





# Factors that contribute to the maintenance or decline of relationship satisfaction

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**Abstract** | The quality of romantic relationships influences physical and mental health. However, maintaining happy and healthy relationships is challenging; relationship satisfaction declines over time, and relationship dissolution is frequent. This raises the question of which factors contribute to the maintenance versus decline of relationship satisfaction. In this Review, we examine the key factors that have been linked to relationship satisfaction in both cross-sectional and longitudinal studies. Specifically, we describe how self-reported perceptions (subjective perceptions of the self, the partner or the relationship), implicit evaluations (automatic evaluations of one's partner assessed indirectly) and objective indexes (demographics, life events, communication patterns and biological indexes) relate to relationship satisfaction. This synthesis suggests that self-reported perceptions are not always the most reliable predictors of longitudinal changes in relationship satisfaction. Thus, to uncover why some relationships flourish and others struggle over time, future research should not solely focus on self-reported perceptions, but also on implicit evaluations, demographics, life events, communication patterns and biological factors, and their combination.

Cross-sectional studies, longitudinal studies and meta-analyses repeatedly suggest that the quality of romantic relationships has a tremendous impact on physical<sup>1,2</sup> and mental health<sup>3-5</sup> outcomes, with important consequences for other key aspects of life such as work productivity<sup>6,7</sup> and children's well-being<sup>8,9</sup>. However, maintaining a positive and long-lasting relationship is a challenge: relationship satisfaction and marriage rates decline over time<sup>10,11</sup>, and divorce rates remain high in many countries<sup>10,12</sup>. This raises the question of what contributes to the maintenance versus decline of relationship satisfaction. Cross-sectional research has revealed a myriad of constructs that are associated with concurrent relationship satisfaction<sup>13</sup>. Thus, a great deal is known about the factors associated with relationship satisfaction at a particular time point. However, much less is known about which factors predict long-term changes in relationship satisfaction. That is, independent of how satisfied partners are with each other at a particular time point, little is known about why some relationships flourish and others struggle over time.

In this Review, we examine three clusters of factors that are associated with relationship satisfaction, that is, the extent that people are happy in their relationship and feel that the relationship is rewarding. First, we review findings on how self-reported perceptions — or people's

subjective perceptions of themselves, their partner or their relationships — are related to how satisfied they are in their relationship. Second, we review the role of implicit evaluations, or people's automatic evaluations of their partner assessed indirectly, typically through performance-based tasks. Third, we examine the role of objective indexes, such as demographics, life events, communication patterns and biological characteristics. For each cluster of factors we review the cross-sectional findings demonstrating the extent to which they are associated with relationship satisfaction and the longitudinal findings demonstrating the extent to which they predict changes in relationship satisfaction. It is important to note that, like the majority of psychological research, relationship science has relied on sampling WEIRD (Western, educated, industrialized, rich and democratic) and heterosexual populations. Thus, the findings discussed here might especially apply to this population<sup>14</sup>. Finally, like the majority of findings in psychology<sup>15,16</sup>, the effect sizes in research on this topic range from small to medium.

## Self-reported perceptions

Self-reported perceptions are subjective perceptions of the self, the partner, or the relationship assessed with a survey or questionnaire. For example, people are

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asked to evaluate the extent to which they feel close, committed or sexually satisfied with one another on a Likert scale ranging from ‘not at all’ to ‘extremely’. For decades, self-reporting has been the main method used to study predictors of relationship satisfaction. A large body of research, using measures such as the Couples Satisfaction Index<sup>17</sup>, The Relationships Assessment Scale<sup>18</sup> and the Relationship Satisfaction subscale of the Investment Model Scale<sup>19</sup>, has identified several individual differences (that is, differences in the way people rate themselves) and relationship or partner assessments that are related to relationship satisfaction. The majority of this literature examines the concurrent link between these variables and relationship satisfaction, that is, when predictors and dependent variables are assessed at the same time. For example, people who report high neuroticism<sup>20,21</sup>, attachment insecurity<sup>22</sup> or stress<sup>20,23</sup> and people who report low agreeableness<sup>24</sup>, self-esteem<sup>25</sup> or self-control<sup>26</sup> simultaneously report poor relationship functioning. Similarly, people who rate their partner or relationship low in trust<sup>27</sup>, closeness<sup>28</sup>, sexual satisfaction<sup>29</sup>, commitment<sup>30</sup>, love<sup>31</sup> or responsiveness<sup>32</sup>, and people who rate their partner or relationship high in conflict<sup>33</sup> simultaneously report lower relationship satisfaction. However, these findings are correlational and therefore cannot shed light on what predicts changes in relationship satisfaction over time.

Longitudinal research has examined the predictors of changes in relationship satisfaction, that is,

how measures taken at one point in time predict relationship satisfaction measured at one or more future points in time (such as after several months or years). Although some couples who start their relationships highly satisfied are able to maintain relatively stable and high levels of relationship satisfaction over many years, other couples experience declines in relationship satisfaction over time<sup>34–38</sup>, and a key question for relationship science is to understand why such change occurs. There are different techniques for predicting changes over time. Each of these techniques might address different theoretical questions (such as between-person versus within-person changes) and have different strengths and shortcomings<sup>39</sup>.

Longitudinal research has identified a number of predictors of decline in relationship satisfaction including, but not limited to, being high in (or having a partner who is high in) neuroticism<sup>35</sup>, depression<sup>40,41</sup>, anxiety<sup>40</sup>, unrestricted sociosexuality<sup>42</sup> or trait aggression<sup>35</sup> and being low in (or having a partner who is low in) self-esteem<sup>35</sup> or self-compassion<sup>43</sup>. Furthermore, being low in self-concept clarity<sup>44</sup> (the extent to which self-beliefs are clearly and confidently defined)<sup>45</sup> and not feeling understood by one’s partner<sup>46</sup> predict a decline in relationship satisfaction. By contrast, sexual satisfaction<sup>47,48</sup>, unmitigated communion<sup>49</sup> (being overinvolved with meeting a partner’s needs to the exclusion of one’s own needs), making positive attributions about a partner’s behaviour<sup>50</sup> and perceiving one’s partner as supporting one’s goals<sup>51</sup> predict positive changes in relationship satisfaction.

Given the number of studies on the link between self-reported perceptions and relationship satisfaction over decades of research, meta-analyses are needed to synthesize the most important self-reported predictors of relationship satisfaction concurrently and over time. To address this challenge, Joel et al.<sup>13</sup> applied random forest, a machine learning method that is able to handle many predictors at once and that considers nonlinear relationships and interactions among predictors, to data from 43 longitudinal datasets with 11,196 couples (these datasets tracked couples for an average of four time points over 14 months, ranging from 2 to 48 months). Using self-reported perceptions of the self, the relationship and the partner, and capitalizing on the dyadic nature of the data to examine both actor (for example, Alex’s self-reported variables predicting her own relationship satisfaction) and partner effects (for example, Cameron’s self-reported variables predicting Alex’s relationship satisfaction) (BOX 1), Joel et al. examined how much variance each predictor explained in relationship satisfaction concurrently and over time and which predictors emerged as the most successful in predicting variance in relationship satisfaction. As shown in TABLE 1, the self-reported perceptions about oneself that were most consistently associated with relationship satisfaction were one’s own satisfaction with life, negative affect, depression and anxiety<sup>13</sup>. The self-reported perceptions of the relationship that explained the most variance were perceived partner responsiveness, intimacy, and perceived partner satisfaction and commitment<sup>13</sup>.

Box 1 | Dyadic data

Dyadic data — data collected from both members of a dyad — can be a rich source of information for romantic relationship research<sup>152</sup>. This type of data allows researchers to test complex research questions and distinguish between actor effects, the effect of a person’s own score on their own outcome (for example, partner A’s stress level on their own relationship satisfaction), and partner effects, the effect of a person’s own score on their partner’s outcome (for example, partner A’s stress level on partner B’s relationship satisfaction)<sup>153</sup>. The underlying idea is that people’s own behaviours, cognition and emotions not only influence their own personal and relational outcomes, but also their partner’s. In other words, the partners are in an interdependent relationship, with a high degree of mutual influence on one another. This interdependence is a cornerstone of all relationships, including romantic relationships<sup>154</sup>.

The most popular model for analysing dyadic data is the Actor–Partner Interdependence Model<sup>153</sup>, which considers the mutual influence between partners and accounts for the non-independence of the data (as scores within couple members are more highly correlated than scores with other individuals). In this model (see the figure), each outcome is regressed onto both partners’ predictors simultaneously (for example, partner A’s relationship satisfaction onto both partner A’s and partner B’s stress levels). This allows researchers to examine the partner effect above and beyond the actor effect, or vice versa, such as whether partner A’s stress level influences partner B’s relationship satisfaction (partner effect) above and beyond partner B’s own stress level (actor effect). The error terms of the outcome variables are also correlated between partners to account for the dependency between their scores. The Actor–Partner Interdependence Model is highly adaptable; it can be used for both cross-sectional and longitudinal research questions and has been applied to various statistical techniques such as multilevel modelling, structural equation modelling and Bayesian modelling<sup>155,156</sup>.

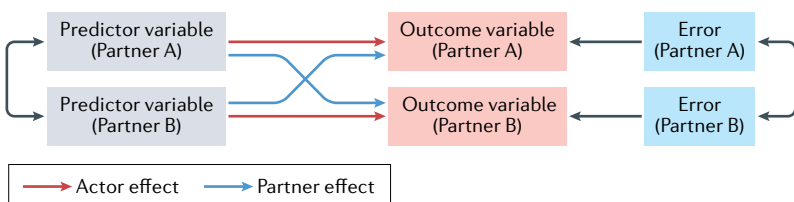


Table 1 | Success rates of the ten strongest self-reported predictors of relationship satisfaction reported in Joel et al.<sup>13</sup>

Predictors	Percentage of actor effects successful	Percentage of partner effects successful
<i>Self-reported perception of the self</i>		
Satisfaction with life	100	92
Negative affect	90	33
Depression	82	72
Anxiety	73	50
Avoidant attachment	71	80
Anxious attachment	71	62
Neuroticism	65	33
Self-esteem	56	67
Psychological well-being	53	44
Positive affect	53	40
<i>Self-reported perceptions of the partner and relationship</i>		
Perceived partner responsiveness	93	69
Intimacy	92	67
Perceived partner satisfaction	91	78
Perceived partner commitment	90	100
Appreciation	90	60
Conflict	90	57
Sexual satisfaction	90	54
Love	88	76
Trust	87	73
Capitalization	81	40

Success rate percentages can be interpreted as the strength of the variable relative to the strength of other variables included in the model, but it does not have any independent meaning or effect size. Random forests do not specify the size or the direction of the effect; only that the variable meaningfully contributes to the total variance explained in a given model. Capitalization refers to communicating a positive event to one's partner and receiving a response (either positive or negative) to this disclosure. The table is adapted with permission from REF.<sup>13</sup>, PNAS.

Several findings from Joel et al.<sup>13</sup> are particularly noteworthy. First, in the concurrent analyses, self-reported perceptions about oneself (for example, people's self-reported Big Five personality traits) were weaker predictors of relationship satisfaction (19% of the variance explained) compared to self-reported perceptions of the relationship (for example, people's self-reported sexual satisfaction, perceptions of partner appreciation; 45% of the variance explained). Thus, although certain individual differences, such as high neuroticism or low self-esteem, are considered risk factors for healthy relationships<sup>35</sup>, this meta-analysis suggests that the unique properties of the relationship and of the partners' dynamics are most strongly associated with relationship satisfaction<sup>13</sup>.

Second, also in the concurrent analyses, partner effects explained very little variance (15%) compared to actor effects (45%)<sup>13</sup>. That is, one's own self-reported perceptions of the relationship were more strongly associated with relationship satisfaction than their partners' self-reported perceptions of the relationship. For example, Alex's self-reported perceptions of how much Cameron trusts her were strongly associated with Alex's

relationship satisfaction, whereas Cameron's actual ratings of how much he trusts Alex were weakly associated with Alex's relationship satisfaction.

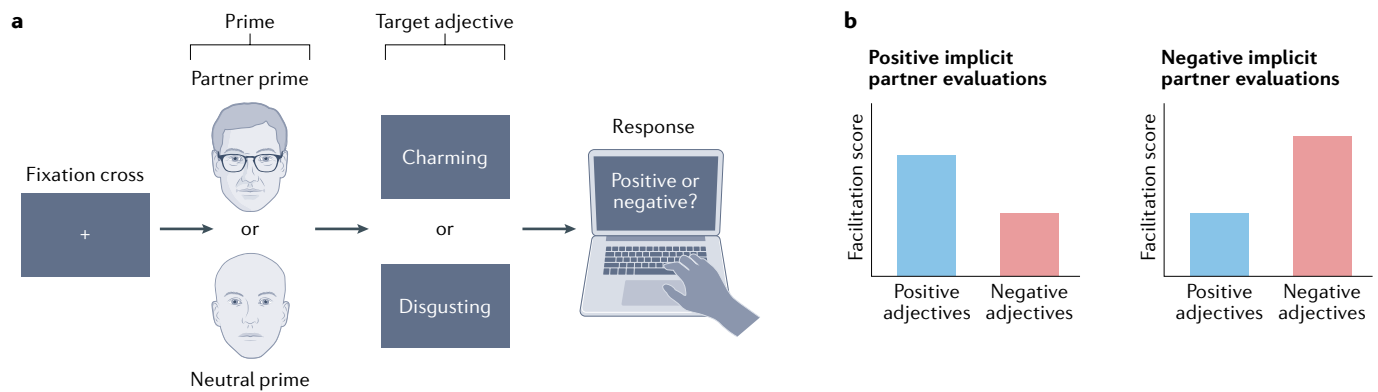
Finally, Joel et al.<sup>13</sup> found that most of the 43 self-reported perceptions failed to predict changes in relationship satisfaction from baseline to follow-up (self-reported perceptions explained no more than 5% of the variance). Thus, the authors concluded that self-reported perceptions are not reliable predictors of whether a person's relationship satisfaction will improve or decline. It is important to note that although this meta-analysis included many of the most frequently assessed self-reported perceptions, some perceptions that might have important relationship implications (such as self-expansion, or expanding one's sense of self through novel and exciting activities with one's partner)<sup>52</sup>, were not considered.

In sum, decades of research examining the link between self-reported perceptions and relationship satisfaction reveal robust concurrent associations with relationship satisfaction. However, it is possible that these associations may be inflated by problems inherent to the self-reporting measures. First, associations based on measures that use the same assessment strategy (for example, self-report) can be inflated because both measures are susceptible to the same sources of bias (common method variance)<sup>53</sup>. For example, Alex's positive way of looking at the world and answering questions on surveys might lead her to report that she trusts Cameron and that she is happy with the relationship. Second, according to motivated reasoning<sup>54</sup>, people also want to justify the partners they choose and therefore report that they are happy with their relationship and that the partner possesses the qualities they desire, regardless of whether this is true or not. Finally, general sentiment toward the relationship may colour self-reported perceptions of the partner and the relationship<sup>55</sup>. This sentiment override makes it challenging to draw causal conclusions about whether self-reported perceptions are the predictors or outcomes of relationship satisfaction. For example, although it is possible that Alex's trust in Cameron leads her to report that she is satisfied with the relationship, it is equally plausible that Alex's satisfaction with Cameron predicts her trust.

To determine how well self-reported variables can predict relationship satisfaction, research needs to examine whether these variables can predict changes in relationship satisfaction. However, as Joel et al.<sup>13</sup> suggest, self-reporting assessments are not always likely to predict such longitudinal changes. To overcome the limitations of self-reported perceptions, relationship scientists have examined other factors that might predict relationship satisfaction, such as implicit evaluations and objective indexes.

### Implicit evaluations

Whereas self-reporting measures directly assess people's perceived affect and behaviours by asking participants to report them in a questionnaire, implicit measures indirectly assess these constructs using performance-based tasks (often reaction-time tasks)<sup>56</sup>. These tasks bypass people's motivations to report in self-desirable or socially



**Fig. 1 | The evaluative priming task.** **a** | In this speeded categorization task, participants are instructed to indicate as quickly and accurately as possible whether the target adjectives that appear on screen are positive or negative. Prior to being shown each target adjective, participants are exposed to a partner or neutral prime. **b** | Facilitation scores can be calculated by subtracting the mean reaction time for positive (or negative) adjectives preceded by partner primes from the mean reaction time for positive (or negative) adjectives preceded by neutral primes. More positive implicit partner evaluations reflect higher facilitation scores for positive adjectives and lower facilitation scores for negative adjectives (left), whereas more negative implicit partner evaluations reflect lower facilitation scores for positive adjectives and higher facilitation scores for negative adjectives (right).

desirable ways and are less susceptible to the influence of motivated-reasoning processes. In the context of romantic relationships, research has focused on implicit partner evaluation, or the automatic affective reactions — ‘gut feelings’ — that people have toward their partner. These evaluations are considered automatic in that they manifest spontaneously in the absence of substantial cognitive resources or substantial time to generate them, and they operate efficiently and without intention<sup>57</sup>.

For example, in one of the most used paradigms — the evaluative priming task<sup>58</sup> — participants are briefly exposed to pictures of either their partner or neutral pictures and then presented with positive or negative adjectives (for instance, ‘charming’ or ‘disgusting’) that they must categorize by valence (positive or negative) as quickly as possible<sup>59</sup> (FIG. 1a). The evaluative priming task relies on the assumption that if participants hold positive automatic affective reactions toward their partner, exposure to pictures of the partner (versus neutral pictures) should facilitate processing of positive information and therefore result in faster responses to positive adjectives; by contrast, positive feelings activated by the picture of the partner should impair processing of negative information and thus result in slower responses to negative adjectives (FIG. 1b). Accordingly, implicit partner evaluation is inferred from a task-performance indicator: the speed in responding to words paired with pictures of the partner compared to neutral pictures. Although these types of measure have been adopted by relationship scientists to study people’s automatic affective reactions toward their partner only in the last decade<sup>59</sup>, they have been widely validated<sup>56</sup> and used to assess attitudes in other domains such as prejudice<sup>60</sup> and self-esteem<sup>61</sup>.

One question is whether attitudinal scores obtained in implicit tasks correlate with people’s self-reported perceptions. In other fields, self-reported perceptions tend to be only weakly associated with implicit evaluations of that same target (such as attitudes about race)<sup>62</sup>, and partner self-reporting and implicit evaluations are

no exception. In fact, a meta-analysis of relationship studies revealed a very weak correlation ( $r = 0.04$ )<sup>63</sup> between these variables. This weak association between self-reporting and implicit evaluations is not particularly surprising given that people are typically motivated to perceive and describe their relationship in an overly positive way<sup>64,65</sup> when asked to report their evaluation through self-reporting measures. By contrast, in implicit tasks, people have limited opportunities to control their responses and have reduced awareness of their scores<sup>62</sup>. Indeed, self-reported perceptions and implicit partner evaluations are more strongly correlated among people who are less (rather than more) motivated to respond positively and among people with limited (rather than ample) cognitive capacity to process their self-reported perceptions<sup>63</sup>. Because implicit evaluations are somewhat less susceptible to deceptive responding, motivational biases and introspection constraints than self-reporting measures, they offer unique insights into relational outcomes.

Critically, implicit evaluations may predict changes in relationship satisfaction. For example, McNulty et al.<sup>59</sup> assessed self-reported partner perceptions and implicit partner evaluations in a sample of 135 newlywed couples and then tracked those couples’ marital satisfaction for 4 years (measured every 6 months). Growth curve modelling showed that, although self-reported partner perceptions at baseline failed to predict changes in marital satisfaction, implicit partner evaluations assessed with the evaluative priming task measured at baseline predicted such changes: people who held more positive implicit partner evaluations at baseline experienced less steep declines in marital satisfaction over time than people who held more negative implicit partner evaluations<sup>59</sup>. Furthermore, a direct test revealed that implicit evaluations were more strongly associated with changes in relationship satisfaction than self-reported evaluations<sup>59</sup>. The ability of implicit measures to forecast changes in relationship

satisfaction has been conceptually replicated in other samples<sup>66–68</sup>, and implicit partner evaluations have also predicted relationship dissolution<sup>68,69</sup>. Importantly, as in McNulty et al.<sup>55</sup>, in these studies implicit partner evaluations predicted change in relationship satisfaction, above and beyond, and significantly more strongly than, self-reported partner evaluations, highlighting the unique role of automatic feelings in predicting the fate of the relationship.

One challenge that relationship researchers are now facing is trying to understand why implicit evaluations predict changes in relationship satisfaction. One possibility is that implicit partner evaluations are especially likely to influence automatic behaviours in relationships<sup>70,71</sup>. For example, one study found that implicit, but not self-reported, partner evaluations predicted non-verbal behaviour (which is generally automatic and difficult to control) in dyadic interactions, which in turn predicted changes in relationship satisfaction immediately after the interaction and in the following weeks<sup>66</sup>. Likewise, positive implicit partner evaluations predict forgiveness toward the partner in daily life when people have low executive control, that is when they are likely to react to partner's offenses in an automatic fashion<sup>72</sup>. Finally, positive, as compared to negative, implicit partner evaluations are associated with perceiving fewer subsequent problems and fewer destructive relationship behaviours, such as blaming or ignoring the partner<sup>59,68,73</sup>.

Research on implicit evaluations is relatively new and certainly cannot compete with the wealth of evidence available from self-reported perception measures. Furthermore, only Western samples (mostly from the USA and The Netherlands) have been used to measure the impact of implicit measures on relationship satisfaction. Thus, although it seems promising, more research is needed to verify the potential role that implicit evaluations might have in predicting relationship satisfaction longitudinally.

### Objective indexes

A third class of factors that may influence relationship satisfaction is objective, externally assessable data that are not based on partner perceptions and evaluations, such as demographics, life events, objectively coded communication patterns and biological characteristics. Like implicit measures, objective measures are less susceptible to problems inherent to self-reports. Although some of these factors may be self-reported (for example, people self-report demographics or life events) or might be the product of several individuals' appraisals (for example, trained coders who evaluate videotaped couple interactions), we consider them objective indexes because they do not rely on the individual's subjective perception of themselves, their partner or their relationship. Instead, these measures rely on objective facts or observations that are externally assessable and verifiable.

**Demographics.** Demographics are often included in relationship studies to describe sample characteristics, but they are less frequently tested as actual predictors of relationship quality. One reason for this is that these

demographics are usually homogeneous in that they describe the Western, white, middle-class and heterosexual couples that comprise the typical samples in relationship studies<sup>74,75</sup>. That said, some research has explored the extent to which demographic characteristics relate to relationship satisfaction (TABLE 2). We review the most frequently assessed demographics below, and distinguish between individual-level demographics (for example, age, gender and socioeconomic status) and couple-level demographics (for example, relationship length or relationship status).

One important individual-level demographic that has been shown to be a predictor of concurrent and longitudinal relationship satisfaction and dissolution is socioeconomic status<sup>38,76,77</sup>. Individuals with less education and lower income tend to struggle more in their relationships compared to those with more education and higher income, but this is in part due to the stress associated with their life circumstances<sup>78</sup>. Other studies have found that religious people report higher relationship satisfaction than non-religious people<sup>79</sup>, possibly because religious individuals are likely to value forgiveness, fidelity and commitment, which are conducive to good relationship functioning<sup>80</sup>.

Other individual-level demographics are more weakly related to relationship satisfaction<sup>13</sup>. For example, a meta-analysis found that women tend to be less satisfied with their relationships than men, but this effect was only significant among couples who were in marital therapy at the time of data collection<sup>81</sup>. Little research has examined the link between age and relationship satisfaction, and the few studies that have tested this link do not find significant associations<sup>13,82,83</sup>. Some research has found that Black Americans experience less marital satisfaction and steeper declines in marital satisfaction than white Americans<sup>38,84</sup>. However, these findings should be interpreted with caution because, rather than by ethnicity, the effects could be driven by the fact that Black Americans have lower socioeconomic status or experience more discrimination (and therefore more stress) than white Americans<sup>84</sup>.

Regarding couple-level demographics, the only robust predictor of relationship decline is relationship length<sup>13,34,45,85</sup>. As previously mentioned, relationship satisfaction steadily declines over time, although this decline can be steeper or more gradual depending on certain relationship characteristics, such as being or having a partner high in neuroticism and low in self-esteem<sup>34</sup>. There is conflicting evidence on how relationship type (homosexual versus heterosexual) is related to relationship satisfaction. On the one hand, preliminary evidence has shown that lesbian couples exhibit significantly higher levels of relationship satisfaction compared to heterosexual couples<sup>86</sup>; on the other hand, homosexual couples might be at higher risk of relationship dissolution than heterosexual couples<sup>87,88</sup>. There is also conflicting evidence regarding whether people in arranged marriages are more or less satisfied than people in self-choice marriages (that is, in marriages where partners chose each other). Whereas some research finds that people in arranged marriages are less satisfied<sup>89–91</sup>, other research finds that they are more satisfied than

Table 2 | Demographic indexes linked to relationship satisfaction

Index	Designs	General findings	Refs
<i>Individual-level demographics</i>			
Age	Cross-sectional	No conclusive link	82
	Longitudinal	No conclusive link	83
Gender	Cross-sectional	No conclusive link	81
	Longitudinal	No conclusive link	34
Ethnicity	Cross-sectional	Black Americans report lower relationship satisfaction than white and Mexican Americans	84
	Longitudinal	Being Black (as opposed to white) predicts a steeper decline in relationship satisfaction	38
Socioeconomic status	Cross-sectional	Lower education and financial strains are related to lower satisfaction	38,77
	Longitudinal	Lower education and financial strains are related to lower satisfaction	38
Religious affiliation	Cross-sectional	Religiosity is positively associated with relationship satisfaction	79
<i>Relationship-level demographics</i>			
Relationship length	Cross-sectional	Relationship satisfaction is negatively associated with relationship length	34
	Longitudinal	On average, individuals' relationship satisfaction declines with increasing relationship length (but there is a lot of variation between couples)	34,35,85
Relationship status (married vs premarital cohabitation vs non-cohabitation)	Cross-sectional	Cohabitation related to lower satisfaction than marriage	97
	Longitudinal	No conclusive link	96
Relationship type (homosexual vs heterosexual)	Cross-sectional	Lesbian couples tend to have higher levels of relationship satisfaction than heterosexual couples	86
	Longitudinal	No conclusive link	86
Marriage type (arranged vs self-choice)	Cross-sectional	Inconsistent results across articles	89–95
Relationship openness (monogamous vs consensual non-monogamous)	Cross-sectional	No conclusive link	98,99

their counterparts in self-choice marriages<sup>92,93</sup>, and other research finds no difference between arranged and self-choice marriages<sup>94,95</sup>. Relationship status (cohabitation versus marriage)<sup>13,96,97</sup> and relationship exclusivity (monogamous versus consensual non-monogamous)<sup>98,99</sup> are not associated with relationship satisfaction, at least according to the current data available.

Overall, with the exception of socioeconomic status, religiosity and relationship length, most demographic variables do not play a strong role in predicting relationship satisfaction<sup>13</sup>. It is nevertheless important to note that, for some of these variables, only preliminary data is available on their potential role in influencing relationship functioning. For example, although relationship satisfaction does not seem to differ between monogamous and consensual non-monogamous couples at one point in time, there is very little data on the longitudinal trajectories of these different types of couples and whether they display similar levels of relationship satisfaction and dissolution over time.

**Life events.** According to the revised vulnerability-stress-adaptation model<sup>100</sup> (FIG. 2), the fate of a relationship depends on the characteristics each individual brings to the relationship, such as their personality traits,

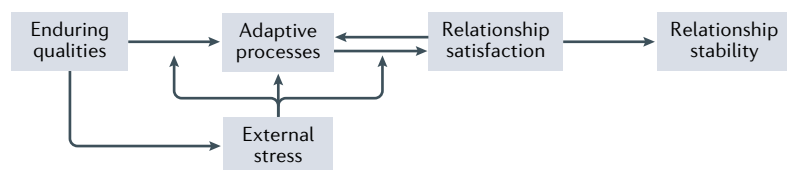
demographics and biological factors, as well as on the stressful events that partners might encounter during their time together. All these factors predict and potentially interact with the behaviours that partners exhibit while trying to cope with these stressors. Some stressful events and how they affect relationships have been widely studied and provide valuable insights into the outside forces that can shape relationship outcomes (TABLE 3).

One of the most significant life events that many couples face during their relationship is the transition to parenthood, which is often experienced as a 'revolution to parenthood' given the profound, quick and pervasive changes that this event entails for both partners' lives and for their relationship dynamics. After childbirth, parents experience a sudden deterioration of relationship functioning<sup>101–103</sup>. Parents only again display similar levels of relationship satisfaction as non-parents several years after birth<sup>102,104</sup>. Job loss and sickness also negatively affect both the individual who experiences the event (because of the stress and challenges that they personally face) and their partners (who need to take care of the affected partner's financial, psychological and physical needs)<sup>105–109</sup>. Finally, encountering a desirable alternative to the current partner and infidelity also lead

to a decline in relationship satisfaction and relationship dissolution<sup>110–112</sup>. Not surprisingly, extramarital affairs are among the top causes of divorce<sup>113</sup>.

In sum, research has shown that events external to the relationship can have an important impact on how partners feel towards each other and whether they decide to stay together. It is important to note that research has focused on the above-mentioned life events not only because it is clear they have a profound impact on relationships but also because they occur frequently (and therefore it is easy to recruit samples that have experienced them). However, there may be other important life events that have not been adequately investigated (for example, relocation, work-related changes, and loss of family members or close friends) because data on these events are more difficult to collect. Furthermore, research has focused on events that may disrupt relationship functioning; there is less research on events that may foster positive feelings between partners (for example, taking a world trip or starting an engaging hobby together, receiving a promotion at work, or experiencing a positive financial change). These positive events might indeed renew passion and increase relationship satisfaction<sup>52</sup>.

**Communication patterns.** The revised vulnerability-stress-adaptation model suggests that many factors that influence relationship satisfaction do so through the adaptive processes people employ, including the behaviours they express when interacting with each other, specifically when solving relationship problems together<sup>20</sup>. We consider such behaviours objective indexes because they are often assessed by independent judges, external to the couple, following a standardized coding scheme. In the typical paradigm, couples are recorded while discussing a relationship problem and several independent coders subsequently rate this interaction according to standardized criteria. Thus, this index is different from self-reported perceptions because it does not involve the partner's subjective judgement of the interaction but rather relies on external observers reaching a consensus regarding an objective, observable reality. There are several behavioural coding schemes and they generally assess whether the behaviours exhibited during the interaction are cooperative (such as expressing agreement, affection and humour) or oppositional (such as blaming, insulting and withdrawing)<sup>114</sup>.



**Fig. 2 | The revised vulnerability-stress-adaptation model.** According to this model, stress plays a critical role in determining how relationships change over time. Although enduring qualities predict relationship satisfaction and therefore the eventual stability of the relationship through adaptive processes such as behaviour and cognition, external stress can directly influence adaptive processes, alter the manner in which enduring qualities predict such processes, or alter the manner in which adaptive processes predict relationship satisfaction. For this reason, it may be difficult to account for changes in relationship satisfaction without considering the role of stress.

Studies that assess the link between communication patterns and relationship satisfaction paint a complex picture of the relation between these variables (TABLE 4). Whereas cooperative and oppositional communication are linked to positive and negative relationship satisfaction, respectively, when assessed in cross-sectional research designs<sup>115</sup>, the longitudinal findings are much less consistent. First, many studies report null main effects between communication patterns and changes in relationship satisfaction<sup>116</sup>. Among studies that find significant associations, the results are often inconsistent. Cooperative communication sometimes promotes positive changes in relationship satisfaction, but other times it promotes negative changes;<sup>20,117,118</sup> likewise, oppositional communication sometimes promotes negative changes, but other times it promotes positive changes<sup>119,121</sup>. In fact, hostile disagreement can sometimes promote rather than deteriorate relationship satisfaction over time<sup>117,120</sup>, whereas expressing agreement and humour can sometimes undermine satisfaction and stability over time<sup>117,118</sup>.

To shed light on the conditions under which cooperative communication might backfire and oppositional communication might improve relationship satisfaction over the long term, a further distinction has been made between direct behaviours (communication that goes to the point and addresses the problem at hand, such as asking to solve a specific problem or blaming the partner for a hurtful behaviour) and indirect behaviours (communication that uses passive or covert ways to solve issues, such as using humour or restraining negative reactions). Compared to indirect behaviours, direct behaviours (cooperative and oppositional) seem to be particularly effective problem-solving techniques that improve relationship satisfaction over time<sup>114</sup>, although this is contingent on several contextual factors. For example, direct oppositional behaviour, such as criticizing, blaming and demanding changes from a partner might improve relationship satisfaction over time, but only when the problems discussed are serious. When the problems are minor, the same behaviours might backfire and be destructive for the relationship in both the short and long term<sup>120</sup>. Thus, under the right circumstances, strongly requesting change, even with oppositional behaviours, might help partners to realize the severity of the situation and motivate them to enact the changes that are necessary to improve the relationship<sup>121</sup>. However, at times, partners might not be capable of making the necessary changes. For example, when partners are depressed, and therefore unable to make significant changes, oppositional communication backfires and reduces the motivation to resolve problems. In other words, it is only for partners with low depressive symptoms that oppositional communication triggers the willingness to make significant changes<sup>122</sup>.

The success of oppositional communication might further depend on the characteristics of the person who demands change. For example, oppositional communication backfires for people with low self-esteem but not for those with high self-esteem<sup>123</sup>. In fact, individuals with low self-esteem tend to express more negativity in the relationship in general and their requests might be

Table 3 | Life events linked to relationship satisfaction

Index	Designs	General findings	Refs
Transition to parenthood	Cross-sectional	The first years of parenthood are associated with lower relationship satisfaction	101–104
	Longitudinal	Relationship satisfaction decreases after child birth	101–104
Job loss	Cross-sectional	Unemployment is associated with lower relationship satisfaction	106
	Longitudinal	Relationship satisfaction decreases after job loss	105
Partner alternatives/infidelity	Cross-sectional	Infidelity is associated with lower relationship satisfaction	110
	Longitudinal	Infidelity decreases relationship satisfaction and predicts divorce	110–112
Sickness	Cross-sectional	Sickness is related to lower relationship satisfaction	107,108
	Longitudinal	Low health predicts lower relationship satisfaction	109

seen as unjustified, exaggerated and less diagnostic of a real, severe problem<sup>124</sup>.

Finally, the effects of oppositional behaviour also depend on the level of stress occurring outside the relationship. An analysis of ten longitudinal studies of marriage<sup>100</sup> found that partners' use of oppositional behaviours was associated with costs to relationship satisfaction over time when those partners were experiencing low levels of stress, but was associated with benefits to satisfaction when those partners were experiencing high levels of stress. The authors suggest that these findings emerged because oppositional behaviours helped motivate change when change was most necessary. In sum, the basic assumption that cooperative behaviours are beneficial and oppositional behaviours are detrimental for relationship functioning has been challenged by empirical evidence showing that oppositional communication can sometimes benefit couples over the long term.

According to the Relationship Problem Solving Model<sup>125</sup>, problem-solving is a complex process involving multiple stages and various contexts, each of which helps to determine the extent to which various behaviours are beneficial or costly to problem-solving and thus relationship satisfaction. For example, the first stage of the problem-solving process requires that people notice a problem, and oppositional behaviours such as blaming a partner for a hurtful behaviour can alert the partner to the problem and potentially motivate them to address it, despite the costs of upsetting that partner in the moment. However, blaming a partner for a problem that the partner knows about and is already motivated to address offers few benefits. Thus, knowing how various behaviours will contribute to problem resolution and therefore changes in satisfaction requires understanding and accounting for the broader context in which those behaviours occur, including the stage of the problem-solving process at which the behaviour is enacted.

**Biological indexes.** A final class of factors that have been studied in relation to relationship satisfaction are biological indexes, such as hormones, genes, neural

activation and cardiovascular responses (TABLE 5). This field of research is relatively young, with most of the studies conducted over the past decade. Moreover, most of these studies are cross-sectional and therefore little is known about how these biological indexes affect changes in relationship satisfaction.

Hormones, especially cortisol, testosterone and oestradiol, are the most extensively studied biological indexes. Several studies have found that cortisol, the hormone associated with stress, can influence relationship satisfaction<sup>127–129</sup>. However, the link between cortisol and relationship satisfaction does not seem very robust, as a recent meta-analysis did not find a significant association between them<sup>1</sup>. Testosterone, the hormone associated with male sexuality and competition, seems to negatively affect relationship satisfaction. In fact, negative associations have emerged for both the individual high in testosterone and their partner<sup>130–132</sup>. Finally, women's peaks in oestradiol during ovulation negatively influence relationship satisfaction both for women and men<sup>133,134</sup>. These findings are consistent with evolutionary perspectives that propose that during ovulation women might disengage from their long-term partner (particularly those with less desirable qualities) to seek alternative partners with higher genetic fitness<sup>135</sup>.

In terms of other biological indexes, cardiovascular responses during interactions and conflicts with one's partner have been repeatedly shown to be associated with relationship functioning. Indeed, meta-analytical evidence shows that individuals with greater cardiovascular reactivity to stress in the relationship are also less likely to report high satisfaction in relationships<sup>136</sup>. Furthermore, three genetic sequences have been found to be associated with relationship functioning. First, individual variations on the *CD38* gene, a gene implicated in the regulation of oxytocin release<sup>137</sup>, is positively associated with expression of gratitude<sup>138</sup>, communal behaviours<sup>139</sup>, and relationship satisfaction<sup>140</sup>. Second, *AVPR1a* RS3, which has been associated with pair-bonding in voles and humans, is positively associated with greater partner bonding, higher commitment, fewer relationship problems, and greater relationship satisfaction for both the individual carrying the gene and their partner<sup>141,142</sup>. Third, variations in the serotonin transporter promoter polymorphism (5-HTTLPR) are associated with relationship satisfaction<sup>143</sup>. Finally, although the vast majority of neuroscience work has examined brain regions involved in romantic and sexual desire specifically<sup>144</sup>, some work has revealed regions associated with relationship satisfaction, including the ventral tegmental area, a dopamine-rich area related to reward processing, and the orbitofrontal cortex, an area associated with reward evaluation and decision-making<sup>143,145,146</sup> (TABLE 5).

The effects of biological indexes on relationship satisfaction should be interpreted with caution. First, many studies rely on small sample sizes, which may undermine the reliability of the findings<sup>147</sup>. Second, the vast majority of this work is correlational, and therefore does not support causal conclusions. Although it seems implausible that relationship satisfaction would influence the presence or absence of certain genetic variations, relationship



quality can affect people’s health and well-being<sup>2</sup> and, therefore, their biology. Thus, it could very well be that relationship satisfaction can cause certain cardiovascular responses. Likewise, it might be possible that individuals who are less (versus more) happy in their relationships may exhibit stronger physiological responses to conflicts. Future research needs to elucidate the direction of the link between these variables as well as whether these and other biological indexes can predict changes in relationship satisfaction.

**Integration across factor clusters**

For simplicity, we organized this Review around three main clusters of factors (self-reported perceptions, implicit evaluations, and objective indexes). However, assessing the same constructs in different ways could provide valuable insight and clarify their predictive power. For example, stress could be assessed via self-reporting perception (asking people how stressed they feel), a report of a particular life event (a report of a new serious illness), a cardiovascular response (increase in blood pressure) or a hormonal response (increase in cortisol). Similarly, conflict could be assessed via self-reporting (asking people if they had a conflict with their partner), observation of communication patterns (coding an interaction as hostile), or the report of a life event (a report of divorce). Given the biases and errors linked to each methodology, it is plausible that these different measures will not always strongly correlate with each other, highlighting the necessity of using them in combination to best capture the underlying construct. Thus, although self-reporting measures have been favoured and widely used in the past because they are easier and quicker to administer<sup>75</sup>, it is important to gather data in multiple ways to reach a complete understanding and assessment of a phenomenon.

Furthermore, it is important to study not only which factors might be the strongest determinants of relationship satisfaction but also how these factors might interact with each other. For example, McNulty et al.<sup>100</sup> pooled data from ten longitudinal studies of married couples that all contained self-reported perceptions of both partners’ traits (self-reported factor) and observations of their behaviours (objective factor). As previously discussed, a similar analysis by Joel et al.<sup>13</sup> that relied on self-reported perceptions alone failed to document reliable effects of own and partner traits on relationship satisfaction. McNulty et al.<sup>100</sup> observed similar results when they ignored the role of behaviour

and stress — self-reported and partner-reported traits exerted negligible direct influences on change in marital satisfaction.

However, consistent with several models, including the Vulnerability-Stress-Adaptation model<sup>100</sup>, Contextual Model<sup>125</sup>, and the Relationship Problem-Solving Model<sup>126</sup>, McNulty et al.<sup>100</sup> found that every individual and partner self-reported trait examined exerted indirect effects on changes in marital satisfaction that were mediated by observations of behaviour. Furthermore, consistent with the idea that the effects of behaviour depend on context, these indirect effects were moderated by stress, such that the same traits and behaviours were sometimes adaptive and sometimes maladaptive, depending on the levels of stress occurring outside the relationship. These results help explain why self-reported perceptions might not exert strong direct effects on change in satisfaction — the manner in which individual traits matter depends on the behaviours they produce and the context in which those behaviours occur. Thus, this study highlights the importance of examining different classes of factors together: objective observations of behaviour led to a better understanding of self-reported perceptions.

An interesting avenue for future research would be to investigate how biological factors interact with environmental circumstances to predict relationship outcomes. Just as many outcomes are predicted by gene–environment interactions, the fate of a relationship might depend on which genes people have and which life events they encounter during the course of the relationship. Similarly, some demographic variables might make an individual more or less at risk of relationship dissatisfaction and dissolution depending on their communication patterns. For example, although low socio-economic status and financial problems are risk factors, if couples are able to communicate adequately, engage in improvement efforts and find constructive solutions, they might not experience a deterioration of relationship satisfaction.

It will also be important to understand which factors are especially predictive of changes in relationship satisfaction under which circumstances. It might be that implicit evaluations are especially predictive of the fate of a relationship when couples encounter stressful life events, such as transition to parenthood, because under those circumstances much of their behaviour might be automatic. By contrast, self-reported evaluations might be good predictors of relationship success (or decay) over time depending on individual differences or contextual events that promote introspections and diminish socially desirable responses.

That said, although examining the interactions among factors can help to shed light on ways in which they are independently or dependently related to relationship outcomes, these factors do not always need to interact; sometimes changes in one factor might be strong enough to provoke serious changes in relationship satisfaction independently of the other factors. For example, in some cases, the changes caused by some life events might be so large and overwhelming that any prior affect and cognition might have relatively little

Table 4 | Communication patterns linked to relationship satisfaction

Index	Designs	General findings	Refs
Cooperative communication	Cross-sectional	Positive association with relationship satisfaction	115–118
	Longitudinal	Effects may be positive or negative depending on circumstances	115–118
Oppositional communication	Cross-sectional	Negative association with relationship satisfaction	114–120
	Longitudinal	Effects may be positive or negative depending on circumstances	114–120

Table 5 | **Biological indexes linked to relationship satisfaction**

Index	Designs	General findings	Refs
<b>Hormones</b>			
Cortisol	Cross-sectional	No strong link	1
Testosterone	Cross-sectional	Negatively associated with relationship satisfaction	130
	Longitudinal	Predicts lower relationship satisfaction	131
Oestradiol	Cross-sectional	Negatively associated with relationship satisfaction	133,134
<b>Cardiovascular</b>			
Heart rate reactivity	Cross-sectional	No significant association with relationship satisfaction	136
Heart rate, systolic blood pressure, diastolic blood pressure	Cross-sectional	Negatively associated with relationship satisfaction	1
<b>Genetics</b>			
CD38 (rs3796863)	Cross-sectional	Negatively associated with relationship satisfaction	139,140
	Longitudinal	No significant effects	140
AVPR1a rs3	Cross-sectional	Positive association with relationship satisfaction	141,142
5-HTTLPR	Cross-sectional	Positive association with relationship satisfaction	143
<b>Neural</b>			
Right anterior putamen, right dorsolateral prefrontal cortex, left midbrain reticular formation	Cross-sectional	Positive association with relationship satisfaction	145
Right subcallosal cingulate gyrus	Cross-sectional	Negative association with relationship satisfaction	145
Right ventral prefrontal cortex	Cross-sectional	Positive association with relationship satisfaction	143
Posterior region of the medial orbitofrontal cortex, caudate tail	Longitudinal	Positive association with relationship satisfaction	146
Anterior region of the medial orbitofrontal cortex, the accumbens, the subcallosal cingulate	Cross-sectional	Negative association with relationship satisfaction	146
	Longitudinal	Negative association with relationship satisfaction	146

influence on how partners feel about each other after the event.

**Summary and future directions**

Self-reported perceptions of individuals, partners, and relationships are the assessments most frequently used to understand and predict relationship satisfaction. Thus far, it seems clear that self-reported perceptions are strongly associated with concurrent relationship satisfaction but are less likely to predict longitudinal changes, at least when considered on their own. Consequently, research that includes measures of other factors, such as implicit evaluations, life events, objective indexes of behaviour, and biological indexes might be more informative, especially as these measures are less susceptible to the biases inherent to self-reporting measures. Of course, self-reported perceptions are not without their merits; knowing how happy people think they are, how they think they behave, and generally what people

think about their relationships is extremely informative. Moreover, self-reported perceptions are easier to collect than implicit or biological measures and can therefore be more easily used with larger and more diverse samples. However, research using self-reporting measures should be interpreted in light of their potential limitations. Overall, the best research will probably use a combination of the measures described here.

More research is needed to corroborate the findings that implicit evaluations might be reliable predictors of changes in relationship satisfaction, perhaps even more so than self-reporting measures. Despite the need for more evidence, there are several reasons why implicit evaluations may be particularly predictive. One possibility is that implicit partner evaluations, which are assumed to represent the accumulation of positive and negative experiences that people have with their partner, are automatic and difficult to control, whereas self-reported perceptions tend to be motivationally biased in that people often downplay negative aspects and promote positive ones to protect their relationships<sup>57,70</sup>. Consistent with this idea, most people report that their relationships are better than average<sup>64</sup> (which obviously cannot be true) and view their partners more positively than their partners view themselves<sup>65</sup> (which is remarkable given that individuals already tend to have positive self-biases)<sup>148</sup>. Thus, although at one time point the relationship might not be as ideal as it could be, people might be motivated to downplay this negativity in a self-reporting questionnaire, whereas implicit evaluations might better reflect affective experiences (positive and negative) between partners. This reasoning also applies to certain objective indexes (such as communication patterns and cardiovascular responses): objective indexes might be able to capture feelings and evaluations that are important and diagnostic for the future of the relationship but that people are not willing or able to report accurately.

Furthermore, implicit evaluations are more likely to colour perception and predict automatic, spontaneous behaviour. Although people might at times have full control over their actions in a relationship, inevitably they will encounter circumstances in which exerting control is difficult (such as heated conflicts or situations in which partners are under stress or time pressure). Under such circumstances, people's behaviour will mostly be automatic and guided by implicit evaluations. Thus, in these cases, if someone holds negative implicit evaluations, they will be likely to perceive their partner negatively and engage in automatic judgements and behaviours that could damage their relationship in lasting ways<sup>57</sup>.

Although self-reported perceptions explain little variance in changes in relationship satisfaction according to a meta-analysis<sup>13</sup>, it remains plausible that self-reported perceptions can predict changes given certain contextual factors<sup>100</sup> or partner characteristics. For example, although trust typically has a positive impact on relationship functioning<sup>149</sup>, trusting an untrustworthy partner can be detrimental over time<sup>150</sup>. Likewise, whereas forgiving a partner who is relatively cooperative might benefit relationship satisfaction, forgiving a more oppositional partner might harm relationship

satisfaction<sup>151</sup>. Future research should explore the circumstances under which self-reported perceptions can predict relationship success or deterioration over time, and when other measures (or a combination thereof) might be better suited to do so. Furthermore, given the promising role of implicit partner evaluations, future research should not only measure a person's general positive and negative affect automatically associated with their partner but also with more specific aspects of the relationship, such as trust, sexual desire, commitment and feelings of rejection, to test how these other automatic associations might influence behaviours and relationship dynamics.

Of the objective factors related to relationship satisfaction, life events seem to most robustly predict relationship satisfaction both concurrently and longitudinally. Although two people might initially love each other, and although they might have well-adjusted personalities and relational dynamics, they might still be seriously challenged as a couple by aversive external events. Demographics should also be more systematically investigated in future research. In particular, relationship scientists should make a conscious effort to recruit more heterogeneous samples. Furthermore, although researchers have started studying less common types of relationships, such as same-sex and consensually non-monogamous relationships, more research is needed before strong conclusions can be made regarding whether these and other couple-demographic factors are related to relationship success. Finally, more research

is needed to understand under which circumstances cooperative versus oppositional communication leads to improved relationship satisfaction over time. More fine-grained assessment of behaviours during dyadic interactions that goes beyond the general assessment of valence and directness and that is better able to measure the wide range of nuances that qualify communication patterns are needed. For example, it could be that some combinations of behavioural strategies, like criticizing (which signals the severity of the issue) while engaging in soft touch (which signals closeness and care) may be especially effective in solving problems over time.

One of the biggest challenges for future research will be to identify the most powerful predictors of relationship satisfaction overall. Future work could use a machine learning technique like the one used by Joel et al.<sup>13</sup> to compare the predictive power of all the factors reviewed here. Furthermore, studying the interplay of different factors might also be key to understanding which relationships are likely to succeed rather than fail. Knowing what the most important contributors of satisfying and lasting relationships are is a challenge for science that has important applied implications. By identifying the most powerful causes of relationship decay, people can be better informed and prepared to deal with their interpersonal challenges, and clinicians can develop the right interventions to support couples in difficult times.

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