of individuals' marital satisfaction. In addition, the interaction between own opposition and own stress was positively associated with individuals' initial marital satisfaction; own opposition was significantly negatively associated with own initial marital satisfaction at both low and high levels of stress, but this association was stronger at low (−1 SD, $b = -0.120$, SE = 0.019, $P < 0.001$) versus high (+1 SD, $b = -0.074$, SE = 0.017, $P < 0.001$) levels of stress. See Fig. 2*A*. Individuals' own opposition was not significantly associated with changes in individuals' satisfaction over time, either as a main effect or in interaction with stress. In contrast, individuals' engagement did interact with individuals' stress to predict changes in their marital satisfaction over time; own engagement was not significantly associated with changes in own marital satisfaction among individuals experiencing relatively low levels of stress on average (−1 SD, $b = -0.008$, SE = 0.014, $P = 0.544$), but own engagement was positively associated with changes in own marital satisfaction among individuals experiencing high levels of stress on average (+1 SD, $b = 0.029$, SE = 0.012, $P = 0.012$). In other words, being more engaged in problem-solving discussions was only beneficial for changes in marital satisfaction among individuals who experienced high levels of stress over time on average. See Fig. 2*B*. Controlling for these effects, none of individuals' own enduring qualities were directly associated with changes in marital satisfaction over time.

Regarding partner effects, partner attachment anxiety and partner opposition were again negatively associated with individuals' initial levels of marital satisfaction. Controlling for these associations, both partner engagement and partner oppositional behavior interacted with partner stress to predict changes in individuals' marital satisfaction over time. Among individuals married to partners who experienced low levels of stress on average, partner engagement was not significantly associated with changes in individuals' marital satisfaction ($b = -0.006$, SE = 0.014, $P = 0.675$), and partner opposition was negatively associated with changes in individuals' marital satisfaction ($b = -0.030$, SE = 0.015, $P = 0.042$). Among individuals married to partners who experienced high levels of stress on average, in contrast, both partner engagement ($b = 0.030$, SE = 0.012, $P = 0.010$) and partner opposition ($b = 0.027$, SE = 0.012, $P = 0.023$) were positively associated with changes in individuals' marital satisfaction over time. See Fig. 2 *C* and *D*. Although the benefits of partner opposition may seem counterintuitive, they are consistent with other research indicating that opposition can be adaptive over time by clarifying problems and motivating people to more effectively manage them (39, 45, 46), which may be particularly necessary among people facing the more demanding circumstances that accompany high stress (47). Controlling for these effects, none of individuals' partners' enduring qualities were directly associated with changes in marital satisfaction over time.

Table 4. Interactive effects of own and partner behavior and stress on the trajectory of individuals' marital satisfaction

Predictor	*b*	SE	*P*
Intercept	**0.183**	**0.019**	**<0.001**
Own sex (−1 = men; 1 = women)	**0.053**	**0.013**	**0.034**
Own neuroticism	**−0.034**	**0.016**	**0.039**
Own attachment anxiety	**−0.071**	**0.017**	**<0.001**
Own attachment avoidance	**−0.094**	**0.016**	**<0.001**
Own stress	**−0.052**	**0.014**	**<0.001**
Own opposition	**−0.099**	**0.016**	**<0.001**
Own engagement	−0.016	0.017	0.336
Own stress × own opposition	**0.022**	**0.011**	**0.045**
Own stress × own engagement	0.005	0.013	0.726
Time	**−0.168**	**0.012**	**<0.001**
Time × own stress	**−0.035**	**0.008**	**<0.001**
Time × own engagement	0.010	0.011	0.341
Time × own stress × own engagement	**0.019**	**0.008**	**0.012**
Partner neuroticism	−0.032	0.016	0.054
Partner attachment anxiety	**−0.040**	**0.017**	**0.018**
Partner attachment avoidance	−0.028	0.016	0.090
Partner stress	−0.016	0.014	0.234
Partner opposition	**−0.065**	**0.017**	**<0.001**
Partner engagement	0.028	0.017	0.089
Partner stress × partner opposition	−0.022	0.014	0.111
Partner stress × partner engagement	0.002	0.013	0.886
Time × partner stress	**−0.017**	**0.008**	**0.041**
Time × partner opposition	−0.000	0.011	0.988
Time × partner engagement	0.014	0.011	0.200
Time × partner stress × partner opposition	**0.028**	**0.008**	**0.001**
Time × partner stress × partner engagement	**0.019**	**0.008**	**0.017**

Bold entries highlight associations that are statistically significant.

In sum, own and partner behavior did not exert direct main effects on changes in marital satisfaction over time. Instead, all four behaviors examined—own opposition, own engagement, partner engagement, and partner opposition—interacted with either initial stress or changes in stress to predict either initial satisfaction or changes in satisfaction over time. Own opposition interacted with initial stress to predict initial satisfaction, such that own opposition was more negatively associated with initial levels of own satisfaction among individuals who experienced low stress. Partner opposition and both own and partner engagement interacted with the average levels of stress reported across the study to explain changes in satisfaction. Own and partner engagement were only associated with more stable marital satisfaction when those individuals or their partners experienced more stress over time on average. Partner opposition was associated with steeper declines in satisfaction among individuals whose partners experienced relatively low levels of stress over time on average but associated with more stable satisfaction among individuals whose partners experienced high stress over time on average. These findings make sense when one considers that one of the critical functions of problem-solving behaviors is to solve problems. Being engaged in problem-solving discussions and behaving in an oppositional manner during such discussions can motivate change (39, 46), which may be most, or perhaps only, necessary when couples tend to face challenging circumstances—such as high levels of stress. When circumstances are less stressful, and thus change is less necessary, being more engaged does not appear to be necessary, and being oppositional appears to be costly. All told, these three enduring traits, two types of behavior, stress, and their interactions accounted for 15.5% of the variance in the trajectory of individuals' marital satisfaction.

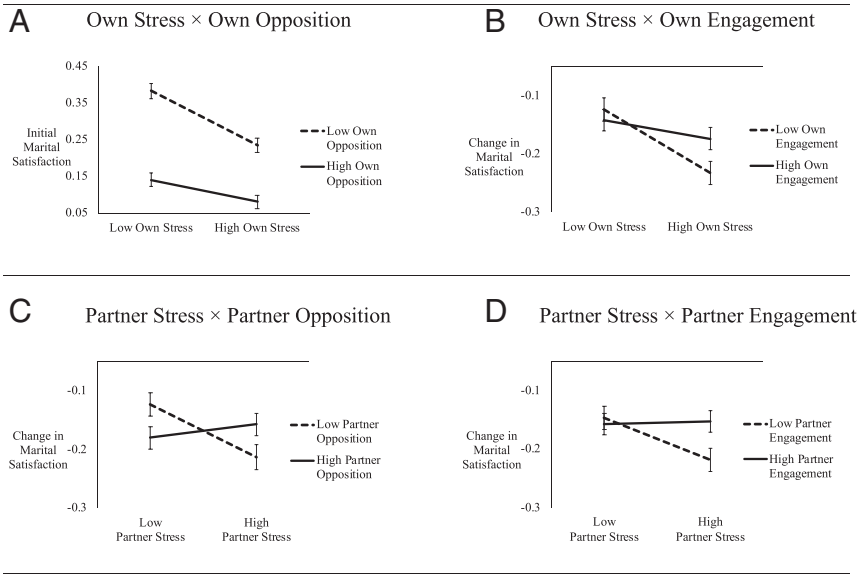

Fig. 2. Interactive effects of behavior and stress on the trajectory of marital satisfaction. (*A*) Own stress × own opposition interaction on initial satisfaction. (*B*) Own stress × own engagement interaction on change in satisfaction. (*C*) Partner stress × partner opposition interaction on change in satisfaction. (*D*) Partner stress × partner engagement interaction on change in satisfaction.

Notably, all effects accounting for changes in marital satisfaction involved direct or interactive effects of own or partner stress.

Do Interactive Associations between Behavior and Stress Mediate the Effects of Enduring Qualities on Changes in Marital Satisfaction? The final set of analyses tested the VSA model's mediation prediction by testing whether the interactive effects of behavior and stress on changes in marital satisfaction that emerged in the previous section mediated the effects of individuals' and partners' enduring qualities on changes in individuals' marital satisfaction. Specifically, we used RMediation (48) to estimate indirect effects of each enduring quality based on our estimates of the two paths that comprised the indirect effects, where path a was the extent to which each quality predicted each behavior and path b was the extent to which behavior predicted changes in marital satisfaction at high and low levels of stress experienced over time, controlling for enduring qualities.

Results are presented in Table 5. As can be seen, all six enduring qualities exerted at least one indirect effect on changes in marital satisfaction, though, like the effects of behavior, these indirect effects varied across levels of stress. Given that own and partner engagement were unrelated to changes in satisfaction under conditions of low own and low partner stress, none of the enduring qualities exerted indirect effects through engagement at low levels of own or partner stress. Instead, own neuroticism, own attachment anxiety, and own attachment avoidance each indirectly predicted changes in individuals' own marital satisfaction through their effects on individuals' own engagement at high levels of stress, such that both neuroticism and attachment avoidance were indirectly associated with steeper declines in marital satisfaction through less engagement, whereas attachment anxiety was associated with less steep declines in marital satisfaction through more engagement. Likewise, partner neuroticism, partner attachment anxiety, and partner attachment avoidance each indirectly predicted changes in individuals' marital satisfaction through their effects on partners' engagement at high levels of partner stress, such that both partner neuroticism and partner attachment avoidance were indirectly associated with steeper declines in marital satisfaction through less partner engagement, whereas partner attachment anxiety was associated with less steep declines in marital satisfaction through more partner engagement. Given that partner opposition predicted changes in satisfaction under conditions of both low and high partner stress, indirect effects of enduring qualities emerged in both contexts, though, like the effects of partner opposition, the direction of these effects was different across low versus high partner stress. Partner attachment anxiety and partner attachment avoidance were each indirectly associated with steeper declines in marital satisfaction under conditions of low partner stress because each quality was associated with partners exhibiting more oppositional behavior during problem-solving discussions, which was harmful in the context of low partner stress. In contrast, these same variables were indirectly associated with more stable marital satisfaction under conditions of high partner stress because oppositional behavior was beneficial in that context.

Discussion

These findings should be considered in light of several limitations common to all 10 studies. First, all couples were different-sex newlyweds, and most were White. Although some of the associations observed here are unlikely to vary across stages of marriage or race/ethnicity, the strength and even direction of some associations may vary in different populations. For example, the fact that partner oppositional behavior benefits marital satisfaction when partners experience high stress may be unique to the newlywed period as such new couples work to establish the norms of the relationship. Second, given the limited variables common to all data sets, we were only able to consider a few partner qualities and behaviors. Other specific associations may have emerged if additional variables had been included, including other behaviors like social support, other enduring qualities like narcissism, and acute stress. Indeed, each behavior and enduring quality examined here exerted unique effects.

These limitations notwithstanding, these findings have numerous implications, including for understanding the VSA model of change in relationship satisfaction. First, the fact that individuals' reports of enduring qualities, as well as partners' reports of attachment anxiety, were associated with individuals' reports of stress supports the model's stress generation hypothesis—own and partner enduring qualities predict individuals' experience with

Table 5. Indirect effects of partner traits on changes in marital satisfaction

	Low stress		High stress	
	b	95% CI	*b*	95% CI
Enduring quality → own stress × engagement → changes in marital satisfaction				
Own neuroticism	0.001	−0.001 to 0.003	**−0.002***	**−0.005 to −0.000**
Own attachment anxiety	−0.001	−0.003 to 0.001	**0.002***	**0.000 to 0.005**
Own attachment avoidance	0.001	−0.002 to 0.003	**−0.002***	**−0.005 to −0.000**
Partner neuroticism	0.000	−0.001 to 0.002	−0.001	−0.003 to 0.000
Partner attachment anxiety	−0.001	−0.003 to 0.002	−0.001	−0.004 to 0.000
Partner attachment avoidance	0.001	−0.002 to 0.004	0.000	−0.002 to 0.003
Enduring quality → partner stress × partner engagement → changes in marital satisfaction				
Own neuroticism	0.000	−0.001 to 0.002	−0.001	−0.003 to 0.000
Own attachment anxiety	−0.000	−0.003 to 0.002	−0.001	−0.004 to 0.000
Own attachment avoidance	0.001	−0.002 to 0.004	0.000	−0.002 to 0.003
Partner neuroticism	0.000	−0.002 to 0.003	**−0.002***	**−0.005 to −0.000**
Partner attachment anxiety	−0.000	−0.003 to 0.002	**0.002***	**0.000 to 0.005**
Partner attachment avoidance	0.001	−0.002 to 0.003	**−0.003***	**−0.005 to −0.000**
Enduring quality → partner stress x partner opposition → changes in marital satisfaction				
Own neuroticism	−0.002	−0.005 to 0.000	0.000	−0.002 to 0.002
Own attachment anxiety	−0.001	−0.004 to 0.000	0.001	−0.000 to 0.003
Own attachment avoidance	−0.001	−0.003 to 0.000	0.001	−0.000 to 0.003
Partner neuroticism	−0.000	−0.002 to 0.002	0.000	−0.001 to 0.002
Partner attachment anxiety	**−0.003***	**−0.006 to −0.000**	**0.002***	**0.000 to 0.005**
Partner attachment avoidance	**−0.002***	**−0.005 to −0.000**	**0.002***	**0.000 to 0.004**

Bold entries highlight associations that are statistically significant. *$P < .05$.

stress. Second, the fact that individuals' and partners' enduring qualities were associated with individuals' behavior supports the model's dyadic hypothesis—both members of the couple affect adaptive processes. Third, the fact that individuals' and partners' enduring qualities predicted changes in marital satisfaction that were entirely mediated by individuals' and partners' behavior supports the model's dyadic and mediation hypotheses—behavior accounts for how both partners' enduring qualities affect individuals' relationship satisfaction. Finally, the fact that individuals' and partners' experiences of stress over time moderated every effect that accounted for changes in satisfaction supports the overall premise of the model—accounting for conditions external to the couple is critical to understanding how relationships develop.

In addition to offering these key takeaways, these findings highlight nuances that help reconcile prior inconsistencies in research on relationships. First, these findings help explain why some prior studies have failed to document strong associations between enduring qualities and individuals' relationship satisfaction. For example, the analysis cited earlier involving nearly 200 variables from 43 longitudinal data sets (24) were not able to account for unique variance in individuals' satisfaction using information self-reported by those individuals' partners and could account for no more than 5% of the variance in changes in satisfaction over time using any combination of own and partner variables. In contrast, the analyses reported here used just six individual variables and six partner variables to show that both individuals' and partners' variables contributed to changes in marital satisfaction, accounting for nearly 16% of the variance in the trajectory of marital satisfaction assessed over the early years of marriage. We attribute the explanatory power of individuals' partners' variables to 1) our focus on the mediational role of behavior, 2) the use of observational assessments of those behaviors, and 3) consideration of the moderating role of stress. Indeed, partners' enduring qualities are associated with changes in individuals' relationship satisfaction but only indirectly through the interactive effects of partner stress and observations of couples' behavior. Without considering the role of behavior, only own and partner attachment anxiety were associated with changes in individuals' marital satisfaction, and both of these effects were completely mediated by the interactive effects of stress and behavior. We attribute our ability to explain changes in satisfaction over time to our repeated assessments of stress. Explaining changes in satisfaction over time requires understanding changes in couples' experiences over time, including their experiences with stress. Indeed, as noted, our repeated measurements of both partners' experiences of stress were involved in every significant association that emerged to explain changes in satisfaction over time.

As much as these analyses confirm central tenets of the VSA model, they suggest important revisions as well. Whereas the original VSA model posits that stress directly predicts behavioral processes and the model's moderation prediction suggests that stress also accentuates the association between enduring vulnerabilities and such behavioral processes, our measure of stress was unrelated to observed behaviors and did not accentuate the association between any enduring qualities and behavior. On the contrary, partner stress minimized the association between several partner qualities and individuals' behavior. Our analyses join several others (27–29, 47) in revealing that stress moderates how both engagement and opposition predicted changes in marital satisfaction. This finding may explain why some studies have failed to document main effects of behavior on relationship satisfaction (43). Behavior did not exert main effects on changes in marital satisfaction in the current studies either, not because behavior did not predict satisfaction, but because the way behavior predicted satisfaction depended on concurrent levels of stress. Accordingly, we suggest a revision to the VSA model that acknowledges the role of stress in moderating the link between behavior and satisfaction. See the Revised VSA (RVSA) model in Fig. 3.

Although we found no evidence that stress predicted behavior or accentuated the link between enduring qualities and behavior,

we retain these predictions in the revised version of the VSA model for two reasons. First, although it minimized rather than accentuated the effects of several partner qualities, partner stress did interact with several partner enduring qualities to predict individuals' behaviors. Second, it remains possible that stress measured in other ways more reliably predicts behavior and/or interacts with enduring qualities to predict behavior, perhaps even in the manner proposed by the original VSA model. In the current studies, we measured couples' more chronic experiences with stress by asking how much stress they experienced over many prior months (usually six). Capturing any tendency for stress to predict behavior, either directly or in interaction with enduring qualities, may require capturing stress experienced at the moment that behavior is enacted. Indeed, prior research has shown that measures of such acute stress have been related to adaptive processes in prior work (49–51). Acute stressful events may exert such effects because they minimize cognitive capacity and make people more reactive to salient stimuli in the moment (52). Because of its long-term nature, chronic stress, in contrast, may operate on long-term outcomes, such as the changes in marital satisfaction over time, as shown here. In other words, it may be that acute stress interacts with enduring qualities to predict behavior in the moment, whereas more chronic stress, like we measured here, moderates the downstream implications of that behavior for marital satisfaction.

One more difference between the RVSA model and the original VSA model warrants comment: The revised model refers to enduring "qualities," whereas the original model refers to enduring "vulnerabilities," the latter of which was meant to suggest that certain enduring qualities are liabilities for relationship satisfaction. Although this assumption may be correct on average, the current findings suggest important exceptions. In particular, although both indices of attachment insecurity were associated with lower levels of relationship satisfaction initially, the manner in which each quality indirectly predicted changes in satisfaction over time depended on stress and the behaviors they predicted. For example, both own and partner attachment anxiety exerted indirect positive effects on changes in satisfaction through their positive effects on engagement. Likewise, although partner attachment anxiety and partner attachment avoidance indirectly predicted steeper declines in individuals' satisfaction through more partner opposition when those partners experienced less stress, those same qualities indirectly predicted less steep declines in marital satisfaction through more partner opposition when those partners experienced more stress.

The idea that enduring qualities are not inherently beneficial or harmful for relationships is not unprecedented—others have also documented benefits of qualities typically presumed to be harmful for relationships (53–58). For example, although neuroticism is robustly negatively associated with relationship satisfaction on average (for review, see ref. 40), Daspe et al. (53) demonstrated a curvilinear association between neuroticism and marital quality, such that both extremely high and extremely low levels of own and partner neuroticism were associated with less relationship satisfaction, suggesting a small dose of neuroticism can benefit a relationship. More pertinent to the present analyses, Ein-Dor and his colleagues (55–57) have put forth and supported the idea that that both forms of attachment insecurity evolved because they can be functional not just for individuals but also for others around them. For example, people high in attachment anxiety are particularly attentive to signs of threat, which can protect against real and avoidable threats.

The bottom line is that enduring qualities are composed of a complex set of cognitive and behavioral tendencies, and such tendencies are not inherently good or bad—their implications depend on the context in which they are enacted and the outcomes in question (59–62). Consistent with an affordance perspective (63), the same situation offers different people different opportunities for thought and action. Accordingly, individual differences may be best considered as an antecedent of processes that can be harmful or beneficial for relationships, depending on the 1) downstream process in question, 2) context in which it occurs, and 3) outcome under consideration. The idea that accurately understanding one source of influence on relationships requires acknowledging the independent and interactive effects of the other sources of influence highlights the need for relationship science to consider multiple sources of influence simultaneously.

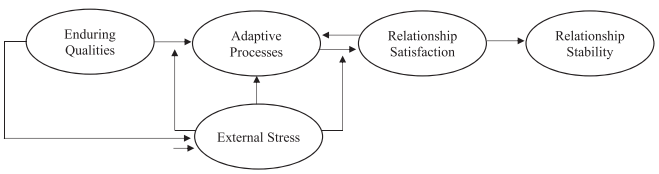

Fig. 3. Revised VSA model.

Materials and Methods

All studies were longitudinal, spanned between 2 and 4 y, and included between 5 and 10 waves of assessment. At baseline of each study, both members of the couple completed a battery of self-report surveys that assessed their neuroticism, attachment security, stress, and marital satisfaction, as well as other qualities that were idiosyncratic to each study and thus beyond the scope of the current analyses. Also, at baseline of all studies, couple members attended a laboratory session during which they engaged in at least two problem-solving interactions that were video recorded. Studies 1 through 4 and 6 through 10 included two problem-solving interactions, and Study 5 included four. The interactions were 10 min long in Studies 1 through 4 and 6 and 7 and 8 min long in Studies 5 and 8 through 10. Each member of the couple chose a topic for discussion that was a source of difficulty or tension in the marriage (in Study 5, each spouse chose two topics—one minor problem and one severe problem). In all studies, couples were given general instructions to work toward a solution and left alone in a private room during the discussions to do so. All discussions were coded using the same microanalytic coding system, and nine of the studies were also coded with the same global coding system. Subsequent to their baseline assessment, all couples were contacted every 4 to 6 mo for the duration of each study and asked to complete another battery of surveys that included measures of stress and marital satisfaction. Both members of the couple consented to these procedures at baseline of each study. All studies were approved by the institutional review boards of the universities at which the studies were conducted (University of Florida; The Ohio State University, Mansfield; University of Toledo; University of Tennessee; University of Texas; Southern Methodist University; Florida State University). Additional details of each study appear in *SI Appendix*.

Coding of the behavioral data was performed by the individual laboratories that collected the data (*SI Appendix*); thus, coding procedures varied slightly across the studies. In all cases, coding was completed by teams of five to eight individuals who underwent training for several months until reliability was reached. Coders watched each video at least three times, pausing and rewinding as much as necessary. Coders watched the video once to gain a general understanding of the conversation and its dynamics. Coders then watched the video a second time to code the levels of opposition exhibited by one partner using the microanalytic coding system and then a third time to code the opposition exhibited by the second partner using that same system. Finally, after having watched the video at least three times, each coder answered global questions about the topic and each spouse's general behavioral tendencies during the discussion, including their levels of engagement. The specific details of the two coding systems are described below.

Neuroticism. In Studies 1 through 6 and 9 and 10, neuroticism was assessed using the Neuroticism subscale of the international personality item pool (64), where participants were asked to indicate the extent to which each statement described them using a 5-point scale (1 = very inaccurate, 5 = very accurate). Each study used the short form of this measure that included 10 items except Studies 5 and 10, which included the 60-item long form. Studies 7 and 8 used the Neuroticism subscale of the Ten Item Personality Inventory (65), which uses two items to assess each of the five traits. On this scale, participants indicated on a 7-point scale (1 = strongly disagree, 7 = strongly

agree) the extent to which pairs of personality traits apply to them (e.g., anxious or easily upset).

Attachment Security. In Studies 3 through 5 and 9 and 10, attachment security was assessed with the Experiences in Close Relationships Scale-Revised (66). This scale is a continuous measure of attachment insecurity that identifies the extent to which a person is characterized by two dimensions: attachment anxiety and attachment avoidance. The Attachment Anxiety subscale is composed of 18 statements that describe the degree of concern intimates have about losing or being unable to become sufficiently close to a partner, and the Attachment Avoidance subscale is composed of 18 statements that describe the extent to which partners attempt to maintain distance from a partner. Participants were asked to rate how much they agreed or disagreed with these statements using a 7-point scale (1 = disagree strongly, 7 = agree strongly). Appropriate items were reversed. In Studies 1 and 2, attachment security was assessed with the Adult Attachment Scale-Revised (67). This version of the scale also assesses attachment anxiety and attachment avoidance as two separate dimensions, where 6 items assess attachment anxiety, and 12 items assess attachment avoidance. Participants were asked to rate themselves on a 5-point scale (1 = not at all characteristic of me, 5 = very characteristic of me). In Studies 6 through 8, attachment security was assessed with the Adult Attachment Questionnaire (51). This measure assesses attachment anxiety with nine items and attachment avoidance with eight items. Participants indicated the extent to which they agreed with each statement using a 7-point scale (1 = strongly disagree, *7* = strongly agree). In all cases, higher scores indicate higher attachment anxiety/avoidance. Given that these different scales were used across the studies, scores were standardized within study prior to analyses.

Stress. Stress was assessed at baseline and over time using the same instrument across all 10 studies. Participants were asked the extent to which the following areas of their lives had been stressful on a 9-point scale (1 = not at all stressful, 9 = extremely stressful): parenthood (if applicable), living conditions, finances, work (if applicable), school (if applicable), being a homemaker (if applicable), own health, partner health, relationships with own family, relationships with in-laws, and relationships with friends. Reports were averaged and standardized within each study.

Marital Satisfaction. In Studies 1 through 6 and 9 and 10, marital satisfaction was assessed with the Quality Marriage Index [QMI (68)], which contains five items that asked participants the extent to which they agree or disagree with general statements about their marriage (e.g., "We have a good relationship") on a 7-point scale (1 = very strong disagreement, 7 = very strong agreement), and one item that asks spouses to answer the question "All things considered, how happy are you with your marriage?" on a 10-point scale (1 = very unhappy, 10 = perfectly happy). In Studies 7 and 8, marital satisfaction was assessed with the 16-item Couples Satisfaction Index [CSI (69)]. The CSI was developed by applying item response theory and principal component analysis to the unique items derived from eight previously validated measures of marital satisfaction (including the QMI). Given that these different scales were used across the studies, scores were standardized within study prior to analyses.

It is worth noting that both the QMI and CSI are global measures of relationship satisfaction that assess participants' general evaluations of the relationship as a whole rather than their evaluation of specific qualities of the relationship, such as communication. Accordingly, they offer a conservative test of the implications of various relationship processes for satisfaction compared to other measures of satisfaction that confound global sentiments with the relationship processes that presumably predict such sentiment, such as the Marital Adjustment Test (70) and the satisfaction subscale of Investment Model Scales (71, 72).

Opposition. In all 10 studies, the recorded problem-solving discussions were coded using a version of the Verbal Coding Tactics Scheme (73). Each on-topic speaking turn from each spouse was coded as either integrative or distributive, where distributive codes capture oppositional behaviors (i.e., those that challenge the other person's goals or points of view). Distributive behaviors could be direct or indirect. Direct distributive codes include oppositional statements that 1) blame and criticize the partner (e.g., "You never listen to me," "This is your fault"), 2) command the partner to change in some way (e.g., "Don't do that anymore," "You need to stop spending so much money"), or 3) insult or undermine the partner (e.g., "You're so immature," "I don't care what you think"). Indirect distributive codes include oppositional statements that blamed, commanded, or rejected the partner indirectly through presumptive attributions/mindreading (e.g., "I know how you really feel about this"), hostile/trapping questions (e.g., "What did I tell you?"), avoiding/denying responsibility (e.g., "I can't stop"), and sarcasm (e.g., "Yeah, *that's* a good idea").

In all cases, we formed an index of the proportion of speaking turns that received an oppositional code, which varied from 2.5% (Study 2) to 15.7% (Study 9), for an average (weighted by sample size) of 8.7%. Given differences in trainers, trainees, and study methods, we standardized scores within study.

Studies 1, 3 through 5, and 9 and 10 distinguished between direct and indirect oppositional statements. Following the coding manual (56), when a single speaking turn could be assigned multiple codes, one code was assigned according to a predetermined hierarchy in which direct statements took precedence over indirect ones, except in Studies 9 and 10 where both codes were given. All studies collapsed across these forms of opposition.

Engagement. All studies except Study 3 also applied a global coding system in which the same coders answered questions about the overall nature of the behaviors exhibited by each husband and each wife. Each study contained several questions regarding the extent to which each partner was engaged (e.g., "how engaged was the husband/wife?", "how much did the husband/wife avoid the issue?", and "how much did the husband/wife withdraw?") (42). Items were averaged and scores were standardized within study.

Data Availability. Anonymized spreadsheet data have been deposited in Open Science Framework (OSF) (https://osf.io/Q2KWP) (74).

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