ORIGINAL ARTICLE

Parsing the Mechanisms that Increase Relational Intimacy: The Effects of Uncertainty Amount, Open Communication About Uncertainty, and the Reduction of Uncertainty

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This study examined amount of uncertainty, openness of communication about uncertainty, and the uncertainty reduction process as three competing mechanisms that account for increased intimacy in romantic relationships. To test these competing mechanisms, we used multilevel modeling to analyze longitudinal data that were collected from individuals in romantic associations over a 6-week period. Results of separate analyses indicated that the amount of uncertainty was negatively associated with concurrent intimacy and the openness of communication about uncertainty, and decreases in uncertainty were positively associated with subsequent intimacy. When all three predictors were considered simultaneously, the decrease in uncertainty was the only significant predictor of intimacy. These findings highlight the importance of the uncertainty reduction process, rather than low amounts of uncertainty, for increased intimacy.

Uncertainty and its management hold a prominent place in the study of interpersonal communication. In particular, uncertainty, information seeking, and uncertainty reduction are highlighted as core mechanisms in the development of interpersonal relationships (e.g., Berger & Calabrese, 1975; Knobloch & Solomon, 2002b; Planalp & Honeycutt, 1985). Although the earliest theorizing about the role of uncertainty in relationship development pointed to the ways in which uncertainty is a negative experience that needs to be eliminated for relationships to move forward (e.g., Berger & Calabrese, 1975), other perspectives have highlighted the benefits that ambiguity can bring to individuals and their close relationships (e.g., Afifi & Weiner, 2004; Baxter & Montgomery, 1996; Brashers, 2001). Given that uncertainty can have both positive and negative repercussions in relationships, questions naturally arise about the function of uncertainty reduction in those associations.

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A review of the literature reveals three alternative views on the link between uncertainty experiences and intimacy in personal relationships. Uncertainty reduction theory suggests that less uncertainty corresponds with greater intimacy (Berger & Calabrese, 1975). Other research has assumed that uncertainty sparks information seeking and that open communication about uncertainty promotes closeness (e.g., Baxter & Wilmot, 1984; Berger & Bradac, 1982). Yet another possibility is that the uncertainty reduction process itself is experienced as rewarding and fosters intimacy, irrespective of the uncertainty that remains (e.g., Knobloch & Solomon, 2002b; Livingston, 1980). Our goal in this article is to use longitudinal data to distinguish amount of uncertainty, the openness of communication about uncertainty, and reducing uncertainty as factors that shape intimacy in personal relationships.

Although uncertainty is a broad construct that has been applied to a variety of interpersonal experiences (e.g., initial interaction, Berger & Calabrese, 1975; health contexts, Afifi & Weiner, 2004; Brashers, 2001), prior research reveals that romantic relationships and courtships are contexts especially ripe for the experience of uncertainty (e.g., Afifi & Burgoon, 1998; Knobloch & Solomon, 2002b). Knobloch and Solomon (1999, 2002a) asserted that ambiguity about dyadic involvement becomes particularly salient within the context of romantic relationships. Those scholars explicated *relational uncertainty* as the degree of confidence that people have in their perceptions of involvement within interpersonal associations; relational uncertainty encompasses self-focused, partner-focused, and relationship-focused doubts about an intimate association (Knobloch & Solomon, 1999). Because intimacy and relational uncertainty are intertwined within romantic relationships, we focused our investigation on this context.

In the sections that follow, we consider theory and research linking amount of uncertainty, the openness of communication about uncertainty, and the experience of reducing uncertainty to the level of intimacy in romantic relationships. Then, we report a longitudinal study that allowed us to examine the effects of these factors on the level of intimacy in ongoing dating relationships. Finally, we discuss the implications of our findings for understanding uncertainty, communication, and intimacy in close relationships.

The amount of uncertainty as a predictor of intimacy

Some perspectives highlight the *amount* of uncertainty in a relationship as the mechanism that increases or decreases intimacy. Uncertainty reduction theory, for example, suggests that initial interactions are laden with uncertainty, which individuals are motivated to reduce in an effort to increase the predictability of their partner's future behavior (Berger & Calabrese, 1975). In particular, people experience uncertainty about their own and their partner's communication skills, goals, plans, emotional states, and beliefs (Berger, 1995). Although Berger (Berger & Bradac, 1982) acknowledges that complete certainty can be stifling and unlikely to achieve given the dynamic nature of interpersonal relationships, the underlying assumption is that decreases in uncertainty correspond with increases in intimacy. From this

perspective, uncertainty is a negative state that people are motivated to resolve or eliminate, especially if they anticipate future interaction with the person and if a relationship with that person is perceived as highly rewarding (Berger & Calabrese, 1975).

Evolving romantic relationships provide a unique context in which to examine the effects of uncertainty because some of the specific problems that can arise under conditions of uncertainty are magnified in the context of ongoing romantic relationships. For example, Berger and Calabrese (1975) argued that heightened levels of uncertainty diminish intimacy and attraction. Moreover, conditions of uncertainty present a general lack of information, which undermines people's ability to form and execute communication plans that are tailored to their interaction partner (Berger, 1995). The discomfort associated with this compromised communication situation, as well as the more stylized and impersonal communication that results, acts as a barrier to intimacy between partners.

Consistent with this theoretical perspective, empirical evidence points to ways in which high levels of uncertainty limit the knowledge necessary to establish intimacy. Knobloch and Solomon (2005) found that experiencing relational uncertainty makes it difficult for people to derive inferences about their relationship because they lack the knowledge necessary to correctly interpret relationship cues. Prior research has also found that increased relational uncertainty corresponds with decreased liking (Kellerman & Reynolds, 1990), heightened cognitive and emotional jealousy (Afifi & Reichert, 1996; Knobloch, Solomon, & Cruz, 2001), appraisals of irritations as more severe and relationally threatening (Solomon & Knobloch, 2004; Theiss & Solomon, 2006b), increased negative emotions (Planalp & Honeycutt, 1985), and negative cognitive and emotional reactions to sexual intimacy (Theiss, 2005). Taken together, these studies point to the ways in which uncertainty, or the lack of knowledge it creates, can be detrimental for maintaining or developing intimacy.

In this section, we have examined how relational uncertainty leaves people unable to identify appropriate courses of action and confused about the meaning of relationship cues. Moreover, both theoretical reasoning and empirical research suggest that uncertainty prevents or undermines intimacy. This association between uncertainty and intimacy is formalized as H1; although this relationship is well established in the literature, we offer it as a point of comparison for the variations we explore subsequently.

> H1: Self, partner, and relationship uncertainty are negatively associated with concurrent levels of intimacy.

The openness of communication about uncertainty as a predictor of intimacy

Prior research has characterized communication about uncertainty in myriad ways. Uncertainty reduction theory conceptualized communication about uncertainty in terms of information-seeking strategies that take various forms (e.g., Berger, 1979).

Subsequent research has highlighted the variation in communicative responses to uncertainty-increasing events (Knobloch & Solomon, 2003). Some studies have also examined the ways in which uncertainty shapes characteristics of messages expressed during interpersonal interactions (e.g., Knobloch, 2006). In this section, we review these three conceptualizations of communication about uncertainty, and we examine the ways in which the openness of communication about uncertainty can impact intimacy.

One perspective on communication about uncertainty emphasizes the strategies that people might use to reduce the uncertainty they have about an interaction partner. When people have the goal of reducing uncertainty, they engage in various information-seeking strategies that take passive, active, or interactive forms (e.g., Baxter & Wilmot, 1984; Berger, 1979; Berger & Bradac, 1982). Passive strategies involve indirect and unobtrusive observation to gather information about another person. Active strategies entail communicating with third parties or manipulating the environment to indirectly discern information about a partner. The most direct information-seeking strategies are interactive approaches, which involve communicating with a partner to obtain information. Discussions with a partner regarding their doubts and ambiguities about the relationship might constitute *relationship talk*, which occurs when the content of messages references the state of the relationship between two people (e.g., Baxter & Wilmot, 1985; Knobloch, Solomon, & Theiss, 2006). When relationship events trigger uncertainty, relationship talk reflects an interactive information-seeking strategy that can vary in openness and explicitness (Knobloch et al., 2006). Thus, communication practices designed to mitigate uncertainty can vary in terms of openness from very open relationship talk to more covert information-seeking strategies.

Research focused on reactions to uncertainty-increasing events also points to openness as an important dimension along which communication behavior varies. Knobloch and Solomon (2003) examined communicative responses to doubts evoked by specific episodes within a relationship. Their findings revealed that communicative reactions to uncertainty-increasing events vary on two dimensions: approach versus avoidance and positive versus negative valence (Knobloch & Solomon, 2003). The approach versus avoidance dimension distinguishes efforts to engage or evade communication about the event. Positive versus negative valence involves either constructive or destructive behaviors in response to uncertainty-provoking situations. As in the case of information-seeking strategies, this research demonstrates the centrality of openness as a dimension underlying communication under conditions of uncertainty. More to the point, prior research has revealed that open conversations about uncertainty-provoking events are more beneficial to a relationship than are avoidance strategies (Planalp & Honeycutt, 1985; Planalp, Rutherford, & Honeycutt, 1988).

Although open communication is not inherently beneficial for individuals and their relationships, empirical evidence does suggest that openness has some advantages for promoting positive relationship outcomes. We know of no research that has specifically linked the openness of communication about uncertainty, per se, with relationship outcomes, but research on conflict and other relationship transgressions

points to the benefits of open communication about negative relationship experiences. For example, research indicates that people who use more integrative communication strategies for managing conflict with a partner tend to report more trust, intimacy, and satisfaction in the relationship (e.g., Canary & Cupach, 1988). Likewise, the directness of communication about conflict (Theiss & Solomon, 2006b) and jealousy (Theiss & Solomon, 2006a) increases subsequent levels of intimacy in the relationship. Explicit acknowledgments of relational transgressions correspond with increased forgiveness and relational repair (Kelley & Waldron, 2005). Moreover, couples who want to repair a relationship following transgressions (Dindia & Baxter, 1987; Emmers & Canary, 1996) or salvage a relationship during times of dissolution (Baxter & Bullis, 1986) often rely on open relationship talk to overcome this adversity. To the extent that these findings generalize when relational uncertainty, rather than other relationship issues, is the subject up for discussion, open communication about uncertainty should yield similar benefits.

The evidence we have summarized in this section points to the ways in which open communication is a mechanism that people can use to improve self-disclosure, manage interpersonal conflicts, increase relational closeness, and decrease perceptions of relational uncertainty. Although open communication might not always be successful at achieving these positive outcomes, engaging in communication about one's doubts and fears in a relationship could create a relational culture that welcomes openness between partners. When relational partners take advantage of opportunities to openly discuss their relationship, the potential exists to achieve a closer and more intimate bond. Notably, the association between amount of uncertainty and intimacy articulated in our first hypothesis was based on the immediate tradeoff between having doubts about a relationship and perceiving that relationship as intimate. When we consider the role of open communication about uncertainty, we must appreciate the time required for communication experiences to impact perceptions of relationships. In particular, it takes time for open communication about uncertainty to invite more open and intimate discussions of other relationship topics and, thereby, promote an overall greater sense of closeness. For this reason, we expect that the effect of open communication about uncertainty has a lagged effect on perceptions of intimacy, such that the openness of communication about uncertainty in one week will give rise to perceptions of increased intimacy in the following week, after the impact of that openness has been fully realized. This line of reasoning suggests the following hypothesis:

> H2: Open communication about relational uncertainty is positively associated with subsequent perceptions of intimacy.

Reducing uncertainty as a predictor of intimacy

Up to this point, we have offered the amount of uncertainty and the openness of communication about uncertainty as two possible mechanisms responsible for

increased intimacy in a relationship. As a third possibility, some scholars have suggested that it is not low amounts of uncertainty in a relationship that contribute to more intimacy, but rather it is the experience of reducing uncertainty that relationship partners perceive as rewarding. For example, Knobloch and Solomon (2002a) asserted that there might be important dyadic benefits that are inherently gained during the process of negotiating relational uncertainty. They base this logic on Livingston (1980), who pointed out that "it is the process of uncertainty reduction, not the having of certainty, that is experienced as engaging and thus maintains the romantic experience" (p. 142). In other words, the process of reducing uncertainty provides partners with opportunities to clarify ambiguities, resolve doubts, and achieve mutual understanding of the nature of their relationship.

Engaging in uncertainty reduction enlists a number of processes that are inherently rewarding and largely positive for individuals and their relationships. Communicating with a relationship partner about questions and insecurities not only reduces uncertainty, it creates a sense of accomplishment that bolsters feelings of intimacy and togetherness (Knobloch & Solomon, 2002a). This collaboration helps to answer important questions about the relationship, as well as foster skills that will enable partners to overcome challenges and barriers in the future. Consistent with this perspective, Emmers and Canary (1996) found support for a causal model in which uncertainty-increasing events corresponded with uncertainty reduction strategies, which in turn affected self-reported perceptions of relationship repair and subsequent intimacy. From this perspective, it is not an outcome of less uncertainty that is perceived as rewarding, but rather the efficacy that partners build by working together to surmount challenges and resolve relationship doubts. Thus, the actions that partners take to reduce their uncertainty might have unique benefits for the relationship, irrespective of the resulting amount of relational uncertainty.

Although we know of no empirical evidence that has directly observed outcomes of the uncertainty reduction process itself, research on other relationship experiences has pointed to dyadic benefits resulting from collaboration between partners to overcome relational difficulties. Siegert and Stamp (1994) found that couples who collectively negotiated and survived their first big fight in a relationship experienced a clarification of one another's feelings and an increased awareness of the interdependence between partners. Theoretical reasoning also suggests that overcoming interference from a partner is an important feature of establishing interdependence in developing romantic relationships (Knobloch & Solomon, 2004; Solomon & Knobloch, 2001, 2004). Moreover, engaging in pro-relationship behavior, like accommodating a partner and making sacrifices for the relationship, contributes to increased trust and dependence on the relationship (Wieselquist, Rusbult, Foster, & Agnew, 1999). These programs of study reveal how collaborating in efforts to improve and nurture the relationship may be perceived as rewarding and satisfying by romantic partners.

In this section, we highlighted how the uncertainty reduction process provides opportunities for partners to clarify their feelings, work through conflicts, and

establish an intersubjective understanding of the relationship. From this perspective, it is not the resulting amount of uncertainty that increases intimacy, but the satisfaction that comes from the experience of decreasing uncertainty. As with H2, our logic suggests an over-time process. In particular, the experience of changes in uncertainty level in the recent past promotes a sense of intimacy in the present. This logic supports the following hypothesis:

> H3: The magnitude of a decrease in self, partner, or relationship uncertainty is positively associated with intimacy.

In sum, this article offers three alternative hypotheses that aim to explain the relationship between uncertainty and intimacy in romantic relationships. The first hypothesis follows from the logic of uncertainty reduction theory, which predicts that low amounts of uncertainty correspond with high levels of intimacy. The second hypothesis highlights the openness of communication about uncertainty as a force that contributes to heightened intimacy. Finally, the third hypothesis focuses on the inherent benefits of the uncertainty reduction process for achieving intimacy. Where the first two predictions are largely replicative of patterns documented in previous research, the third hypothesis remains untested, as does a direct comparison of these competing claims. Distinguishing the unique effects of uncertainty, open communication about uncertainty, and uncertainty reduction has proven elusive in previous research because these three factors are intertwined in uncertainty experiences. Thus, we conducted a longitudinal study designed to parse the effects of these three variables and clarify the link between aspects of the uncertainty reduction experience and increases in relational intimacy.

Method

To test our hypotheses and our research question, we conducted a longitudinal Web-based survey that assessed participants' level of relational uncertainty, degree of intimacy, and the openness of communication about relational uncertainty. Students in communication classes at a large university in the Midwestern United States were given a small amount of extra credit for their participation in a study in which they completed six weekly questionnaires about a current romantic relationship.[1] We recognize that a college-aged sample limits the generalizability of our findings; however, college undergraduates represent a population in which individuals are frequently entering into new romantic relationships and grappling with issues of uncertainty as they attempt to identify a viable partner for lifelong commitment. Thus, they represent a rich population in which to study the uncertainty reduction processes that are examined in this article.

   In selecting a time frame of 6 weeks, we were informed by previous longitudinal and retrospective studies of relationship development. In particular, VanLear's (1987) study of self-disclosure patterns between acquaintances documented significant changes in private/personal disclosures and patterns of reciprocity during

a 6-week period. In addition, retrospective accounts of turning points in romantic relationships, plotted in monthly intervals from the beginning of a relationship to the point at which partners are 100% committed, reveal that romantic couples can experience events that substantially increase or decrease intimacy and commitment in a single 1-month interval (e.g., Baxter & Bullis, 1986; Huston, Surra, Fitzgerald, & Cate, 1981; Surra & Hughes, 1997). These findings suggested to us that a 6-week period would capture fluctuations in relationship characteristics.

We recruited individuals for the study who had a romantic interest in another person with whom they had previously interacted and with whom they anticipated future interaction. We used this broad definition of romantic interest because previous research has documented a floor effect in self-reports of uncertainty among highly intimate and committed relationship partners (e.g., Knobloch & Carpenter-Theune, 2004; Knobloch & Donovan-Kicken, 2006; Knobloch et al., 2001; Solomon & Knobloch, 2001); therefore, we wanted a sample spanning the full spectrum of intimacy in an effort to capture more variability in people's experiences of relational uncertainty. Likewise, participants who reported that they were engaged or married were excluded from the analyses. Two individuals requested to terminate their involvement in the study due to a breakup; data from these individuals are included in the analyses up until the point they terminated their relationship. In the following sections, we describe the sample, procedures, and measures that were used in this study.

Sample

Respondents in this study were 297 undergraduate students (84 males and 213 females). Participants ranged in age from 18 to 25 years with a mean age of 20.62 years. The majority of the sample was White/Caucasian (90.2%), with an additional 7.4% Asian, 2.0% Hispanic, 0.7% Native American, 0.7% Black, and 0.3% other. Although the predominantly White sample used in this study limits generalizability of our findings to the population in general, it is reflective of the racial demographic at the university where these data were collected, where 89.5% of students are White. Of the current relationship partners, 208 were males and 85 were females (four provided no response). Six individuals reported on a same-sex relationship and 287 reported on an opposite-sex relationship (four provided no response). Partners ranged in age from 17 to 43 years, with a mean age of 22.79 years. When asked to characterize the status of their relationship during the first week of the study, 4.7% reported that they were acquaintances, 22.6% were friends, 23.6% were causally dating, and 49.2% were seriously dating. Respondents reported on relationships that ranged in length from 0 to 72 months, with an average of 13.87 months.

Procedures

Weekly questionnaires were administered through an Internet Web site. Students interested in participating in the study provided contact information and were later e-mailed with an individual username and password to access the first survey.

During subsequent weeks, the participants were e-mailed a new password to access the next phase of the study. After completing the questionnaire each week, responses were submitted online, and data were stored on a secure server. Usernames and passwords were not included in the data file to ensure anonymity for respondents. Participants were instructed to attempt to complete their questionnaires at roughly the same time each week to ensure that enough time had elapsed to capture changes in relationship characteristics. Across all weeks of the study, 68.7% of the questionnaires were submitted within 5–9 days of the submission in the previous week. In addition, 16.6% were submitted within 1–4 days of the previous submission, and 14.7% were submitted within 10–12 days of the previous submission. The maximum amount of time that elapsed between the first and last measurement was 48 days.

During the first week, participants provided demographic information about themselves and their partners, and they completed closed-ended scales to report their perceptions of intimacy, relational uncertainty, and the openness of communication about their uncertainty. Questionnaires during subsequent weeks asked participants to provide an open-ended account of relationship events during the past 7 days, and they included all the same measures of intimacy, relational uncertainty, and communication that were in the baseline questionnaire. Respondents were instructed to answer questions during Weeks 2 through 6 based on events and characteristics of their relationship over the course of the past week. In addition, all items in the weekly questionnaires were preceded by the stem "During the past week . . . ," and all items were changed from present tense to past tense to focus respondents on events of the past week rather than general feelings.

Measures

A variety of closed-ended Likert-type scales were used to operationalize variables in the study. Confirmatory factor analyses (CFAs) were conducted on all the multi-item scales to ensure that they met the criteria of face validity, internal consistency, and parallelism (Hunter & Gerbing, 1982). The CFAs used maximum likelihood (ML) estimation, and all error correlations in the models were fixed at 0. After confirming the unidimensionality of the scales, we created a composite score by averaging responses to the individual items. See Table 1 for a summary of descriptive statistics for each measure in each week of the study.

Intimacy

We operationalized intimacy through a composite measure that incorporated indicators of intimacy associated with developmental patterns (cf. Cloven & Roloff, 1994; Solomon, 1997; Solomon & Knobloch, 2004). This strategy resulted in an inclusive and parsimonious indicator that assessed multiple aspects of intimacy.

One component of the composite measure was Rubin's (1970) Love Scale. Although the name of the scale implies a narrow focus on love, this measure actually assesses three important components of intimacy: feelings of affiliative need, willingness to help, and exclusiveness toward a partner. Respondents used a Likert scale

Table 1 Weekly Descriptive Statistics for All Variables

	Week 1	Week 2	Week 3	Week 4	Week 5	Week 6
Sample size (N)	297	279	278	284	277	282
Intimacy						
Love	5.80 (1.77)	5.41 (1.54)	5.17 (1.71)	5.23 (1.84)	5.14 (1.92)	5.10 (2.01)
Commitment	4.66 (1.26)	4.65 (1.26)	4.50 (1.39)	4.41 (1.50)	4.31 (1.56)	4.35 (1.60)
Chance of lifelong commitment	45.58 (31.56)	44.45 (31.97)	44.14 (32.04)	44.20 (32.01)	41.92 (33.36)	41.95 (33.65)
Self uncertainty	2.34 (1.06)	2.36 (1.10)	2.37 (1.18)	2.40 (1.24)	2.40 (1.26)	2.34 (1.30)
Partner uncertainty	2.69 (1.34)	2.70 (1.39)	2.65 (1.37)	2.59 (1.37)	2.70 (1.48)	2.57 (1.44)
Relationship uncertainty	2.58 (1.16)	2.56 (1.17)	2.50 (1.18)	2.47 (1.25)	2.54 (1.25)	2.47 (1.30)
Communicative openness	3.49 (1.57)	2.83 (1.61)	3.13 (1.56)	3.14 (1.59)	3.27 (1.63)	3.26 (1.63)

Note: Cell entries are means. Values in parentheses are standard deviations.

(1 = *not at all true* and 9 = *definitely true*) to indicate their responses to the four items in the measure (comparative fit index (CFI) = 0.99, root mean squared error of approximation (RMSEA) = 0.04, parsimony ratio (PRATIO) = .33; α = .93).

Commitment to continuing the association comprised the second component of the composite intimacy variable. Participants responded on a 6-point Likert scale (1 = *strongly disagree* and 6 = *strongly agree*) to indicate their agreement with four statements (e.g., I am very committed to maintaining this relationship; CFI = 0.99, RMSEA = 0.08, PRATIO = .33; α = .92); this measure has been used in a number of previous studies (e.g., Cloven & Roloff, 1993).

A third aspect of the composite intimacy variable encompassed the probability that the relationship would continue to progress toward lifelong commitment. Participants were presented with the question: "At this point in time, what do you feel the chance is of your relationship leading to marriage or a similar monogamous commitment?" Then, they indicated their perception of the likelihood of this outcome by selecting a response from 0% to 100% on a scale that provided 5% increments (cf. Lloyd, Cate, & Henton, 1984).

Bivariate correlations indicated sizable overlap between love and commitment (r = .79, p < .001), between love and likelihood of marriage/serious commitment (r = .72, p < .001), and between commitment and likelihood of marriage/serious commitment (r = .71, p < .001). We also conducted a principal axis exploratory factor analysis with varimax rotation to determine if these three variables formed a single unidimensional factor. Results indicated that all three variables loaded onto a single factor explaining 83.2% of the variance. Thus, the measures of love, commitment, and likelihood of marriage were converted to z scores, which were averaged to form a composite measure (range = −2.28 to 1.48, SD = 0.89). Coefficient alpha for the composite scale was .90.

Relational uncertainty

We used measures developed by Knobloch and Solomon (1999) to assess relational uncertainty. Respondents were presented with a stem that read "How certain are you about . . . " followed by a series of statements. Participants used a 6-point Likert scale (1 = *completely or almost completely uncertain* and 6 = *completely or almost completely certain*) to rate their certainty with each of the statements. Responses to all items were reverse scored to compute measures of relational uncertainty. Consistent with Knobloch and Solomon's (1999) previous operationalization of this scale, unidimensional subscales were identified for self, partner, and relationship uncertainty. The self uncertainty subscale comprised six items (e.g., whether or not you want the relationship to work out in the long run; CFI = 0.98, RMSEA = 0.05, PRATIO = .60; α = .92). The partner uncertainty scale also consisted of six items (e.g., whether or not your partner is ready to commit to you; CFI > 0.99, RMSEA = 0.03, PRATIO = .60; α = .95). The relationship uncertainty subscale included eight items (e.g., whether or not the relationship will work out in the long run; CFI = 0.99, RMSEA = 0.03, PRATIO = .71; α = .94).

Decrease in relational uncertainty

We also computed variables measuring the decrease in self, partner, and relationship uncertainty. The use of change scores has been subject to much discussion (e.g., Harris, 1963), and some scholars argue that change scores are almost always less preferable to alternative procedures for estimating growth or decay (e.g., Cronbach & Furby, 1970). In particular, change scores can compound measurement error; they are confounded by regression to the mean, and estimates of associations between change scores and other variables assume equivalence in the correlations for each component of the change score (e.g., Lord, 1963). Thus, the most widely recommended procedure for analyzing change is to assess the association between the indicator of interest (e.g., X_i) and a second variable while covarying the reference score (i.e., X_{i-1}). This procedure, however, was not an option for us, given our goal of operationalizing the magnitude of the decrease in uncertainty (per H3), in a manner that was statistically unique from the amount of uncertainty (per H1).

Discussions of the limitations of change scores typically focus upon how to analyze increases or decreases between pretest and posttest scores as dependent variables (e.g., Allison, 1990). In the present study, we sought to evaluate decreases in relational uncertainty over a 1-week period as an independent variable predicting intimacy at the second time point. Using a manifest difference score, the equation would be $intimacy_i = \beta(uncertainty_i - uncertainty_{i-1})$. This equation can be rewritten as $intimacy_i = \beta(uncertainty_i) - \beta(uncertainty_{i-1})$. The second equation highlights a central problem with the manifest difference score; namely, it assumes that $uncertainty_i$ and $uncertainty_{i-1}$ have equivalent associations with the intimacy variable. To address the unique association between intimacy and each of the measures of uncertainty, the equation should be as follows: $intimacy_i = \beta_i(uncertainty_i) - \beta_{i-1}(uncertainty_{i-1})$. In turn, this equation can be rewritten as $intimacy_i = \beta_i[uncertainty_i - \beta_{i-1}/\beta_i(uncertainty_{i-1})]$. In the final equation, the regression coefficient β_i corresponds with a term that represents the difference between $uncertainty_i$ and $uncertainty_{i-1}$, in which $uncertainty_{i-1}$ has been weighted based on its unique association with intimacy. The parameters β_i and β_{i-1} are computed from the data, which consume one degree of freedom, and the resulting values are used in the equation to compute the difference score.[2]

Following this logic, we computed change scores as relational uncertainty in Week $i-1$ minus the corresponding relational uncertainty measure in Week i, but we weighted the value of uncertainty in Week i based on its association with intimacy in Week i and the association between relational uncertainty in Week $i-1$ and intimacy in Week i. This procedure involves computing the slope for the association between intimacy in Week i and each facet of relational uncertainty in Week i and Week $i-1$; we used the substantive analyses described subsequently to obtain these values. Then, change scores representing the decrease in relational uncertainty are calculated as $[uncertainty_{i-1} - \beta_i/\beta_{i-1}(uncertainty_i)]$. This score represents the change in each facet of relational uncertainty from one week to the next, and it accounts for the unique association between relational uncertainty in Week i and the

dependent measure of intimacy. Positive values represent the magnitude of a decrease in relationship uncertainty, and negative values represent the magnitude of an increase in relationship uncertainty (self uncertainty Δ: range = -7.64 to 4.56, $M = -1.07$, $SD = 1.18$; partner uncertainty Δ: range = -5.84 to 4.86, $M = -0.37$, $SD = 1.07$; and relationship uncertainty Δ: range = -7.40 to 4.60, $M = -1.01$, $SD = 1.08$).[3]

Openness of communication about uncertainty

Using a 6-point Likert scale ($1 = $ *strongly disagree* and $6 = $ *strongly agree*), participants also recorded their agreement with a series of statements characterizing the openness of their communication about their uncertainty. Four items measured openness of communication about uncertainty: (a) I am usually explicit about my uncertainty in this relationship, (b) I can openly talk about my uncertainty with my partner, (c) Uncertainty in the relationship is not a topic that my partner and I discuss openly, and (d) My partner and I have never directly discussed our uncertainty about this relationship. The last two items were reverse coded to create a composite measure of openness (CFI = 0.96, RMSEA = 0.08, PRATIO = .33; $\alpha = .70$).

Time

We quantified the passage of time during the study in weeks, where the baseline week of the study was quantified as Week 1 and the remaining weeks were quantified Weeks 2 through 6.

Analyses

Preliminary analyses

As a starting point, we examined data gathered by the baseline questionnaire in Week 1. First, we conducted independent sample t tests to evaluate each of the variables for sex differences. A power analysis using GPOWER (Faul, Erdfelder, Lang, & Buchner, 2007), which allowed us to adjust the power estimate for the unequal numbers of males and females in our sample, indicated that power was .34 to detect a small effect (i.e., $d = .2$) and .97 to detect a moderate effect (i.e., $d = .5$). The results revealed no significant differences between males and females on any of the variables in this study; however, we note that our sample was 72% female and only 28% male.[4]

We also assessed the bivariate correlations among all the variables (see Table 2). Results indicated that intimacy was negatively associated with all three facets of relational uncertainty and positively associated with communicative openness. Although the three facets of uncertainty were highly correlated in these data, previous research has revealed that the 3-factor measurement solution is superior to a single-factor solution (e.g., Knobloch, 2007) and that the three facets of uncertainty can sometimes have divergent effects on other variables (e.g., Knobloch & Carpenter-Theune, 2004; Knobloch & Donovan-Kicken, 2006; Knobloch et al., 2001; Theiss & Solomon, 2006a). Thus, we decided to maintain separate variables for the three facets of relational uncertainty.

Table 2 Correlations Among Intimacy, Relational Uncertainty, and Communicative Openness at Week 1

	1	2	3	4	5
1. Intimacy	—				
2. Self uncertainty	−.71***	—			
3. Partner uncertainty	−.65***	.66***	—		
4. Relationship uncertainty	−.71***	.75***	.87***	—	
5. Communicative openness	.49***	−.38***	−.48***	−.51***	—

***$p < .001$.

We also calculated the intraclass correlation (ρ) for intimacy as the dependent variable in this study. The intraclass correlation calculates the proportion of total variation in the dependent variable that is attributed to between-persons, as opposed to within-person, variance. An intraclass correlation that is close to 0 indicates that the variability in the dependent variable is attributable mostly to within-person variance, and a correlation that is close to 1 suggests that most of the variance is between persons (Kreft & De Leeuw, 2002; Snijders & Bosker, 2003). The intraclass correlation for intimacy ($\rho = .82$) indicates that the majority of variability in the dependent variable was attributable to between-persons variation. In other words, there was substantial variation in intimacy levels between the different respondents in the study, but fluctuations in intimacy level for any individual from week to week were relatively small in comparison.

Substantive analyses

The longitudinal analyses focused on the association between concurrent levels of relational uncertainty and intimacy, the impact of open communication about relational uncertainty on intimacy in the subsequent week, and the effect of the change in relational uncertainty on subsequent reports of intimacy. The data were analyzed using hierarchical linear modeling (HLM) 6.0 software, which is designed to test multilevel models and accommodate nonindependent or nested data (Bryk & Raudenbush, 1992). One advantage of using multilevel modeling (MLM), as opposed to other types of repeated measures analysis, is that this treatment of multiple observations as nested counteracts difficulties that often arise with unbalanced designs and missing data. Our analyses included data from any study participants who provided data during the baseline week of the study and who had data for at least two consecutive weeks.

We treated the multiple observations across weeks as nested within the individual; relationship change was represented through a 2-level model using ML estimation with time-varying predictors at Level 1 and stable person or relationship characteristics at Level 2. MLM Thus, models provided insight to the structure and predictors of individual change (Raudenbush & Bryk, 2002). In the models that

follow, the subscript i refers to the time-varying repeated measurements across weeks (Level 1) and the subscript j refers to characteristics of the respondent that were not measured over time (Level 2).

One consideration in MLM is whether to include predictors in the model as uncentered variables, group-mean-centered variables (where the observed variable is centered around the individual's mean across the 6 weeks of the study), or grand mean centered (where the observed variable is centered around the population mean for the variable). In the following models, centered variables are indicated in parentheses with the group mean or the grand mean subtracted from the observed variable. A group mean is denoted as lowercase and italicized (e.g., *self uncertainty*$_{ij}$), and a grand mean is denoted as uppercase and italicized (*RELATIONSHIP STATUS..*).

To conduct our analyses, we configured the data to include five sets of repeated measures, consisting of pairs of subsequent weeks. Specifically, the openness of communication about relational uncertainty during Week $i-1$ was combined with measures of relational uncertainty, negative change in relational uncertainty, and intimacy for Week i (where i = Weeks 2 through 6). In each of our analyses, intimacy for Week i was treated as the dependent variable, so we controlled for the intimacy level reported during the previous week ($i-1$). Relationship status measured during the first week was included as a covariate on the intercept and was entered as grand mean centered to control for differences in intimacy between people with varying degrees of relational closeness.[5] The remainder of the models were configured as required to test the associations addressed by each of the hypotheses and the research question.

Results

Model 1: The amount of uncertainty as a predictor of intimacy (H1)

Recall that H1 predicted that self, partner, and relationship uncertainty are negatively associated with concurrent intimacy. To test H1, the facets of relational uncertainty, as measured in Week i, were entered as predictors in separate models to avoid problems of multicollinearity. The relational uncertainty variables were entered as group mean centered to determine how deviations around the individual mean of that variable corresponded with perceptions of the dependent variable. We also included the within-subject mean for the corresponding source of uncertainty in each model as a covariate on the intercept to discern the within-person effect from the between-persons effect. For each model, the intercept and all slopes were estimated as random effects. The following equations represent the model that was constructed to test H1 when self uncertainty was the independent variable. Identical models were constructed for partner and relationship uncertainty.

Model 1: The amount of uncertainty as a predictor of concurrent intimacy.

Level 1 equation :
$$Y_{ij} = \pi_{0j} + \pi_{1j}(Y_{(i-1)j}) + \pi_{2j}(\text{self uncertainty}_{ij} - \textit{self uncertainty}_{.j}) + r_{ij}$$

Level 2 equation :
$$\pi_{0j} = \beta_{00} + \beta_{01}(\text{Relationship Status}_{ij} - \textit{RELATIONSHIP STATUS..}) + \beta_{02}(\textit{self uncertainty}_{.j}) + u_{0j}$$
$$\pi_{1j} = \beta_{10} + u_{1j}$$
$$\pi_{2j} = \beta_{20} + u_{2j}.$$

In the Level 1 equation for this model, π_{0j} represents the intercept for the model, $\pi_{1j}(Y_{(i-1)j})$ represents intimacy in Week $i-1$, π_{2j} (self uncertainty$_{ij}$ − $\textit{self uncertainty}_{.j}$) represents the amount of uncertainty as a group mean–centered variable, and r_{ij} represents the residual. In the Level 2 equation for the intercept, β_{00} represents the value of the intercept, β_{01} (Relationship Status$_{ij}$ − $\textit{RELATIONSHIP STATUS..}$) represents the between-person differences in the intercept attributable to differences in relationship status, β_{02} ($\textit{self uncertainty}_{.j}$) represents the between-person differences in the intercept attributable to relational uncertainty, and u_{0j} represents the residual for the intercept. In the Level 2 equations for the slopes (π_{1j} and π_{2j}), the β_{ij} represents the value of the slope for that variable and the u_{ij} represents the residual for the slope.

The results of this model supported our first hypothesis (see Table 3). As a starting point, the first panel of the table summarizes the extent to which the Level 2 variables modified the value of the intercept. The intercept statistics indicated that between-person differences in relational uncertainty decreased the value of the model's intercept, indicating that individuals with higher mean levels of relational uncertainty across the weeks of the study also had lower levels of intimacy. The second panel of the table summarizes the slopes for each predictor in the model, which represents the within-person effect of that variable on intimacy within each week of the study. Not surprisingly, intimacy in Week $i-1$ was positively associated with intimacy in Week i. As expected, results also indicated that self, partner, and relationship uncertainty each shared a negative association with concurrent intimacy. In other words, during weeks when participants experienced levels of relational uncertainty greater than their mean uncertainty level across weeks, they also perceived less intimacy within the same week of the study. The third panel of the table summarizes the residuals for the model, which indicate whether there is significant variability left to be explained in the intercept or the slopes. The residuals are reported in the table as τ statistics; a significant τ indicates that there is still variability to be explained in that component of the model. Results of this analysis revealed that there was still significant variability to be explained in the intercept and in the within-person effects (i.e., the slopes) for Week $i-1$ intimacy and relationship uncertainty. These results provide support for H1.

Table 3 Predicting Intimacy from the Amount of Relational Uncertainty

	Self Uncertainty	Partner Uncertainty	Relationship Uncertainty
Intercept	.47***	.33***	.49***
Relationship status	.03	−.00	−.00
Self uncertainty mean	−.18***		
Partner uncertainty mean		−.11***	
Relationship uncertainty mean			−.18***
Slopes			
$i-1$ intimacy	.71***	.77***	.72***
Self uncertainty	−.12***		
Partner uncertainty		−.08**	
Relationship uncertainty			−.12***
Residuals (τ)			
Intercept	.01***	.01***	.01***
$i-1$ intimacy	.03***	.02***	.03***
Self uncertainty	.02		
Partner uncertainty		.01	
Relationship uncertainty			.03*

Note: The dependent variable in each model is intimacy in Week i. Cell entries in the intercept category are the change in the intercept attributable to the within-person mean or relationship status, which represents the between-persons effect on that variable. The cell entries in the slopes category represent the within-person slope over the course of the study. The cell entries in the residuals category are τ and represent the remaining unexplained variation in the intercept or in the slopes represented in the model. Self, partner, and relationship uncertainty were entered in separate models, and their effects are represented on the diagonal.

*$p < .05$. **$p < .01$. ***$p < .001$.

Model 2: Open communication about uncertainty as a predictor of subsequent intimacy

Our second hypothesis predicted that the openness of communication about relational uncertainty in Week $i-1$ would correspond with increased intimacy in Week i. To test H2, the openness of communication about uncertainty as measured in Week $i-1$ was included as the substantive predictor instead of the relational uncertainty variables. Communicative openness about uncertainty was entered as an uncentered variable because we were interested in how communication behavior in 1 week affected intimacy in the following week rather than fluctuations around a person's mean level of communicative openness. The intercept and the slope for intimacy in Week $i-1$ were predicted as random effects. Thus, the following equations represent the model that was constructed to test H2, which predicted a positive association between the openness of communication about uncertainty and subsequent intimacy.

Model 2: Communicative openness as a predictor of subsequent intimacy.

Level 1 equation :
$$Y_{ij} = \pi_{0j} + \pi_{1j}(Y_{(i-1)j}) + \pi_{2j}(\text{communicative openness}_{(i-1)j}) + r_{ij}$$

Level 2 equation :
$$\pi_{0j} = \beta_{00} + \beta_{01}(\text{relationship status}_{ij} - RELATIONSHIP\ STATUS..) + u_{0j}$$
$$\pi_{1j} = \beta_{10} + u_{1j}$$
$$\pi_{2j} = \beta_{20}.$$

In the Level 1 equation for this model, π_{0j} represents the intercept for the model, $\pi_{1j}(Y_{(i-1)j})$ represents the slope for intimacy in Week $i-1$, π_{2j} (communicative openness$_{(i-1)j}$) represents the slope for openness of communication about uncertainty, and r_{ij} represents the residual. In the Level 2 equation for the intercept, β_{00} represents the value of the intercept, β_{01} (relationship status$_{ij} - RELATIONSHIP$ $STATUS..$) represents the between-person differences in the intercept attributable to relationship status, and u_{0j} represents the residual of the intercept. In the Level 2 equations for the slopes (π_{1j} and π_{2j}), the β_{ij} represents the value of the slope for that variable and the u_{ij} represents the residual for the slope.

When interpreting the results for this model, we start by turning to the first panel in the table to examine the value of the intercept and the variables that contribute to between-person differences in the intercept (see Table 4). In this model, baseline relationship status significantly increased the value of the intercept, such that people with higher relationship status at the start of the study also reported significantly more intimacy. Then, turning to the slopes for this model, intimacy in Week $i-1$ was positively associated with intimacy in Week i. Consistent with our prediction in H2, the openness of communication in Week $i-1$ was positively associated with intimacy in Week i. In other words, the more openly people communicated about their relational uncertainty in one week, the more intimacy they perceived in the relationship in the following week. The final panel in the table summarizes the residuals for the model, which indicate that there is still variability to be explained in the intercept and in the within-person effect for Week $i-1$ intimacy. Thus, H2 was also supported.

Model 3: The negative change in uncertainty as a predictor of subsequent intimacy

H3 predicted that decreases in relational uncertainty increase perceptions of intimacy. A model similar to Model 2 was constructed to test H3 in which the openness of communication about uncertainty was replaced by a variable representing the decrease in each facet of relational uncertainty. Similar to Model 1, we tested the decrease in each facet of relational uncertainty in separate models to avoid multi-collinearity. The decrease in uncertainty variables were entered into the model as uncentered because we were interested in how the magnitude of the decrease in relational uncertainty corresponded with subsequent intimacy. The intercept and all slopes were estimated as random effects. Thus, the following equations represent the model that was used to test H3 when a decrease in self uncertainty was the

Table 4 Predicting Intimacy from Communicative Openness in Week $i-1$ and Decreased Uncertainty

	Model 2	Model 3		
	$i-1$ Communicative Openness	$-\Delta$ in Self Uncertainty	$-\Delta$ in Partner Uncertainty	$-\Delta$ in Relationship Uncertainty
Intercept				
Intercept	.08**	.16***	.05***	.15***
Relationship status	.04*	.05***	.04**	.04**
Slopes				
$i-1$ intimacy	.85***	.82***	.87***	.84***
$-\Delta$ in self uncertainty		.12***		
$-\Delta$ in partner uncertainty			.09***	
$-\Delta$ in relationship uncertainty				.12***
$i-1$ communicative openness	.02**			
Residuals (τ)				
Intercept	.01***	.03***	.01***	.04***
$i-1$ intimacy	.01***	.02***	.01***	.02***
$-\Delta$ in self uncertainty		.00		
$-\Delta$ in partner uncertainty			.00	
$-\Delta$ in relationship uncertainty				.02**

Note: The dependent variable in each model is intimacy in Week i. Cell entries in the intercept category are the change in the intercept attributable to relationship status, which represents the between-persons effect on relationship status. The cell entries in the slopes category represent the within-person slope over the course of the study. The cell entries in the residuals category are τ and represent the remaining unexplained variation in that variable. The negative change variable for each facet of uncertainty was entered in separate models, and their effects are represented on the diagonal.

*$p < .05$. **$p < .01$. ***$p < .001$.

independent variable. Identical models were constructed to reflect decreases in part-
ner uncertainty and relationship uncertainty.

Model 3: The negative change in uncertainty as a predictor of subsequent
intimacy.

Level 1 equation :
$$Y_{ij} = \pi_{0j} + \pi_{1j}(Y_{(i-1j)}) + \pi_{2j}(-\Delta \text{ in self uncertainty}_{ij}) + r_{ij}$$

Level 2 equation :
$$\pi_{0j} = \beta_{00} + \beta_{01}(\text{relationship status}_{ij} - RELATIONSHIP\ STATUS..) + u_{0j}$$
$$\pi_{1j} = \beta_{10} + u_{1j}$$
$$\pi_{2j} = \beta_{20} + u_{2j}.$$

In the Level 1 equation for this model, π_{0j} represents the intercept for the model,
$\pi_{1j}(Y_{(i-1)j})$ represents the slope for intimacy in Week $i-1$, $\pi_{2j}(-\Delta$ in self uncertain-
ty$_{ij})$ represents the slope for the negative change in relational uncertainty from Week
$i-1$ to Week i, and r_{ij} represents the residual. In the Level 2 equation for the intercept,
β_{00} represents the value of the intercept, β_{01} (relationship status$_{ij} - RELATIONSHIP$
$STATUS..$) represents the change in the intercept attributable to between-person
differences in relationship status, and u_{0j} represents the residual for the intercept. In
the Level 2 equations for the slopes (π_{1j} and π_{2j}), the β_{ij} represents the value of the
slope for that variable and the u_{ij} represents the residual for the slope.

Turning first to the results for the intercept, results of this analysis revealed that
between-person differences in relationship status increased the value of the intercept,
such that people with higher relationship status started with significantly more
intimacy (see Table 4). Then, examining the slopes for the model revealed that
intimacy in Week $i-1$ was positively associated with intimacy in Week i. Results
also indicated that the magnitude of the decrease in self, partner, and relationship
uncertainty from Week $i-1$ to Week i was each positively associated with intimacy in
Week i. In other words, decreasing relational uncertainty from one week to the next
corresponded with perceptions of greater intimacy in the second week. Finally, the
residuals for this model indicate that there is still variability left to be explained in the
intercept and in the slope for Week $i-1$ intimacy. Thus, H3 was supported.

Model 4: Distinguishing between uncertainty amount, openness, and decrease
We conducted one final analysis that combined the amount of uncertainty, the
openness of communication about uncertainty, and the decrease in uncertainty in
the same model. Intimacy in Week i was the dependent variable in this model. As
a starting point, we included baseline relationship status on the intercept to control
for between-person differences in intimacy. We also included intimacy in Week $i-1$
as a predictor in the model. Once again, we entered the amount of self, partner, and
relationship uncertainty in Week i as group-mean-centered predictors in separate
models. The within-person mean for the corresponding uncertainty variable was also

entered on the intercept to control for between-person variation in relational uncertainty. We also included the negative change in the corresponding uncertainty variable and the openness of communication about uncertainty in Week $i-1$ as uncentered predictors in the model. The intercept and all the slopes except for openness of communication about uncertainty were estimated as random effects. The following equations represent the model that was constructed when the amount of self uncertainty and the decrease in self uncertainty were predictors. Identical models were created for partner uncertainty and relationship uncertainty.

Model 4: Distinguishing between uncertainty amount, openness, and decrease.

Level 1 equation :
$$Y_{ij} = \pi_{0j} + \pi_{1j}(Y_{(i-1)j}) + \pi_{2j}(\text{self uncertainty}_{ij} - \textit{self uncertainty}_{\cdot j})$$
$$+ \pi_{3j}(-\Delta \text{ in self uncertainty}_{ij}) + \pi_{4j}(\text{communicative openness}_{(i-1)j})$$
$$+ r_{ij}$$

Level 2 equation :
$$\pi_{0j} = \beta_{00} + \beta_{01}(\text{relationship status}_{ij} - \textit{RELATIONSHIP STATUS}_{\cdot\cdot}) +$$
$$\beta_{02}(\textit{self uncertainty}_{\cdot j}) + u_{0j}$$
$$\pi_{1j} = \beta_{10} + u_{1j}$$
$$\pi_{2j} = \beta_{20} + u_{2j}$$
$$\pi_{3j} = \beta_{30} + u_{3j}$$
$$\pi_{4j} = \beta_{40}.$$

In the Level 1 equation for this model, π_{0j} represents the intercept for the model, $\pi_{1j}(Y_{(i-1)j})$ represents the slope for intimacy in Week $i-1$, π_{2j} (self uncertainty$_{ij}-$ self uncertainty$_{\cdot j}$) represents the slope for the amount of uncertainty as a group-mean-centered variable, π_{3j} ($-\Delta$ in self uncertainty$_{ij}$) represents the slope for the negative change in uncertainty from Week $i-1$ to Week i, π_{4j} (communicative openness$_{(i-1)j}$) represents the slope for openness of communication about uncertainty in Week $i-1$, and r_{ij} represents the residual. In the Level 2 equation for the intercept, β_{00} represents the value of the intercept, β_{01} (relationship status$_{ij}$ $-RELATIONSHIP\ STATUS_{\cdot\cdot}$) represents the between-person differences in the intercept attributable to relationship status, β_{02} (self uncertainty$_{\cdot j}$) represents the between-person differences in the intercept attributable to self uncertainty, and u_{0j} represents the residual of the intercept. In the Level 2 equations for the slopes (π_{1j}, π_{2j}, π_{3j}, and π_{4j}), the β_{ij} represents the value of the slope for that variable and the u_{ij} represents the residual for the slopes that were estimated as random effects.

Focusing first on the value of the intercept, the between-person differences in relational uncertainty reduced the value of the intercept, such that people with more uncertainty had lower amounts of intimacy (see Table 5). Turning to the slopes, intimacy in Week $i-1$ was again positively associated with subsequent intimacy. When all three of the predictors (i.e., amount of uncertainty, openness of communication about uncertainty, and negative change in uncertainty) were included in the

Table 5 The Amount of Uncertainty, Communicative Openness, and the Decrease in Uncertainty as Predictors of Increased Intimacy

	Self Uncertainty	Partner Uncertainty	Relationship Uncertainty
Intercept	.45***	.31***	.39***
Relationship status	.04**	.01	.01
Self uncertainty mean	−.11***		
Partner uncertainty mean		−.09***	
Relationship uncertainty mean			−.09***
Slopes			
$i-1$ intimacy	.73***	.80***	.77***
Self uncertainty	−.02		
Partner uncertainty		−.02	
Relationship uncertainty			−.02
$i-1$ communicative openness	.02*	.01	.01
$-\Delta$ in self uncertainty	.08***		
$-\Delta$ in partner uncertainty		.07***	
$-\Delta$ in relationship uncertainty			.09**
Residuals (τ)			
Intercept	.04**	.01**	.03**
$i-1$ intimacy	.02**	.02***	.03**
Self uncertainty	.01		
Partner uncertainty		.00	
Relationship uncertainty			.01
$-\Delta$ in self uncertainty	.02		
$-\Delta$ in partner uncertainty		.02	
$-\Delta$ in relationship uncertainty			.02

Note: The dependent variable in each model is intimacy in Week i. Cell entries in the intercept category are the change in the intercept attributable to the within-person mean or relationship status, which represents the between-persons effect on that variable. The cell entries in the slopes category represent the within-person slope over the course of the study. The cell entries in the residuals category are τ and represent the remaining unexplained variation in that variable. Self, partner, and relationship uncertainty, as well as the negative change variable for each facet of uncertainty, were entered in separate models, and their effects are represented on the diagonal.
*$p < .05$. **$p < .01$. ***$p < .001$.

same model, the effects for the amount of self, partner, and relationship uncertainty were nonsignificant. The openness of communication about uncertainty in Week $i-1$ was positively associated with subsequent intimacy in the model for self uncertainty, but the effect was not significant in the models for partner and relationship uncertainty. Finally, the decrease in relational uncertainty was positively associated with intimacy in each of the models. The residuals for these models reveal that there was still significant variability left to explain in the intercept and the slope for Week

$i-1$ intimacy. The results of this analysis point to a reduction in relational uncertainty (H3) as the only mechanism that is consistently and significantly associated with intimacy when amount of uncertainty, openness of communication about uncertainty, and a reduction in uncertainty are considered simultaneously.

Discussion

The goal of this study was to parse the effects of the amount of uncertainty, the openness of communication about uncertainty, and the magnitude of decreases in uncertainty to determine the mechanism in the uncertainty reduction process that promotes intimacy. When these three variables are considered in combination as predictors in the same model, results indicate that a decrease in relational uncertainty is the only significant predictor of intimacy. On one level, these findings highlight the process of uncertainty reduction as a force that has the potential to transform people's perceptions of their relationships. On another level, questions remain about the specific uncertainty reduction strategies that are perceived as rewarding. In this section, we discuss the contribution of these findings to the literature on uncertainty reduction and relationship development. Then, we identify the strengths and limitations of this study.

The inherent benefits of uncertainty reduction for relationships
We offered three somewhat competing hypotheses in this study that correspond with three different lines of reasoning about the factors that contribute to increased intimacy in relationships. Following previous theoretical arguments and empirical evidence, we predicted that increased intimacy in relationships could be explained by (a) the amount of uncertainty in the relationship, (b) the openness of communication about uncertainty, or (c) the magnitude of a decrease in uncertainty. The initial results of our analyses supported all three of these positions. Thus, our findings are consistent with previous research on the role of uncertainty, communicative openness, and uncertainty reduction for increasing intimacy in close relationships. Moreover, the longitudinal nature of our data adds weight to claims that communication and uncertainty experiences causally impact intimacy within romantic relationships.

We explored the relative impact of the three mechanisms by combining them within a single multilevel model predicting intimacy. Results of that analysis suggested that the magnitude of a decrease in relational uncertainty is a robust predictor of intimacy and that the impact of uncertainty reduction subsumes the association between concurrent amount of uncertainty and intimacy. Phenomenologically, of course, experiences of decreased uncertainty are often confounded with low amounts of concurrent uncertainty. In reflecting on these distinct predictors, it is helpful to bear in mind the operationalization of each variable. Amount of uncertainty was based on weekly reports and mean centered by group so that variation in the variable reflected deviations around each individual's mean level of uncertainty over the course of the 6-week study. In other words, "low amounts of uncertainty" reflect low amounts as

defined by each respondent's personal average. The decrease in uncertainty measure was computed as a change score, such that it reflects the difference between uncertainty scores over a 1-week period, irrespective of the amount of uncertainty. Although change scores can be distorted by ceiling and floor effects, they are otherwise independent of the amount of uncertainty variable. Thus, a direct interpretation of the results pertaining to the research question is that decreases in uncertainty over the course of a week predict intimacy in the second week, and the negative association between amount of uncertainty and concurrent intimacy may be an artifact of this effect.

What relevance is distinguishing the effects of uncertainty amount versus the magnitude of decrease in uncertainty? We think that our findings shed light on the ongoing discussion about the fruits and foibles of uncertainty and uncertainty reduction. On one hand, Berger (1997) suggested that amount of uncertainty complicates message production because it undermines basic cognitive processes related to communication goals and plans; by his logic, uncertainty is inherently an impediment. Other scholars have critiqued this view of uncertainty by pointing to contexts in which people may embrace uncertainty as exciting or preferable to receiving negative information (Afifi & Weiner, 2004; Baxter & Montgomery, 1996; Brashers, 2001). Even Berger (Berger & Bradac, 1982) has acknowledged that complete certainty can be undesirable and unattainable in close relationships. We propose disentangling this debate by distinguishing between the effects of uncertainty on communication versus personal or relational well-being. We concur with Berger's (1997) argument that uncertainty complicates communication (see also Knobloch & Solomon, 2005); however, uncertainty does not necessarily undermine personal or relational well-being. The results of the present study suggest that witnessing one's ability to reduce uncertainty about a romantic relationship can foster feelings of closeness, and it is that process—irrespective of the resulting amount of uncertainty—that has benefits for the development of intimate relationships (cf. Knobloch & Solomon, 2002a).

This study also adds to the corpus of knowledge about uncertainty and intimacy in close relationships by highlighting communicative openness about uncertainty as a strategy for increasing intimacy in the context of romantic relationships. Specifically, our longitudinal design revealed that open communication about relational uncertainty in one week corresponded with increased intimacy in the next week. Notably, this effect was somewhat disadvantaged in comparison to the effects for uncertainty and uncertainty reduction because the measure was less reliable and the effect was required to persist across weeks to measure the impact on subsequent intimacy. The fact that the openness of communication about uncertainty remains a significant predictor of increased intimacy despite these circumstances points to the influential nature of open communication within the context of close relationships. Although we are encouraged by these findings, we also note that the effect size for the communicative openness variable is rather small and that the effects for partner uncertainty and relationship uncertainty are nonsignificant in the combined model. These findings remind us that fully open communication is not always good for relationships, especially under conditions of uncertainty.

The small effects for communicative openness also imply that people may use a variety of tactics to reduce their uncertainty that are equally as satisfying, or perhaps even more satisfying, than direct communication about relationship ambiguities. People might successfully reduce their uncertainty, and thereby increase their intimacy, through self-reflection, quiet observation, secret tests, or direct relationship talk. In the end, intimacy is not necessarily enhanced by how partners reduce their uncertainty or even how certain they are able to become, but rather by creating a sense that partners have successfully managed their uncertainty and were able to reduce it. That movement from uncertain to less uncertain, coordinated through much more nuanced dyadic interaction patterns than scholars have considered before, is where the payoff for relationship partners might be. The results associated with open communication also remind us that a number of factors influence the decision to seek information through direct communication, including a discrepancy between a person's actual and preferred level of uncertainty, a person's ability to perform information-seeking behavior and cope with the information he or she is likely to get, and the ability of the relationship partner to provide the sought-after information (Afifi & Weiner, 2004). Thus, we see open communication as a piece of a more complex process in which information management, uncertainty, and intimacy are intertwined.

Although speculative, we believe that increases in intimacy following successful uncertainty reduction reflect the closeness that evolves out of resolving ambiguity and co-constructing a mutual understanding of the relationship. The current investigation gestures toward the perceived rewards of the uncertainty reduction process, but our data only reflect the perspective of one individual in the relationship. Further research is required to examine the unique dyadic features of this process that contribute to such intersubjectivity, but we are encouraged by the initial evidence of a direct correspondence between decreases in uncertainty and subsequent increases in intimacy. Although the results of this study suggest that the benefits of communicative openness for increasing intimacy are limited to particular uncertainty contexts, we see virtue in a closer examination of the features of relationship talk that contribute to decreased uncertainty and increased intimacy.

We also note the potential for reciprocal effects among intimacy, relational uncertainty, and communicative openness in relationships. Many studies have examined the influence that intimacy has on a variety of other relationship characteristics, including relational uncertainty and communication. In contrast, this study focused on the relationship characteristics and specific mechanisms responsible for increased intimacy in a relationship. Both perspectives provide insight into the outcomes of different relationship qualities and processes. Taken together, however, they point to a delicate reciprocity between relationship characteristics. We observed that decreases in uncertainty and open communication increase perceptions of intimacy in romantic relationships, but as intimacy increases, it creates a relational context that welcomes more open communication between partners and clarifies relationship ambiguities, which in turn should contribute to even more intimacy. Future

research should consider the delicate reciprocity between intimacy and other relationship characteristics.

Strengths and limitations

Our study has some significant strengths but also some weaknesses that are important to recognize. One strength of this study is the longitudinal nature of the data. Our research design enabled us to measure changes in perceived relationship characteristics over a 6-week period. In particular, we were able to observe how behaviors during one week of the study affected perceptions of relationship characteristics in the following week. Consequently, this study marks an important contribution to the literature on uncertainty reduction and relationship development because it advances a causal model of the effects of communicative openness and decreases in uncertainty on subsequent intimacy. This strategy allowed us to advance claims about the interplay among communicative openness, relational uncertainty, and intimacy that are often more difficult to assess in correlational data.

One limitation of this study is its focus on only one person's perceptions of relationship characteristics. Given that relationships are negotiated and maintained in the interactions between partners (e.g., Masuda & Duck, 2002), the individual perspective represented in this study limits our understanding of processes related to uncertainty reduction and relationship development. In particular, we note that one person's propensity for communicative openness might successfully decrease his or her own relational uncertainty while at the same time increase the partner's uncertainty (e.g., Bevan, 2004). Moreover, one person's subjective perceptions of his or her own communicative openness might vary substantially from how the partner viewed openness in the interaction. Future research should attempt to measure perceptions of the relationship from both partners. Given that the current investigation also had a predominantly female sample, a study that obtained information from both partners would also make the findings more generalizable to the relationship experiences of both males and females.

Another limitation in this study is our reliance on mostly White, middle- to upper-class college undergraduates as our respondents. Although the relationship experiences of individuals during this stage of life are rich with all three types of uncertainty, we recognize that at the very least, this strategy renders our findings less generalizable to the population in general. On one hand, we tested our thinking within the population that has been studied in most of the previous research on uncertainty and uncertainty reduction. At the same time, we see a need to extend research on uncertainty processes beyond this domain in future research. Recent efforts by other scholars (e.g., Knobloch, Miller, Bond, & Mannone, 2007) provide exemplars for researchers seeking to expand our understanding of interpersonal communication and relationships beyond the convenient college sample.

In conclusion, this study used a longitudinal research design to distinguish the mechanisms that are responsible for increases in relational intimacy. Our findings suggest that there is something inherently rewarding about the process involved in

reducing uncertainty that contributes to perceptions of increased intimacy and that this process appears to subsume the effect on intimacy that is often attributed to the amount of uncertainty in a relationship. In addition, our results also indicate that openness of communication about uncertainty has a positive impact on perceptions of intimacy. This effect should be interpreted with some caution, however, because open communication may not always have positive repercussions for individuals and their relationships. Nevertheless, we are encouraged by the finding that the uncertainty reduction process, rather than the resulting amount of uncertainty, is perceived as rewarding in close relationships. We are hopeful that future research can further explore the complex relationships among communicative openness, relational uncertainty, and intimacy.

Notes

1   The data from this study also contributed to two previous articles (Theiss & Solomon, 2006a, 2006b). Those studies examined the facets of relational uncertainty and intimacy as predictors of communicative directness and other relationship episodes.
2   We are indebted to E. L. Fink (personal communication, October 9, 2007) for recommending and clarifying this strategy.
3   One common concern about change scores is that they compound measurement error because error is contributed by each score used in the computation (e.g., Harris, 1963). To obtain a more accurate assessment of the reliability for the change scores, we squared the coefficient alpha obtained for each of the facets of relational uncertainty during Week 1. Applying the product rule in this way provides a general estimate of the constraint imposed on the reliability of the change score by error within each component variable (e.g., Anderson & Gerbing, 1982). The squared reliability estimates for the self, partner, and relationship uncertainty variables indicate that coefficient alpha for scores computed as the difference between measures in subsequent weeks is adequate (self uncertainty $\alpha^2 = .85$; partner uncertainty $\alpha^2 = .90$; and relationship uncertainty $\alpha^2 = .88$).
4   Although we did not observe mean differences between males and females in this sample, this does not preclude biological sex as a moderator of the effects in our analyses. Because we do not advance a rationale for exploring the moderating effects of sex differences, we did not examine the potential for moderation in these analyses.
5   Variables that appear as uppercase italicized were grand mean centered in the model. Variables that appear as lowercase italicized in later models were group mean centered in the model.

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Une analyse des mécanismes qui augmentent l'intimité relationnelle : les effets du degré d'incertitude, de la communication ouverte à propos de l'incertitude et de la réduction de l'incertitude

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Résumé

Cette recherche examine le degré d'incertitude, la communication ouverte à propos de l'incertitude et le processus de réduction de l'incertitude comme étant trois mécanismes rivaux qui expliquent l'augmentation de l'intimité dans les relations amoureuses. Pour tester ces mécanismes rivaux, nous avons utilisé un modèle à plusieurs niveaux pour analyser les données longitudinales recueillies chez des individus en association romantique au cours d'une période de six semaines. Les résultats d'analyses séparées indiquent que le degré d'incertitude était associé négativement à l'intimité simultanée et que la communication ouverte à propos de l'incertitude et les réductions de l'incertitude étaient associées positivement à une intimité subséquente. Lorsque les trois variables indépendantes étaient examinées de façon simultanée, la diminution d'incertitude était la seule variable explicative significative de l'intimité. Ces résultats soulignent l'importance, pour une augmentation de intimité' du processus de réduction d'incertitude plutôt que d'une incertitude réduite.

Eine Analyse der Mechanismen, die Intimität in Beziehungen fördern: Der Einfluss von Unsicherheit, offener Kommunikation über Unsicherheit und der Reduktion von Unsicherheit

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Die Studie untersucht das Ausmaß von Unsicherheit, Offenheit der Kommunikation über Unsicherheit und den Prozess der Reduktion von Unsicherheit als drei konkurrierende Mechanismen, welche für eine Intensivierung von Intimität in romantischen Beziehungen verantwortlich sind. Um diese konkurrierenden Mechanismen zu beleuchten, nutzen wir eine Mehrebenen-Modellierung zur Analyse von Langzeitdaten, die von Personen in romantischen Beziehungen über sechs Wochen gesammelt wurden. Die Ergebnisse separater Analysen zeigen, dass das Ausmaß von Unsicherheit negativ zusammenhängt mit gleichzeitiger Intimität, und Offenheit der Kommunikation über Unsicherheit und Verringerung der Unsicherheit positiv zusammenhängen mit folgender Intimität. Werden alle drei Prädiktoren gemeinsam berücksichtigt, zeigte sich die Abnahme von Unsicherheit als einziger signifikanter Prädiktor von Intimität. Diese Ergebnisse betonen die Bedeutung von Unsicherheitsreduktionsprozessen im Gegensatz zu einem niedrigen Maß an Unsicherheit für eine Intensivierung von Intimität.

Analizando los Mecanismos que Incrementan la Intimidad Relacional: Los Efectos de la Cantidad de Incertidumbre, la Apertura de la Comunicación sobre la Incertidumbre, y la Reducción de la Incertidumbre

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Resumen

Este estudio examinó la cantidad de incertidumbre, la apertura de la comunicación sobre la incertidumbre, y el proceso de reducción de incertidumbre, como 3 mecanismos en competencia que explican el incremento de la intimidad en las relaciones románticas. Para poner a prueba estos mecanismos en competencia, usamos un modelo de niveles múltiples para analizar los datos longitudinales colectados de individuos en asociaciones románticas durante un período de 6 semanas. Los resultados de los análisis separados indican que la cantidad de incertidumbre fue asociada negativamente con la intimidad concurrente y que la apertura de la comunicación sobre la incertidumbre y la disminución de la incertidumbre fueron asociadas positivamente con la intimidad subsecuente. Cuando los tres vaticinadores fueron considerados en forma simultánea, la disminución de la incertidumbre fue el único vaticinador significante de la intimidad. Estos resultados subrayan la importancia del proceso de reducción de la incertidumbre, más que las cantidades bajas de incertidumbre, para incrementar la intimidad.

解析亲密关系提升之机制： 不确定性因素的数量、不确定性的坦诚交流以及不确定减少等的效果

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本研究检验了不确定因素的数量、有关不确定性之沟通的坦诚程度以及不确定性减少的过程这三种机制对增加浪漫关系中亲密程度的影响。为了检测这三个机制，我们用多层面模型来分析跨时 6 周的纵向数据。这些数据从处于浪漫关系中之个体那里收集而来。单独分析的结果显示：不确定因素的数量和同时发生的亲密程度成反比关系；而对不确定性的开诚布公的沟通以及不确定的减少和随之产生的亲密程度呈正比关系。当将这三种机制一并考虑时，不确定的减少是唯一一个能预测亲密程度的变量。这些发现显示了不确定因素减少，而非不确定因素多寡，在提升亲密程度方面的重要性。

관계적 친밀성을 증가시키는 구조의 분석: 불확실성 정도의 효과, 불확실성에 관한 커뮤니케이션의 개방, 그리고 불확실성의 감소

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요약

본 연구는 불확실성의 정도, 불확실성에 관한 커뮤니케이션의 개방, 그리고 불확실성 감소과정을 낭만적인 관계에서 상호성을 증가시키는 3 가지 경쟁정 구조로서 연구하였다. 이러한 경쟁적인 구조들을 연구하기 위해, 우리는 6 주간 낭만적인 관계에 있는 개인들로부터 취합한 종적데이터를 분석하기 위해 다면적 모델을 사용하였다. 분리된 분석들로부터의 연구는 불확실성의 양은 현재 진행되고 있는 친밀성과 부정적으로 연계되고 있으며, 불확실성에 관한 커뮤니케이션의 개방과 불확실성의 감소들은 연속적인 친밀성과 긍정적으로 연계되어 있는 것으로 나타났다. 이들 세가지 예측계들을 동시에 고려할때, 불확실성의 감소가 친밀성의 유일한 주요 예측계임이 밝혀졌다. 이러한 발견들은 증가된 친밀성을 위해서는 불확실성의 양을 줄이는 것보다는 불확실성의 감소과정이 더 중요하다는 것을 보여주고 있다.