Jealousy and the nature of beliefs about infidelity: Tests of competing hypotheses about sex differences in the United States, Korea, and Japan

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Abstract

The different adaptive problems faced by men and women over evolutionary history led evolutionary psychologists to hypothesize and discover sex differences in jealousy as a function of infidelity type. An alternative hypothesis proposes that beliefs about the conditional probabilities of sexual and emotional infidelity account for these sex differences. Four studies tested these hypotheses. Study 1 tested the hypotheses in an American sample ($N = 1,122$) by rendering the types of infidelity mutually exclusive. Study 2 tested the hypotheses in an American sample ($N = 234$) by asking participants to identify which aspect of infidelity was more upsetting when both forms occurred, and by using regression to identify the unique contributions of sex and beliefs. Study 3 replicated Study 2 in a Korean sample ($N = 190$). Study 4 replicated Study 2 in a Japanese sample ($N = 316$). Across the studies, the evolutionary hypothesis, but not the belief hypothesis, accounted for sex differences in jealousy when the types of infidelity are rendered mutually exclusive; sex differences in which aspect of infidelity is more upsetting when both occur; significant variance attributable to sex, after controlling for beliefs; sex-differentiated patterns of beliefs; and the cross-cultural prevalence of all these sex differences.

Evolutionary psychologists hypothesized almost two decades ago that men and women would differ psychologically in the weighting given to cues that trigger jealousy (Daly, Wilson, & Weghorst, 1982; Symons, 1979). A man's jealousy has been hypothesized to focus on cues to sexual infidelity because a long-term partner's sexual infidelity jeopardizes his certainty in paternity, thereby placing him at risk of in-

vesting in another man's offspring. A woman's jealousy has been hypothesized to focus more on cues to the long-term diversion of a man's commitment, such as his emotional involvement with another woman. The predicted sex differences in the nature of jealousy have been found repeatedly by different investigators—psychologically, physiologically, and to a limited degree cross-culturally (Buss, Larsen, Westen & Semmelroth, 1992; Buunk, Angleitner, Oubaid, & Buss, 1996; DeSteno & Salovey, 1996; Geary, Rumsey, Bow-Thomas, & Hoard, 1995; Wiederman & Allgeier, 1993). Both sexes, of course, are distressed by both forms of infidelity, and the evolutionary hypothesis suggests that they should be, given their correlated nature in

everyday life (Buss et al., 1992). The hypothesis, rather, is about sex differences in the *emotional weighting* of the aspects of infidelity.

The logic of the evolutionary psychological hypothesis does not suggest that men and women are necessarily cognizant of the nature of the selection pressures that have given rise to their psychology of jealousy, just as people need not be conscious of the nutritive logic underlying their evolved taste preferences or the reproductive logic underlying their evolved mate preferences (Buss, 1994). Rather, the underlying psychology of jealousy is proposed to contain design features that reflect solutions to the recurrent adaptive problems that each sex faced over the long expanse of human evolutionary history. These design features are hypothesized to be universal, and hence are predicted to be found across cultures. This provides an additional arena for empirical testing and potential falsification.

Another explanation, the so-called double-shot hypothesis, was recently proposed as an alternative hypothesis to account for these sex differences (DeSteno & Salovey, 1996). This hypothesis proposes that people get more upset about the type of infidelity that they happen to believe most implies the occurrence of the other. If a person happens to believe, for example, that a sexual infidelity implies an emotional infidelity more than the reverse, then according to the belief hypothesis the person will become more upset about a sexual than an emotional infidelity. If a person happens to believe that the reverse conditional probabilities hold, then he or she is predicted to become more upset about an emotional infidelity. According to the belief hypothesis, men and women "in some samples" happen to hold different beliefs about these conditional probabilities, although the hypothesis contains neither an explanation for why the sexes would differ in these ways nor an explanation for why the sexes might differ in some samples and not others.

Notwithstanding this lack of specification, in those samples where the sexes hold different beliefs about the conditional probabilities, they are predicted to show corresponding sex differences in which type of infidelity is more upsetting, according to the belief hypothesis. The sex differences in jealousy, on this account, do not represent evolved sex differences, but rather are incidental or spurious by-products of sex differences in beliefs. Although this hypothesis is post hoc in the sense of proposing an explanation for a sex difference *after* the sex difference had already been discovered (Buss et al., 1992), it does have the virtue of generating further empirical predictions, which can then be pitted against those generated by the evolutionary hypothesis.

Although conceptual arguments have been presented for and against both hypotheses (Buss, Larsen, & Westen, 1996; DeSteno & Salovey, 1996), empirical research is properly the final arbiter of these competing hypotheses. The primary goal of the four studies reported here is to pit predictions of the evolutionary hypothesis against those of the belief hypothesis, and resolve the issue empirically.

Clarifying the nature and origins of sex differences in jealousy has important theoretical and applied implications. Theoretically, at the broadest level, it represents part of a larger debate within psychology about the domain-specificity or domain-generality of psychological mechanisms (Hirschfeld & Gelman, 1994). The evolutionary hypothesis about sex differences in jealousy is domain-specific—it proposes that the psychological mechanisms of each sex will contain dedicated design features, each corresponding to the specific sex-linked adaptive problems that have recurred over thousands of generations over human evolutionary history. From an evolutionary perspective, the odds that the sexes will be psychologically identical in domains where they have recurrently confronted different adaptive problems over the long expanse of human evolutionary history are essentially zero (Buss, 1994; Symons, 1992). The belief hypothesis, in contrast, is more domain-general, corresponding in form to a long and dominant tradition within psychology of positing content-independent psycho-

logical processes, sometimes referred to as the Standard Social Science Model (Tooby & Cosmides, 1992). That is, the belief hypothesis implies a general underlying psychological mechanism common to both sexes—beliefs driving emotional distress. Thus, the empirical resolution of these competing hypotheses, in addition to shedding theoretical light on the nature and origins of jealousy, should contribute to the larger theoretical debate in psychology about domain-specificity versus domain-generality of psychological mechanisms.

From an applied perspective, male sexual jealousy is one of the leading risk factors to women of spousal abuse and homicide (Daly & Wilson, 1988). Furthermore, jealousy, in particular stemming from a man's suspicion of a wife's infidelity, has been implicated as a key cause of divorce across a variety of cultures (Betzig, 1989). Jealousy, therefore, is not a trivial emotion that resides passively in the cognitive processes of men and women. It has large and detrimental social consequences. Knowledge about the underlying psychology of jealousy, including the factors that trigger it, might contribute to the potential future amelioration of these social problems. To proceed with these empirical tests, however, several conceptual issues must be clarified, from which specific predictions derive.

On the Origins and Nature of Beliefs About Sexual and Emotional Infidelity

The belief hypothesis has several conceptual ambiguities that limit its utility as a scientific hypothesis (Buss et al., 1996). First, the belief hypothesis fails to provide an account of *why* the sexes differ in their beliefs about the conditional probabilities of the two types of infidelity. Do parents socialize the beliefs in their children? Does the broader culture send messages that are internalized by the sexes? Do the beliefs stem from personal experiences in observing the actual conditional probabilities of the events? Until the issue of the origins of the beliefs is clarified, the belief hypothesis

lacks conceptual incisiveness and predictive power. Any hypothesis designed to account for sex differences that fails to specify why the sexes differ in the pivotal explanatory variable can charitably be described as incomplete.

Second, the belief hypothesis does not explain why the sexes are proposed to differ only "in some samples" and not in others. Does the qualifying phrase "in some samples" mean only in some samples, but not others, within the United States? Or does it mean only in some samples, but not others, in Western culture? What causal processes account for the origins of differing beliefs across samples, if indeed the samples differ in their beliefs? These ambiguities undermine much of the utility the belief hypothesis could otherwise carry. Furthermore, the lack of specification about why samples would differ in their beliefs means that *any* empirical findings about the actual nature of the beliefs in different samples are "compatible" with the belief hypothesis, rendering this aspect of the belief hypothesis incapable of being empirically falsified.

Third, the belief hypothesis, in postulating sex differences in beliefs about the conditional probabilities of sexual and emotional infidelity, fails to specify whether the sex differences occur in the minds of men and women in their observation of both sexes, *or* in the beliefs men and women share about different objects of belief (men vs. women). This makes a large difference. If the sex difference in belief resides in the minds of men and women rather than in shared beliefs about men and women, then men and women would be predicted to differ in their inferences about which form of infidelity would be more upsetting, regardless of whether the inferences are made about men or women. Conversely, if the sex differences in beliefs are driven by the objects of the belief, then men and women would be predicted to share the same inferences about which form of infidelity would be more upsetting when they are evaluating the same objects (men or women). Again, failure to specify the nature of the crucial

explanatory variable—beliefs—renders the hypothesis vague, undermines its ability to generate specific empirical predictions, and to this degree makes it unfalsifiable. This vagueness is in sharp contrast to an evolutionary psychological hypothesis that makes specific empirical predictions about the origins and nature of beliefs about sexual and emotional infidelity.

An Evolutionary Hypothesis About the Origins and Nature of Beliefs About Infidelity

We suggest that differing beliefs indeed are correlated with sex, and to this degree the evolutionary and belief hypotheses are in agreement. We propose, however, a domain-specific evolutionary explanation for the origins and nature of this correlation: evolved sex differences in the *actual* conditional probabilities of the two types of infidelity. Specifically, men and women have evolved different sexual strategies (Buss & Schmitt, 1993; Symons, 1979; Townsend, 1995; Trivers, 1972). Over evolutionary time, women who engaged in casual sex without emotional involvement would have risked getting pregnant and raising offspring without the aid, protection, and provisioning of an investing man. Ancestral men, in contrast, would have benefited more than ancestral women in reproductive currencies by pursuing a short-term mating strategy with casual sex partners and without further involvement (Buss & Schmitt, 1993). These selection pressures have produced a fundamental sex difference in sexual psychology, namely that men find it far easier than women to have sex without emotional involvement (see Buss, 1994, for extensive empirical documentation). Therefore, the conditional probability of emotional involvement, given a sexual liaison, is predicted to be far lower for men than for women.

We propose, therefore, that the sex differences in beliefs are anchored in an accurately appraised sex difference in the conditional probabilities of sexual and emotional involvement. These sex-differentiated conditional probabilities have their origins in an evolutionary process that resulted in differing sexual strategies of men and women. These sex-differentiated sexual strategies will be found universally rather than merely "in some samples." In contrast to the absence of specification in the belief hypothesis about the origins and nature of beliefs, the evolutionary account is precise, predictive, testable, and falsifiable.

As a final conceptual comment, it is worth noting that it is possible that the evolutionary and belief hypotheses might both be partially correct. Even if men and women have distinct evolved design features associated with jealousy, it is possible that beliefs contribute incremental explanatory variance. Conversely, even if it were to turn out that beliefs accounted for a large share of the variance in responses to the jealousy dilemmas, evolved psychological sex differences in the nature of jealousy might contribute incremental explanatory variance.

Goals of the Current Research

Despite the conceptual ambiguities inherent in the belief hypothesis as currently formulated, it does have the virtue that it can be used to generate several predictions that can be pitted against the competing predictions from an evolutionary psychological account. In the current research, we devised four strategies for testing these competing accounts. In the first, we explicitly render the two types of infidelity mutually exclusive. Thus, we ask participants to consider a sexual infidelity that is *not* accompanied by an emotional infidelity and an emotional infidelity that is *not* accompanied by a sexual infidelity, and we evaluate which one is more upsetting. If the belief hypothesis is correct, the sex differences in reactions to infidelity should disappear, or at least be sharply attenuated. If the evolutionary hypothesis is correct, the sex differences in reactions to sexual and emotional infidelity should remain.

In the second strategy, both forms of infidelity are posited to have occurred, and participants are asked to identify which form is

more upsetting. Consider the following dilemma: Imagine that your partner both formed an emotional attachment to another person *and* had sexual intercourse with that other person. *Which aspect* of your partner's involvement would upset you more: (a) the sexual intercourse with that other person, or (b) the emotional attachment to that other person? According to the belief hypothesis, there should be no sex difference in response to this dilemma, because the different conditional probabilities have been rendered irrelevant. Because both forms of infidelity have occurred for both sexes, both are experiencing the double-shot equally, and so the sex difference should disappear, or at least be sharply attenuated. In contrast, an evolutionary psychological account predicts that the sex difference will remain, because although both forms of infidelity have occurred, the sexes should differ in the weighting given to the two forms, corresponding to the sex-linked adaptive problems confronted over human evolutionary history.

The third method follows DeSteno and Salovey (1996) in using logistic multiple regressions to examine the incremental variance accounted for by sex and by beliefs, after the other has been controlled statistically. This method allows for three possible outcomes: (a) sex might account for the bulk of the variance, with beliefs adding little or no incremental predictive variance; (b) beliefs might account for the bulk of the variance, with sex adding little or no incremental predictive variance; or (c) both sex and beliefs both might contribute predictive variance, with the total variance explained being larger than either predictor considered alone.

A fourth strategy for testing the key hypotheses was to employ all three of the above methods in samples from different cultures. In addition to the United States, we selected two Asian cultures, Korea and Japan, because in many studies these Asian cultures are radically different from Western cultures on dimensions such as individualism, collectivism, and attitudes toward sexuality (Markus & Kitayama, 1991;

Triandis, 1995). If the evolutionary hypothesis is correct, the sex differences in jealousy should be robust across these diverse cultures.

A second primary goal of this research was to test the evolutionary hypothesis that the sex differences in beliefs about conditional probabilities are anchored in another evolved sex difference—men's evolved desire for sexual variety, which predisposes them more than women to have sex without emotional involvement (Buss, 1994). In this context, it is worth noting that DeSteno and Salovey (1996) have explored empirically the beliefs about the conditional probabilities of sexual and emotional infidelity. Their design, however, contained a critical confound—it was not fully crossed. Men judged the conditional probabilities of sexual and emotional infidelity for women, whereas women judged the conditional probabilities for men. Thus, in the possible 2 × 2 design of sex of believer and sex of object of belief, two cells were missing—men's beliefs about the conditional probabilities for men and women's beliefs about the conditional probabilities for women. Without a fully crossed design, it is impossible to evaluate whether any obtained sex differences in beliefs are driven by the sex of the believer, the sex of the object of beliefs, or some combination of both.

Thus, a goal of this research was to clarify the nature and locus of the sex differences in beliefs, and simultaneously test the specific evolutionary hypothesis that the sex difference is primarily driven by shared beliefs that men and women hold about differing objects of belief (men vs. women). Furthermore, we sought to test this hypothesis across cultures to explore the generality of these beliefs.

Study 1: Rendering Sexual and Emotional Infidelity Mutually Exclusive

The goal of Study 1 was to modify the original forced-choice scenarios to isolate more cleanly sexual and emotional infidelity so as to eliminate the issue of differing conditional probabilities. This study uses the first

methodological strategy—rendering sexual and emotional infidelity mutually exclusive.

Method

Participants. Two samples of participants were used for Study 1. The first consisted of 173 men and 323 women enrolled in an introductory psychology class at a liberal arts college in the southeastern United States. The second sample consisted of 201 men and 425 women enrolled in an introductory psychology class at the same college, but drawn from a different semester than participants in the first sample. Thus, a total of 1,122 participants (374 men and 748 women) participated in Study 1. For both samples, participation was voluntary and not rewarded.

Materials. The first part of the instructions paralleled the original Buss et al. (1992) scenarios:

Please think of a serious committed romantic relationship that you have had in the past, that you currently have, or that you would like to have. Imagine that you discover that the person with whom you've been seriously involved became interested in someone else. What would upset or distress you more (please circle only one):

(A) Imagining your partner forming a deep emotional (but not sexual) relationship with that person.

(B) Imagining your partner enjoying a sexual (but not emotional) relationship with that person.

[N.B. underlines appeared in actual items given to participants]

We continue to use the forced-choice methodology for an important methodological reason: Likert-type rating scales are subject to ceiling effects when they are used to rate the magnitude of upset one would experience in response to a partner's infidelity (Buss, 1989; Shackelford & Buss, 1996). Both sexes find both types of infidel-ity distressing, as predicted (Buss et al., 1992; Shackelford & Buss, 1996). The forced choice method—an analogue to Sophie's Choice—is one strategy for circumventing these ceiling effects and revealing patterns of preference and emotion for which Lik-ert-type rating scales are insensitive.

Results and discussion

Analyses for sex differences were conducted for each sample separately. The results are shown in Figure 1. In both samples, a larger percentage of men than women reported greater distress in response to imagining their partner having sexual inter-course with someone else, with no emotional involvement, relative to distress reported in response to imagining their partner forming a deep emotional, but not sexual, relationship with another person, t (494) = 6.09 for Sample 1 and t (624) = 6.82 for Sample 2, both $ps < .001$, two-tailed. The magnitude of the sex difference was substantial in both cases—25% for the first sample and 26% for the second sample.

The results support the evolutionary psychological hypothesis of a sex difference in the weighting of sexual versus emotional triggers of jealousy. The results fail to sup-port the belief hypothesis, because control-ling for the differing conditional prob-abilities should eliminate or at least substantially attenuate the sex difference, if the belief hypothesis is correct. A propo-nent of the belief hypothesis, however, might argue that the beliefs in the condi-tional probabilities of the two types of infi-delity are so powerful that, although par-ticipants were explicitly instructed to consider each one without the other, per-haps it was impossible for them to do so. Hence, sex differences in beliefs about the conditional probabilities still might be driv-ing the sex difference in distress to sexual versus emotional infidelity.

This is not a strong argument, because despite the positive correlation in everyday life between sexual and emotional involve-ment, each can clearly occur without the other, for both sexes. Sex in everyday life
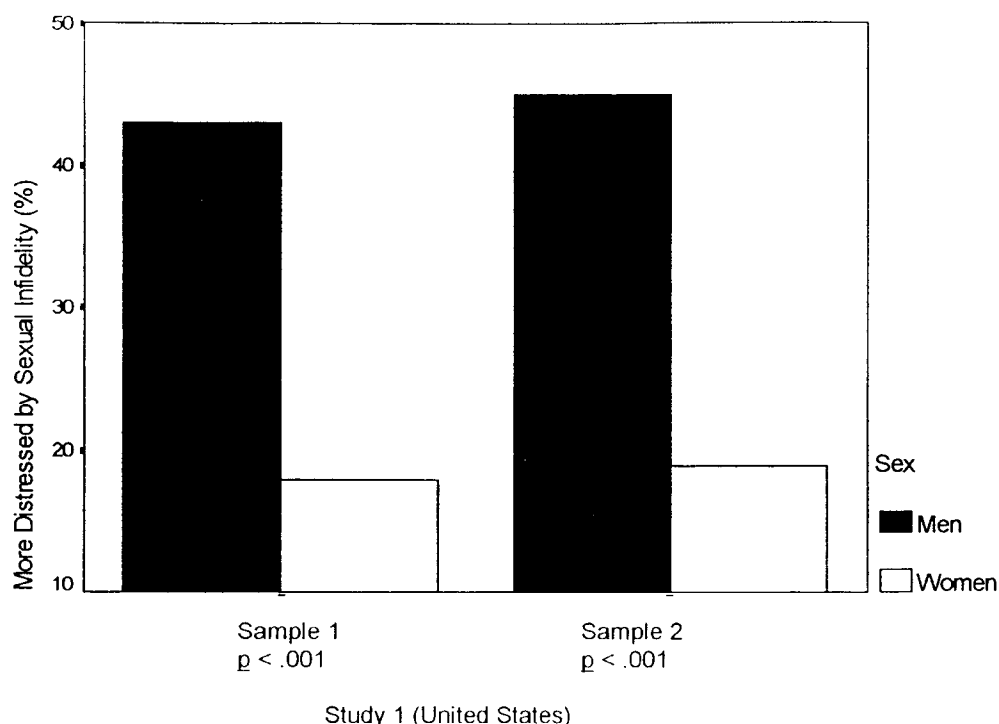
Figure 1. Percentage of participants reporting greater distress to sexual infidelity as a function of participant sex and sample (Study 1, United States). Probability values are two-tailed and were generated by independent-means t tests for sex differences. For Sample 1, $n = 405$; for Sample 2, $n = 626$.

does occur sometimes without emotional involvement—an impulsive one-night stand, a brief affair, a casual sexual encounter. And emotional involvement can occur without sexual involvement—an unrequited love, a chaste love, a postponement of sex until marriage. It is reasonable to assume that participants can separate the two in their minds, and evaluate their level of distress by comparing the two separately. Nonetheless, we designed another study that used two methodological strategies to pit predictions from the competing hypotheses against each other.

Study 2: Two Further Tests of the Competing Jealousy Hypotheses and an Evolutionary Hypothesis About the Origins of Beliefs

To test the competing hypotheses, we devised several different ways of rendering the infidelity types mutually exclusive to eliminate the conditional probability asymmetry (Strategy 1) and a second method for testing the competing hypotheses in which both types of infidelity had occurred and participants evaluate which aspect is more upsetting (Strategy 2).

The second goal of this study was to test the hypothesis that sex differences in beliefs about the conditional probabilities of sexual and emotional infidelity are anchored in veridical perceptions of evolved sex differences in sexual strategy, rather than existing merely "in the sex of the believer."

Method

Participants. Participants were 234 undergraduates (117 men and 117 women) at a large university in the midwestern United States. Participants were drawn from two

sources—a large introductory psychology course and an undergraduate campus library. Participation was voluntary and not rewarded.

Infidelity dilemmas. Six questions presented two infidelity scenarios and asked participants which would upset or distress them more. Two of these dilemmas were replications of previous studies (Buss et al., 1992). In the first replication, participants indicated which of the following two events would be more distressing: "(A) Imagining your partner forming a deep emotional attachment to that other person" or "(B) Imagining your partner enjoying passionate sexual intercourse with that other person." In the second replication, participants indicated which of the following two events would be more distressing: "(A) Imagining your partner falling in love with that other person" or "(B) Imagining your partner trying different sexual positions with that other person." Four additional dilemmas were constructed. These are described next.

Imagine that your partner both formed an emotional attachment to another person and had sexual intercourse with that other person. Which aspect of your partner's involvement would upset you more?:

(A) the sexual intercourse with that other person.

(B) the emotional attachment to that other person.

[N.B. underlines appeared in the actual items given to participants]

In this dilemma, beliefs about the conditional probabilities of the two events are irrelevant, because both have occurred. If the sex difference disappears for this dilemma, then the belief hypothesis would be supported. If the sex difference persists, even when conditional probabilities are rendered irrelevant, then the evolutionary hypothesis would be supported.

Three additional dilemmas used the strategy of rendering the infidelity types mutually exclusive, but varied the wording context from that used in Study 1. One dilemma was constructed with strong wording requiring participants to evaluate each type of infidelity in the absence of the other:

Which would upset or distress you more?

(A) Imagining your partner having sexual intercourse with that person, but you are certain that they will not form a deep emotional attachment.

(B) Imagining your partner forming a deep emotional attachment to that person, but you are certain that they will not have sexual intercourse.

[N.B. underlines appeared in the actual items given to participants]

In this dilemma, participants were instructed to consider only cases in which one type of infidelity occurs, with a certainty that the other type will not occur. If the sex difference persists in reaction to this dilemma, then the hypothesized sex difference in the weighting of cues hypothesis would receive support. If the sex difference disappears, then the double-shot hypothesis would receive support.

The third test differed from the above tests in that it invoked a former lover of one's partner:

Which would upset or distress you more?

(A) Imagining that your partner is still sexually interested in the former lover, but is no longer in love with this person.

(B) Imagining that your partner is still emotionally involved with the former lover, but is no longer sexually interested in this person.

A fourth dilemma read as follows:

Which would upset or distress you more?

(A) Imagining your partner having sexual intercourse for just one night with another person, with no chance of any further involvement.

(B) Imagining your partner becoming emotionally involved with another person, with no chance of any sexual involvement.

Although this dilemma lacked strict parallelism, we judged it to be another reasonable procedure for controlling for differing conditional probabilities. Furthermore, this dilemma offers a contrast between the purely sexual infidelity, which would have compromised an ancestral man's certainty in paternity, with the emotional involvement, which may have signaled to a woman the longer-term diversion of her partner's commitment and resources.

Beliefs about conditional probabilities of sexual and emotional infidelity. Four questions asked about the conditional probabilities of sexual and emotional involvement for a "typical man" and a "typical woman," following the wording used by DeSteno and Salovey (1996), but using a fully crossed design, unlike DeSteno and Salovey (1996). Men and women evaluated both conditional probabilities for each sex. All four questions were parallel to each other, differing only in the sex of the target (male, female) and in the type of involvement that implied the other (sexual, emotional). A sample question was:

The following questions will ask you about how likely a typical man is to act in certain ways. Assume that the letters C.G. refer to a typical man. Please circle the number that best indicates your answer.

If C.G. develops a deep emotional attachment to a woman, how likely is it that C.G. and the woman are now, or soon will be, sleeping together?

unlikely 1 2 3 4 5 6 7 8 9 very likely

Finally, two questions asked about the personal conditional probabilities for the participant of sexual involvement given

emotional involvement, and of emotional involvement given sexual involvement. A sample question was: "If you develop a deep emotional attachment to someone of the opposite gender, how likely is it that you and this other individual are now, or soon will be, sleeping together?" The same 9-point rating scale that was used for the "typical man" and "typical woman" was used for these self-evaluations. The order of the six questions was systematically counterbalanced, using eight different orders, so that approximately 30 participants received each order.

Results

Replication of the Buss et al. (1992) findings. To examine whether the original sex difference replicated, we conducted *t*-tests for the two replication dilemmas. Figure 2 displays the results. For the dilemma of one's partner enjoying passionate sexual intercourse with someone else versus forming a deep emotional attachment, 76% of men, but only 32% of women reported more distress to the sexual infidelity, $t(230) = 7.29, p < .001$, two-tailed. The second replication dilemma showed a similar sex difference, with 43% of men, but only 11% of women reporting more distress to the sexual infidelity versus "falling in love," $t(229) = 5.88, p < .001$, two-tailed.

Tests of the competing jealousy hypotheses. Figure 3 shows the results for the tests of the competing hypotheses. The evolutionary hypothesis was strongly supported, with 61% of men, but only 13% of women, reporting more distress to the sexual aspect of the infidelity, $t(232) = 8.89, p < .001$, two-tailed. This constituted a 48% difference in endorsement between the sexes.

The dilemma contrasting intercourse in the absence of emotional involvement with emotional involvement in the absence of intercourse also elicited support for the evolutionary hypothesis. Sixty-five percent of men, compared with only 31% of women, reported that the pure sexual infidelity would upset them more than the pure

Figure 2. Percentage of participants reporting greater distress to sexual infidelity as a function of participant sex and replication dilemma (Study 2, United States). Probability values are two-tailed and were generated by independent-means t tests for sex differences. $N = 234$.

emotional infidelity, t (232) = 5.55, p < .001, two-tailed.

The third dilemma contrasted a partner's continued emotional but not sexual involvement with a former lover with a partner's continued sexual but not emotional interest in that former lover. Supporting the evolutionary hypothesis, 54% of men, compared with only 27% of women, reported greater upset in response to a current partner's continued sexual but not emotional interest in the former lover, t (231) = 4.34, p < .001, two-tailed.

The fourth test asked participants to compare a sexual one-night stand with no further involvement with nonsexual emotional involvement. The sex difference remained robust, with only 13% of women, compared with 54% of men, reporting greater distress in response to the one-

night stand, t (230) = 7.39, p < .001, two-tailed.

These four tests provided no support for the belief hypothesis. The evolutionary hypothesis of a sex difference in the weighting given to the different forms of infidelity was supported across all four probes and using two different methodological strategies.

Beliefs about conditional probabilities of sexual and emotional involvement. Table 1 shows the results for the analyses of beliefs about the conditional probabilities of sexual and emotional involvement. The belief hypothesis lacks an account of the origins and nature of the beliefs about conditional probabilities, and so is ambiguous about whether the sex differences found in such beliefs are merely in the heads of men and women or are appraisals of actual sex dif-
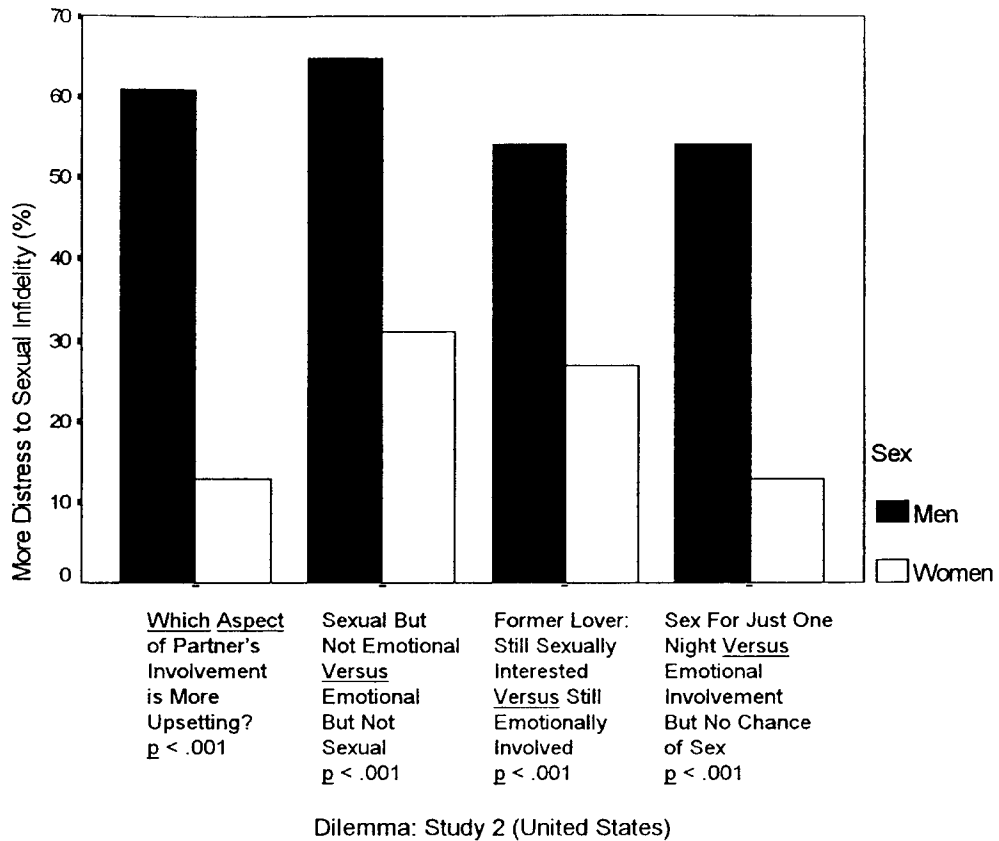
Figure 3. Percentage of participants reporting greater distress to sexual infidelity as a function of participant sex and dilemma (Study 2, United States). Probability values are two-tailed and were generated by independent-means t tests for sex differences. $N = 234$.

ferences in conditional probabilities of sexual and emotional involvement. The evolutionary account, in contrast, provides a clear prediction: Beliefs about conditional probabilities should track actual sex differences in the conditional probabilities.

We conducted repeated-measures multivariate analyses of variance (MANOVAs) on beliefs about the conditional probabilities of emotional involvement given sexual involvement (Table 1, panel A) and sexual involvement given emotional involvement (Table 1, panel B), with sex of believer entered as a between-subjects variable and sex of target entered as a within-subjects variable. Panel A of Table 1 shows that, as predicted by the evolutionary hypothesis, there was a large main effect for sex of target, F (1,230) = 425.63, $p < .001$.

Both sexes reported that men are more likely than women to have sex without emotional involvement. No significant main effect emerged for sex of believer, F (1, 230) = 3.18, $p < .05$. There was a significant sex of target $\times$ sex of believer interaction effect, F (1, 230) = 15.30, $p < .001$. The interaction revealed that ratings of the likelihood of emotional involvement given sexual involvement provided by participants of the same sex as the target were higher than were ratings provided by participants different in sex from the target.

Panel B of Table 1 presents results of the repeated-measures MANOVA on beliefs about the probability of sexual involvement, given emotional involvement. A sex of target effect emerged, revealing that both sexes believe that men, relative to

Table 1. *Beliefs about conditional probabilities of sexual and emotional involvement as a function of sex of believer and sex of target: Study 2 (United States)*

		Sex of Believer		
		Male	Female	
A. If sexual, how likely emotional?				
				Main effect:
Sex of Target	Male	4.91 (1.67)	4.16 (1.41)	*Sex of Target*
				F (1,230) = 425.63
	Female	6.88 (1.63)	7.06 (1.23)	$p < .001$
				Interaction:
		Main effect:		Sex of Believer
		Sex of Believer		$\times$ *Sex of Target*
		F (1,230) = 3.18,		F (1,230) = 15.30,
		$p > .05$		$p < .001$
B. If emotional, how likely sexual?				
				Main effect:
Sex of Target	Male	6.65 (1.85)	7.27 (1.44)	*Sex of Target*
				F (1,230) = 27.94,
	Female	6.28 (1.68)	6.47 (1.34)	$p < .001$
				Interaction:
		Main effect:		Sex of Believer
		Sex of Believer		$\times$ *Sex of Target*
		F (1,230) = 5.22,		F (1,230) = 3.52,
		$p = .023$		$p > .05$

Note: Data provided by 117 women and 117 men. Cells display means and (in parentheses) standard deviations.

women, are more likely to become sexually involved given emotional involvement, F (1, 230) = 27.94, $p < .001$. A sex of believer effect also emerged, with women providing higher ratings than men of the likelihood of sexual involvement given emotional involvement, F (1,230) = 5.22, $p = .023$. The sex of target $\times$ sex of believer interaction was not statistically significant, $p > .05$. Neither the belief hypothesis nor the evolutionary hypothesis had generated a priori predictions about these data. Nonetheless, it is notable that men's beliefs about men are remarkably similar to women's beliefs about women, with both sexes placing the probability just above the mid-point of the scale.

Table 2 shows the results for self-assessments of the conditional probabilities of sexual and emotional involvement. As pre-dicted by the evolutionary hypothesis, women reported a greater probability of becoming emotionally involved with a sexual partner than did men, $F(1,220) = 9.53$, $p = .002$. Nothing in the belief hypothesis predicts this sex difference. A main effect for conditional probability emerged, with both men and women providing lower ratings of the likelihood of sexual involvement given emotional involvement, relative to ratings of the likelihood of emotional involvement given sexual involvement, F (1,220) = 32.30, $p < .001$. Finally, a significant interaction effect emerged for conditional probability $\times$ sex of participant, F (1,230) = 9.53, $p = .002$. The interaction suggested that, although both sexes provided higher ratings of the likelihood of sexual involvement given emotional involvement than of the converse conditional

Table 2. *Self-reported conditional probabilities of sexual and emotional involvement as a function of sex of participant: Study 2 (United States)*

		Conditional Probability		
		If sexual, then emotional	If emotional, then sexual	
Sex of Participant	Male	6.63 (2.07)	5.67 (2.38)	Main effect: *Sex of Participant* $F(1,220) = 9.53$,
	Female	7.54 (1.76)	5.70 (2.31)	$p = .002$
		Main effect: *Conditional Probability* $F(1,220) = 32.30$, $p < .001$		Interaction: Conditional Probability × *Sex of Participant* $F(1,220) = 8.01$, $p = .005$

Note: Data were provided by 117 women and 117 men. Data from 12 participants were excluded because of response omissions. Cells display means and (in parentheses) standard deviations.

probability, the difference in these likelihood ratings was larger for women than for men.

Logistic multiple regressions. Following DeSteno and Salovey (1996), we conducted a series of logistic multiple regressions to assess the absolute and relative predictive power of sex of believer (male, female) and beliefs about the conditional probabilities of sexual and emotional involvement in accounting for variance in the type of infidelity selected as more distressing. To assess perceived differential conditional probability of one type of involvement occurring given the occurrence of the other, and following DeSteno and Salovey (1996), we subtracted estimates of the probability of sexual given emotional involvement from estimates of the probability of emotional given sexual involvement. Because we employed a fully crossed design such that men and women rated the conditional probabilities of one type of involvement given the other for both male and female targets, we were able to create two indexes of perceived differential conditional probability. One such index, Differential Involvement Implication–Opposite sex (DII-O), reflects men's estimates of the differential conditional probabilities of women's sexual and

emotional involvement, and women's estimates of the differential conditional probabilities of men's sexual and emotional involvement. The DII-O is identical to DeSteno and Salovey's (1996) single Differential Infidelity Implication index (we substitute "involvement" for "infidelity" because the items assess beliefs about involvement more generally, not infidelity, in particular).

We created an additional index of differential involvement implication. This index, Differential Involvement Implication–Same sex (DII-Same), reflects men's estimates of the differential conditional probabilities of men's sexual and emotional involvement, and women's estimates of the differential conditional probabilities of women's sexual and emotional involvement. Finally, participants provided estimates of their own likelihood of becoming sexually involved if they were emotionally involved, and vice versa. Using these self-referent estimates, we created a third index of differential involvement implication, Differential Involvement Implication–Self (DII-Self), by subtracting estimates of the probability of sexual given emotional involvement from estimates of the probability of emotional given sexual involvement.

Participants responded to two questions that allowed us to assess the absolute and relative predictive power of sex and beliefs about the conditional probabilities of one type of involvement given the other in explaining variance in type of infidelity selected as more upsetting. One question—identical to the question employed by DeSteno and Salovey (1996)—asked participants to select a partner's (a) passionate sexual intercourse with another person or (b) deep emotional attachment to another person as more upsetting. The second question asked participants to select as more distressing imagining their partner (a) trying different sexual positions with the other person or (b) falling in love with the other person. The pattern of results generated by the logistic multiple regressions did not vary with the wording of the question and, for reportorial efficiency, we present the results for the DeSteno–Salovey question only.

We tested a series of models assessing the predictive power of sex and DII-O. We first regressed infidelity choice on sex. Consistent with DeSteno and Salovey (1996), sex was a significant predictor of infidelity choice, χ^2 (1, $N = 232$) $= 45.04, p < .001$. Next, we regressed infidelity choice on DII-O and, also consistent with DeSteno and Salovey (1996), found that DII-O was a significant predictor of infidelity choice, χ^2 (1, $N = 230$) $= 13.25, p = .003$. We then simultaneously entered sex and DII-O as predictors of infidelity choice. Sex remained highly predictive of infidelity choice, whereas DII-O was no longer predictive of infidelity choice, χ^2 (2, $N = 230$) $= 49.38, p < .001$; for sex: $b = 2.30, se_b = 0.42, Wald$ (1 df) $= 30.41, p < .001$, two-tailed; for DII-O, $b = -0.09, se_b = 0.07, Wald$ (1 df) $= 1.67, p > .05$, two-tailed. Adding sex as a predictor to the model regressing infidelity choice on DII-O resulted in a significant increase in explained variance, $\Delta\chi^2$ (1, $N = 230$) $= 36.14, p < .001$. Adding DII-O as a predictor to the model regressing infidelity choice on sex did not result in a significant increase in explained variance, $\Delta\chi^2$ (1, $N = 230$) $= 1.70, p > .05$. These results indicated

that the predictive value of beliefs about the differential conditional probabilities of one type of involvement given the other in explaining variance in infidelity choice was entirely contingent on the sex of the believer. Moreover, sex was a significant predictor of choice of more distressing infidelity, whether entered alone, or hierarchically or simultaneously with DII-O. An identical pattern of results emerged for parallel models in which infidelity choice was regressed on (a) sex and DII-Same and (b) sex and DII-Self (analyses available on request).

Within-sex logistic regressions. Following DeSteno and Salovey (1996), we conducted a series of within-sex logistic regressions of infidelity choice on DII-O. Neither men's nor women's beliefs about the conditional probabilities of one type of involvement given the other significantly predicted type of infidelity selected as more distressing (for men: χ^2 [1, $N = 113$] $= 0.56, p > .05$; for women: χ^2 [1, $N = 116$] $= 1.15, p > .05$). This same pattern of results emerged when we regressed infidelity choice on DII-Same and DII-Self (analyses available on request).

Discussion

Study 2 employed three strategies for testing the competing hypotheses about sex differences in jealousy. First, when the forms of infidelity were rendered mutually exclusive, strong sex differences still emerged in emotional response to the two types of infidelity. Second, when both forms of infidelity were posited to have occurred, rendering conditional probabilities irrelevant, large sex differences still emerged in which aspect of the infidelity was more distressing. Third, the results of the logistic regressions suggest that sex was a significant and substantial predictor of which form of infidelity is more distressing, when entered alone, when entered simultaneously with beliefs, and when entered hierarchically after the entry of beliefs. Although the results of these three methods could have provided support for the evolutionary hypothesis, the belief hypothesis, or both, the

findings provide support only for the evolutionary hypothesis about sex differences in jealousy.

The findings for the fully crossed design for examining the nature of beliefs about conditional probabilities suggest that the sex differences previously found in beliefs stem primarily from sex differences in the objects of the beliefs, as suggested by the evolutionary hypothesis, and not in sex differences in the believers. Men and women apparently share the belief that men find it easier than do women to have sex without emotional involvement.

Study 3: Tests of the Competing Jealousy Hypotheses in a Korean Sample

The goal of Study 3 was to test the competing hypotheses about jealousy using two methodological strategies in a non-Western culture. The two strategies were those used in Study 2—rendering the infidelity scenarios mutually exclusive (Strategy 1) and requesting participants to evaluate which form of infidelity would be more distressing when both had occurred (Strategy 2). Because the central hypotheses have not yet been tested in competition with one another outside Western cultures, this cross-cultural test represents an important extension.

Method

Participants. Participants were 190 undergraduates (100 men and 90 women) at Seoul National University in Korea. Participation was voluntary and not rewarded.

Materials and procedure. Participants completed the survey used in Study 2, except that none of the questions assessing beliefs about the conditional probabilities of sexual and emotional involvement were included. Thus, the survey included the six jealousy dilemmas described in Study 2. The translation of the survey from English to Korean proceeded as follows: A bilingual speaker translated the English-language survey into Korean. A se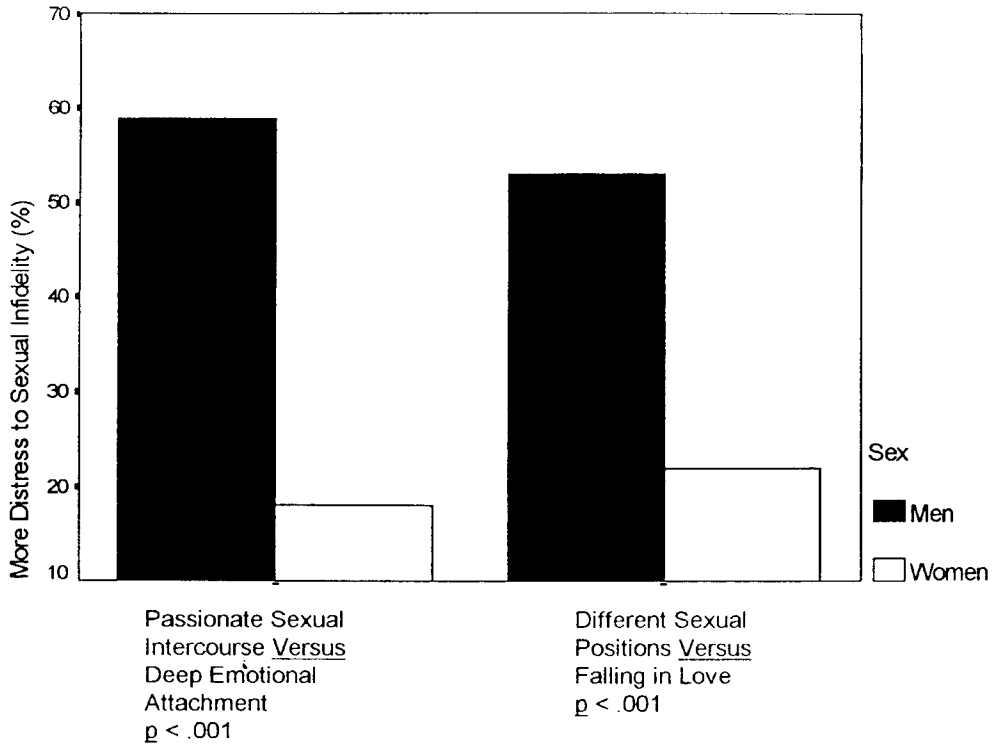cond bilingual speaker unaware of the contents of the original English-language survey back-translated the Korean-language survey into English. The two bilingual speakers consensually resolved the few resulting discrepancies between the original English-language survey and the back-translated English-language survey. The two bilingual speakers then collaboratively translated the original English survey into the final Korean-language survey used in this study.

Results and discussion

Replication of the Buss et al. (1992) findings. To examine whether the original sex difference also replicated for the Korean sample, we conducted t-tests for the replication dilemmas. Figure 4 displays the results. For the dilemma of one's partner enjoying passionate sexual intercourse with someone else versus forming a deep emotional attachment, 59% of men, but only 18% of women, reported more distress to the sexual infidelity, t (185) = 6.31, $p < .001$, two-tailed. The second replication dilemma showed a similar sex difference, with 53% of men, but only 22% of women, reporting more distress to the sexual infidelity versus "falling in love," t (181) = 4.43, $p < .001$, two-tailed.

Tests of the competing jealousy hypotheses. Figure 5 shows the results for the four tests of the competing hypotheses. The first two bars in Figure 5 show the results for positing that both forms of infidelity have occurred, with participants indicating which form they would find most distressing. The evolutionary hypothesis was solidly supported, with 47% of men, but only 27% of women, reporting more distress to the sexual aspect of the infidelity, t (184) = 2.81, p = .006, two-tailed.

The dilemma contrasting intercourse in the absence of emotional involvement with emotional involvement in the absence of intercourse also elicited support for the evolutionary hypothesis. Fifty-four percent of men, but only 30% of women, reported that the pure sexual infidelity would upset them more than the pure emotional infidelity, t (184) = 3.28, p = .001, two-tailed.

Replication Dilemma: Study 3 (Korea)

Figure 4. Percentage of participants reporting greater distress to sexual infidelity as a function of participant sex and replication dilemma (Study 3, Korea). Probability values are two-tailed and were generated by independent-means t tests for sex differences. N = 190.

The third dilemma contrasted a partner's continued emotional but not sexual involvement with a former lover with a partner's continued sexual but not emotional interest in that former lover. Consistent with the evolutionary hypothesis, 52% of men, compared with only 28% of women, reported greater upset in response to a current partner's continued sexual but not emotional interest in the former lover, t (186) = 2.89, p = .004, two-tailed.

The fourth test asked participants to compare a sexual one-night stand with no further involvement with nonsexual emotional involvement. The sex difference obtained again, with 27% of women, compared with 42% of men, reporting greater distress in response to the one-night stand, t (185) = 2.15, p = .03, two-tailed.

The results of this Korean study repli-

cated the results obtained for the three American samples in Studies 1 and 2. For the Korean sample, as for the American samples, the belief hypothesis was not supported. The evolutionary hypothesis of a sex difference in the weighting given to the different forms of infidelity was supported across all four empirical probes.

Study 4: Tests of the Competing Jealousy Hypotheses in a Japanese Sample and Cross-Cultural Tests of the Evolutionary Hypothesis About the Origin of Beliefs

Method

Participants. Participants were 316 undergraduates (213 men and 103 women) at a large university in Japan. Participation was voluntary and not rewarded.
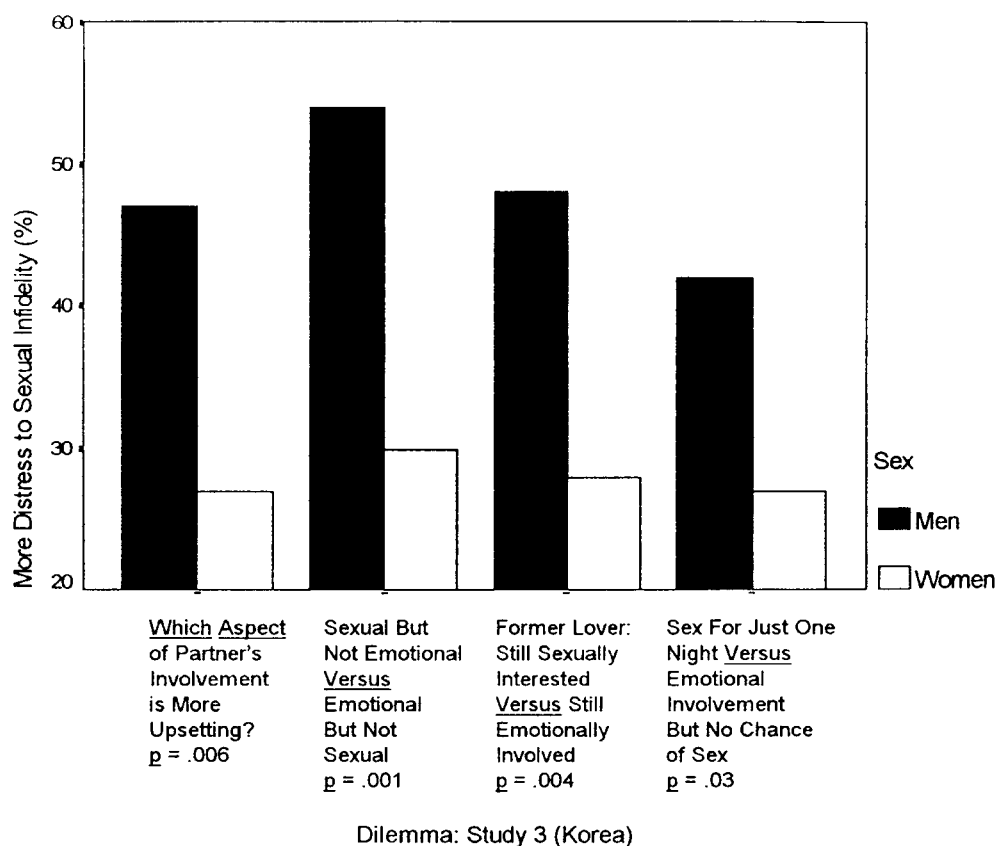
Figure 5. Percentage of participants reporting greater distress to sexual infidelity as a function of participant sex and dilemma (Study 3, Korea). Probability values are two-tailed and were generated by independent-means *t* tests for sex differences. *N* = 190.

Materials and procedure. Participants completed a Japanese translation of procedures used in Study 2: the six jealousy dilemmas and six questions assessing beliefs about the conditional probabilities of sexual and emotional involvement. The translation of the survey from English to Japanese proceeded as described for the Korean-language survey used in Study 3.

Results and discussion

Replication of the Buss et al. (1992) findings. As with Studies 1 through 3, we conducted *t*-tests for the replication dilemmas to examine whether the original sex difference replicated for the Japanese sample. Figure 6 displays the results. For the dilemma of one's partner enjoying passionate sexual in-

tercourse with someone else versus forming a deep emotional attachment, 38% of men, but only 13% of women, reported more distress to the sexual infidelity, *t* (311) = 4.64, *p* < .001, two-tailed. The second replication dilemma showed a similar sex difference, with 32% of men, but only 15% of women, reporting more distress to the sexual infidelity versus "falling in love," *t* (313) = 3.50, *p* = .001, two-tailed.

Tests of the competing jealousy hypotheses. Figure 7 shows the results for the tests of the competing hypotheses. For the most critical test—which form of infidelity would be most distressing when both have occurred—the evolutionary hypothesis received support, with 33% of men, but only 21% of women, reporting more distress to
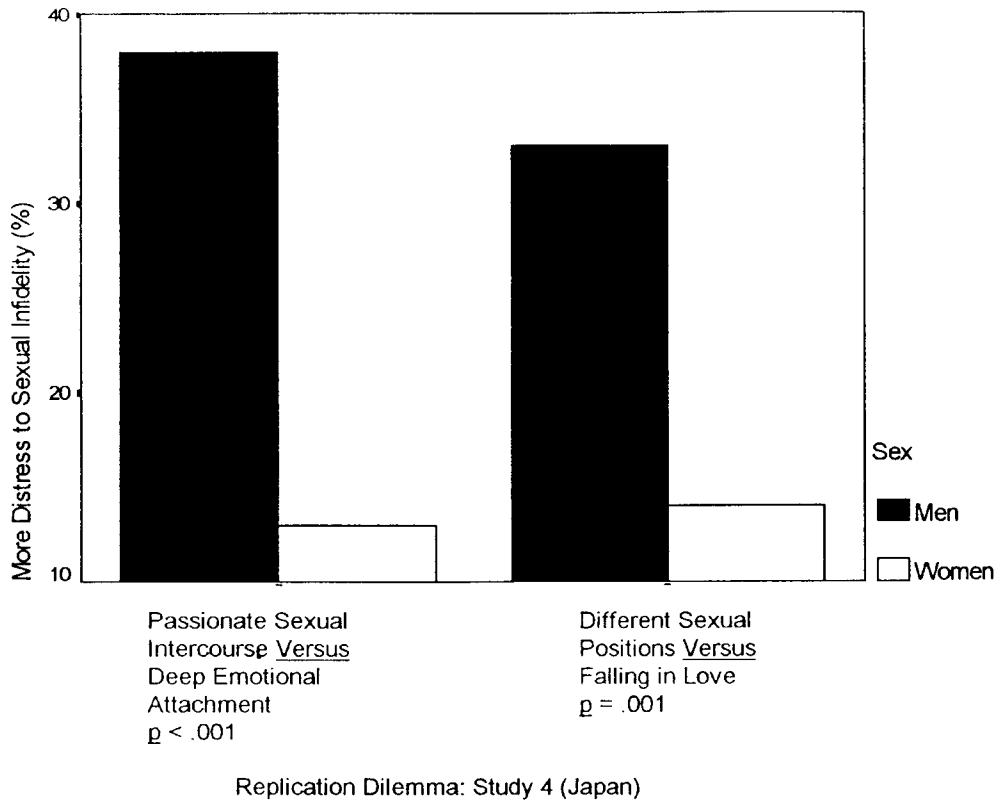
40

30

20

10

More Distress to Sexual Infidelity (%)

Passionate Sexual
Intercourse Versus
Deep Emotional
Attachment
p < .001

Different Sexual
Positions Versus
Falling in Love
p = .001

Sex

■ Men

☐ Women

Replication Dilemma: Study 4 (Japan)

Figure 6. Percentage of participants reporting greater distress to sexual infidelity as a function of participant sex and replication dilemma (Study 4, Japan). Probability values are two-tailed and were generated by independent-means t tests for sex differences. N = 316.

the sexual aspect of the infidelity, t (312) = 2.37, p = .019, two-tailed.

Shown in the second set of bars in Figure 7 are the results of the dilemma contrasting intercourse in the absence of emotional involvement with emotional involvement in the absence of intercourse. Seventy-five percent of men and of women reported that the pure sexual infidelity would upset them more than the pure emotional infidelity, t (308) = 0.04, p > .05, two-tailed. In contrast to the other tests, this empirical probe failed to support the evolutionary hypothesis.

The third dilemma in Figure 7 contrasted a partner's continued emotional but not sexual involvement with a former lover with a partner's continued sexual but not emotional interest in that former lover. Consistent with the evolutionary hypothe-

sis, 38% of men, compared with only 23% of women, reported greater upset in response to a current partner's continued sexual but not emotional interest in the former lover, t (313) = 2.65, p = .008, two-tailed.

Displayed in the fourth set of bars in Figure 7 are the results of the dilemma asking participants to compare a sexual one-night stand with no further involvement with nonsexual emotional involvement. The sex difference was replicated, with 15% of women, compared with 32% of men, reporting greater distress in response to the one-night stand, t (313) = 3.29, p = .001, two-tailed.

In summary, for five of the six Japanese jealousy dilemmas, the results replicated the results obtained for the three American samples in Studies 1 and 2 and for the Ko-
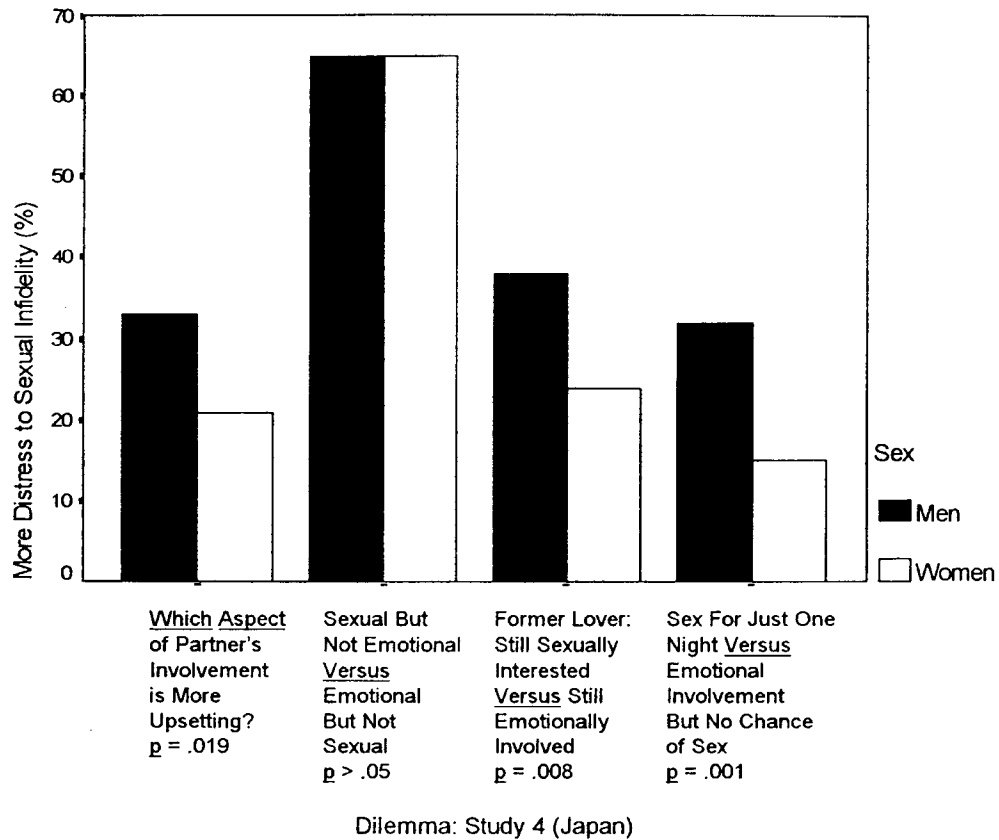
Figure 7. Percentage of participants reporting greater distress to sexual infidelity as a function of participant sex and dilemma (Study 4, Japan). Probability values are two-tailed and were generated by independent-means t tests for sex differences. $N = 316$.

rean sample in Study 3. In one of the six Japanese tests, the results failed to find the predicted sex difference.

Beliefs about conditional probabilities of sexual and emotional involvement. Table 3 shows the results of the analyses of beliefs about the conditional probabilities of sexual and emotional involvement. The survey completed by Japanese participants included the same questions assessing beliefs about the conditional probabilities of sexual and emotional involvement that were completed by American participants in Study 2. To test the evolutionary hypothesis of the origin of beliefs about the conditional probabilities of involvement in the Japanese sample, we conducted analyses identical to those reported in Study 2.

First, we conducted repeated-measures MANOVAs on beliefs about the conditional probabilities of emotional involvement given sexual involvement (Table 3, panel A) and sexual involvement given emotional involvement (Table 3, panel B), with sex of believer entered as a between-subjects variable and sex of target entered as a within-subjects variable. Panel A of Table 3 shows that, as predicted by the evolutionary hypothesis, there was a large main effect for sex of target, $F (1, 310) = 99.48, p < .001$. Replicating the finding reported for the American sample in Study 2, both sexes in the Japanese sample reported that men are more likely than women to have sex without emotional involvement. Also replicating the finding reported for the American sample, no signifi-

Table 3. *Beliefs about conditional probabilities of sexual and emotional involvement as a function of sex of believer and sex of target: Study 4 (Japan)*

		Sex of Believer		
		Male	Female	
A. If sexual, how likely emotional?				
				Main effect:
Sex of Target	Male	5.10 (1.91)	4.63 (1.57)	*Sex of Target*
				$F(1,310) = 99.48$,
	Female	5.73 (2.09)	6.31 (1.86)	$p < .001$
				Interaction:
		Main effect:		Sex of Believer
		Sex of Believer		× *Sex of Target*
		$F(1,310) = 0.10$,		$F(1,310) = 22.06$,
		$p > .05$		$p < .001$
B. If emotional, how likely sexual?				
				Main effect:
Sex of Target	Male	6.26 (2.01)	6.73 (1.89)	*Sex of Target*
				$F(1,311) = 3.64$,
	Female	6.37 (2.00)	6.21 (1.86)	$p = .057$
				Interaction:
		Main effect:		Sex of Believer
		Sex of Believer		× *Sex of Target*
		$F(1,311) = 0.52$,		$F(1,311) = 8.85$,
		$p > .05$		$p = .003$

Note: Data were provided by 103 women and 213 men. For panels A and B, respectively, data from four and three participants were excluded because of response omissions. Cells display means and (in parentheses) standard deviations.

cant main effect emerged for sex of believer in the Japanese sample, $F(1, 310) = 0.10$, $p > .05$. A third replication of results reported for the American sample was a significant sex of target × sex of believer interaction, $F(1, 310) = 22.06$ $p < .001$. Ratings of the likelihood of emotional involvement given sexual involvement provided by Japanese participants of the same sex as the target were higher than ratings provided by participants different in sex from the target.

Panel B of Table 3 shows the results of the repeated-measures MANOVA on beliefs about the probability of sexual involvement, given emotional involvement. With the alpha criterion set to .05, neither a sex of target effect nor a sex of believer effect obtained, $F(1, 311) = 3.64$ and $F(1,$ 311) $= 0.52$, respectively, both $ps > .05$. The sex of target × sex of believer interaction was obtained, $F(1, 311) = 8.85, p = .003$. Ratings of the likelihood of sexual involvement given emotional involvement provided by participants of the same sex as the target were lower than ratings provided by participants different in sex from the target. The parallel analyses for the American sample in Study 2, reported in panel B of Table 1, revealed significant sex of target and sex of believer effects, but not a significant sex of target × sex of believer interaction effect. Although neither the evolutionary nor belief hypotheses made specific predictions about these conditional probabilities, it is noteworthy that the results for the Japanese sample do not replicate the American results for these data, suggesting

that members of the two cultures might differ in their beliefs in this respect.

Table 4 shows the results of self-assessments of the conditional probabilities of sexual and emotional involvement. Contrary to predictions made by the evolutionary hypothesis, women did not report a greater probability of becoming emotionally involved with a sexual partner than did men F (1, 312) = 0.14, p > .05. Neither a main effect for conditional probability nor an interaction of conditional probability × sex of participant obtained for the Japanese data, F (1, 312) = 0.02 and F (1, 312) = 0.34, respectively, both ps > .05.

Logistic multiple regressions. The logistic regression analyses conducted on the Japanese data were identical to those conducted on the American data generated in Study 2. We tested a series of logistic regression models assessing the predictive power of sex and Differential Involvement Implication–Opposite sex (DII-O). The DII-O is identical to DeSteno and Salovey's (1996) single Differential Infidelity Implication index.

Like their American counterparts, Japanese participants responded to two questions that allowed us to assess the absolute

and relative predictive power of sex and beliefs about the conditional probabilities of one type of involvement given the other in explaining variance in type of infidelity selected as more upsetting. Consistent with findings for the American sample, the pattern of logistic regression results for the Japanese sample did not vary with the wording of the question and, for reportorial efficiency, we therefore present the results for the DeSteno-Salovey question only. This question asked participants to select a partner's (a) passionate sexual intercourse with another person or (b) deep emotional attachment to another person as more upsetting.

We first regressed infidelity choice on sex. Consistent with DeSteno and Salovey (1996), and replicating the result reported for the American sample, sex was a significant predictor of infidelity choice, χ^2 (1, N = 313) = 22.34, p < .001. Next, we regressed infidelity choice on DII-O and found that DII-O was not a significant predictor of infidelity choice, χ^2 (1, N = 310) = 1.60, p > .05. We then simultaneously entered sex and DII-O as predictors of infidelity choice. Sex remained highly predictive of infidelity choice, whereas DII-O remained unpredictive of infidelity choice,

Table 4. *Self-reported conditional probabilities of sexual and emotional involvement as a function of sex of participant: Study 4 (Japan)*

		Conditional Probability		
		If sexual, then emotional	If emotional, then sexual	
Sex of Participant	Male	6.02 (2.29)	6.10 (2.26)	Main effect: *Sex of Participant* F (1,312) = 0.14, p > .05
	Female	6.06 (2.26)	5.92 (2.20)	
		Main effect: *Conditional Probability* F (1,312) = 0.02, p > .05		Interaction: Conditional Probability × *Sex of Participant* F (1,312) = 0.34, p > .05

Note: Data were provided by 103 women and 213 men. Data from two participants were excluded because of response omissions. Cells display means and (in parentheses) standard deviations.

χ^2 (2, N = 310) = 22.43, p < .001; for sex: b = 1.40, se_b = 0.34, *Wald* (1 df) = 17.44, p < .001, two-tailed; for DII-O, b = .01, se_b = 0.05, *Wald* (1 df) = 0.04, p > .05, two-tailed. Adding sex as a predictor to the model regressing infidelity choice on DII-O resulted in a significant increase in explained variance, $\Delta\chi^2$ (1, N = 310) = 20.83, p < .001. Adding DII-O as a predictor to the model regressing infidelity choice on sex did not result in a significant increase in explained variance, $\Delta\chi^2$ (1, N = 310) = 0.04, p > .05.

Consistent with results reported for the American sample in Study 2, and failing to replicate DeSteno and Salovey (1996), these results indicated that the predictive value of beliefs about the differential conditional probabilities of one type of involvement given the other in explaining variance in infidelity choice was entirely contingent on the sex of the believer. Additionally, and replicating results reported for the American sample in Study 2, sex was a significant predictor of choice of more distressing infidelity, whether entered alone, or hierarchically or simultaneously with DII-O. An identical pattern of results emerged for parallel models in which infidelity choice was regressed on (a) sex and Differential Involvement Implication–Same sex (DII-Same) and (b) sex and Differential Involvement Implication–Self (DII-Self; analyses available on request).

Within-sex logistic regressions.   Following DeSteno and Salovey (1996), we conducted a series of within-sex logistic regressions of infidelity choice on DII-O. Replicating the results found for the American sample in Study 2, neither men's nor women's beliefs about the conditional probabilities of one type of involvement given the other significantly predicted type of infidelity selected as more distressing (for men: χ^2 [1, N = 211] = 0.18, p > .05; for women: χ^2 [1, N = 99] = 0.27, p > .05). Consistent with results reported for the American sample in Study 2, this same pattern of results emerged when we regressed infidelity choice on DII-Same

and DII-Self (analyses available on request).

In summary, the cross-cultural extension of the tests to a Japanese sample largely confirmed the evolutionary psychological hypothesis about jealousy and provided no support for the belief hypothesis. Five of the six infidelity dilemmas for the Japanese sample showed the predicted sex difference. One failed to show the predicted sex difference. Furthermore, the results of the logistic regressions revealed that sex, but not beliefs, remained strong predictors, whether tested alone, simultaneously, or hierarchically. The within-sex regressions replicated the results of Study 2—beliefs failed to account for any within-sex differences in which form of infidelity was more distressing.

The results for the evolutionary predictions about beliefs were more mixed with the Japanese study. Both sexes in Japan believe that men are more likely than women to have sex without emotional involvement—a result that replicates Study 2 and supports the evolutionary psychological hypothesis. This sex difference, however, failed to emerge with self-reports. Japanese men and women in this sample did not differ in their beliefs about their own conditional probabilities of sexual and emotional involvement. This finding fails to replicate the parallel probe for the American sample and fails to support the evolutionary hypothesis about sex differences in beliefs being anchored in accurately appraised sex differences in conditional probabilities of sexual and emotional involvement.

General Discussion

Four empirical studies were conducted in three different cultures—U.S., Korea, and Japan—to test predictions from an evolutionary psychology model of jealousy against predictions from an alternative hypothesis that posits the differing beliefs of the sexes as the critical explanatory variable. Study 1 involved 1,122 undergraduates at a liberal arts college in the southeastern United States. The original

infidelity scenarios devised by Buss et al. (1992) were altered to render the two types of infidelity mutually exclusive. Participants reported their relative distress in response to a partner's sexual infidelity with no emotional involvement, and emotional involvement with no sexual infidelity. A robust sex difference emerged, as predicted by the evolutionary model. If the belief hypothesis were correct, the sex difference should have disappeared. It did not.

Using 234 undergraduates at a large university in the midwestern United States, Study 2 provided four additional tests of the predictions from the two models using three strategies. One strategy employed three different versions of rendering the two types of infidelity mutually exclusive. A second strategy involved positing that both types of infidelity had occurred, and requested that participants indicate which aspect they found more upsetting. A third strategy used logistic multiple regressions to test the independent and incremental predictive value of sex and beliefs in accounting for which form of infidelity would be more distressing. The results were conclusive: Large sex differences were discovered, precisely as predicted by the evolutionary model. No matter how the questions were worded, no matter which methodological strategy was employed, and no matter how stringently the conditional probabilities were controlled, the sex differences remained robust.

Logistic multiple regressions also supported the evolutionary hypothesis and failed to support the belief hypothesis. Sex accounted for more variance than did beliefs about conditional probabilities when the two were entered as predictors simultaneously. Beliefs did not account for additional variance beyond sex when they were entered hierarchically. And within sex, individual differences in beliefs failed to account for significant variance in which type of infidelity was more upsetting for either sex. In contrast, the evolutionary predictions were supported in these logistic regressions. Sex accounted for the bulk of the variance when it was entered simultane-

ously with beliefs. And sex accounted for substantial incremental variance, beyond beliefs, when the two were entered hierarchically.

The third study replicated the six infidelity dilemmas in a sample of native Koreans. First, the original sex differences reported by Buss et al. (1992) were replicated, showing that women indicated more distress than did men to emotional infidelity, whereas men more than women chose sexual infidelity as more distressing. Furthermore, using two strategies to control for conditional probabilities, the sex differences remained robust. This study provided the first tests of the competing hypotheses in a non-Western culture. The evolutionary hypothesis survived this empirical hurdle. The belief hypothesis did not.

The fourth study tested the predictions about jealousy and about the nature of beliefs in a Japanese sample. The results were more equivocal than in the first three studies, but overall provided support for the evolutionary hypothesis. Five of the six infidelity dilemmas showed the sex difference, as predicted by the evolutionary hypothesis; one failed to find the predicted sex difference. Of the two sets of logistic regressions, sex, but not beliefs, accounted for incremental variance in which form of infidelity was more distressing. Thus, of the eight empirical tests from Study 4, seven supported the evolutionary hypothesis about sex differences in the design of jealousy and one failed to support the hypothesis.

Japanese men and women appear to share the belief that men would find it easier than women to have sex without emotional involvement. This finding, however, did not emerge when subjects reported their own personal conditional probabilities. In comparing the parallel results for American and Japanese samples, it is clear that American men, American women, Japanese men, and Japanese women all share the belief that men more than women can have sex without emotional involvement—supporting the evolutionary hypothesis about the nature and origins of beliefs. Japanese participants, un-

like their American counterparts, however, do not display this sex difference when evaluating their personal conditional probabilities.

Because there is independent evidence that Japanese men more than Japanese women are in fact more likely to seek casual sex without emotional involvement (Buss, 1994), findings that are additionally confirmed in Study 4 by the perceptions of the Japanese participants, the main mystery is why these sex differences fail to emerge in the Japanese self-perceptions. Whether the explanation resides in some particularly strong press for socially desirable responding, the nature of this particular sample, or some other factor must await further empirical testing.

On the nature and origins of beliefs.
Going into these studies, the belief hypothesis carried a number of conceptual problems, including a lack of specification of the nature and origins of beliefs upon which the hypothesis rests, a failure to account for why the sexes would differ in beliefs in some samples and not in others, and a failure to specify whether the sex differences resided in the minds of men and women regardless of the target of belief, or were driven by common beliefs men and women share in their perceptions of men and women. To these conceptual problems, the current studies add formidable empirical problems. The belief hypothesis cannot account for the sex differences that transcend controls on the conditional probabilities. It cannot account for which aspect of infidelity men and women find more distressing when both aspects have occurred. It cannot account for why men and women actually differ in the conditional probabilities of sexual and emotional involvement. It cannot account for why sex, but not beliefs, predicts reactions to the infidelity dilemmas whether entered alone, simultaneously, or hierarchically in logistical multiple regressions. And it cannot account for the cross-cultural robustness of the sex differences in Western and non-Western cultures, even when several different strate-

gies are used to control for conditional probabilities. In summary, the belief hypothesis is not well supported in the four empirical studies reported here as an explanation for the well-documented sex differences in the nature of jealousy.

The evolutionary psychology of jealousy.
The evolutionary hypothesis about the psychology of jealousy has withstood several strong attempts at falsification and parsimoniously accounts for a constellation of empirical findings. It can account for the original findings of sex differences in infidelity documented by Buss et al. (1992). It can account for sex differences in jealousy, even when conditional probabilities are controlled. It can account for sex differences in which aspect of infidelity is more upsetting when both have occured. It can account for sex differences in distress about a partner's sexual and emotional feelings for a former lover. It can account for substantial variance in which type of infidelity is more upsetting, even after beliefs have been given their best predictive shot. And it can account for the cross-cultural robustness of these sex differences, now documented in Western cultures such as the Netherlands and Germany and in the non-Western cultures of Korea and Japan.

Furthermore, a separate evolutionary hypothesis goes a long way toward explaining the origins and nature of the beliefs held by men and women about the conditional probabilities of sexual and emotional involvement. The evidence suggests, with the qualifications noted above, that beliefs represent approximate appraisals of actual sex differences in sexual strategies. Men find it easier than do women to have sex without emotional involvement—a tendency that facilitates a short-term sexual strategy known to be more characteristic of men than women worldwide (Buss & Schmitt, 1993; Symons, 1979).

Conclusions

We have attempted in these studies to elucidate just a few psychological features of

jealousy in men and women. Clearly, many more design features of the psychology of jealousy remain to be uncovered, including the role of the specific characteristics of rivals in evoking jealousy (Buss, Shackelford, & Choe, 1998), the intentional elicitation of jealousy as a mate-assessment or mate-retention strategy (Buss, 1994; Buss & Shackelford, 1997), and causal paths leading to destructive manifestations of jealousy such as violence toward rivals and mates (Buss & Shackelford, 1997). The current findings, however, add to a growing body of evidence suggesting that emotions, as evolved psychological mechanisms, are likely to be at least somewhat domain-specific in nature, corresponding in form and content to the specific adaptive problems confronted by each sex over deep evolutionary time (Tooby & Cosmides, 1990).

Hypotheses must be evaluated by the weight of the empirical evidence. Although pitting competing hypotheses against each other is often held up as an ideal in science, it is rare in psychology that this procedure is followed. Both the evolutionary and belief hypotheses about jealousy are sufficiently precise to have generated specific empirical predictions about the same jealousy phenomena, however, and so lent themselves ideally to this mode of scientific inquiry.

Based on the cumulative weight of the evidence, now spanning half a dozen Western and non-Western cultures, several distinct methodological strategies, and several thousand participants, combined with independent evidence for a strong link between male sexual jealousy and spousal battering and homicide (Daly & Wilson, 1988), the cross-cultural finding of the link between male sexual jealousy and conjugal dissolution (Betzig, 1989), and the sex differences in physiological reactions to the different infidelity scenarios (Buss et al., 1992), the evolutionary account of jealousy appears to be in good scientific standing.

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