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Sex Differences in Jealousy: Evolutionary Mechanism or Artifact of Measurement?

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Two studies are presented that challenge the evidentiary basis for the existence of evolved sex differences in jealousy. In opposition to the evolutionary view, Study 1 demonstrated that a sex difference in jealousy resulting from sexual versus emotional infidelity is observed only when judgments are recorded using a forced-choice response format. On all other measures, no sex differences were found; both men and women reported greater jealousy in response to sexual infidelity. A second study revealed that the sex difference on the forced-choice measure disappeared under conditions of cognitive constraint. These findings suggest that the sex difference used to support the evolutionary view of jealousy (e.g., D. M. Buss, R. Larsen, D. Westen, & J. Semmelroth, 1992; D. M. Buss et al., 1999) likely represents a measurement artifact resulting from a format-induced effortful decision strategy and not an automatic, sex-specific response shaped by evolution.

"Men are from Mars, women are from Venus"—so goes one of the more popular views of the behavior of the sexes with respect to the formation, maintenance, and termination of romantic relationships (Gray, 1992; Walters, 1997). A quick perusal of the selections provided by afternoon television talk shows and the annals of magazines promising to better one's love life reinforces the prevailing view that some differences between male and female approaches to romantic involvement are fundamental and, in many cases, biologically rooted. It is a view that has been bolstered by scientific research as well (Berscheid & Reis, 1998; Buss & Kenrick, 1998). Although it is not the purpose of this article to affirm or deny this general assumption, we do intend to focus on the validity of one specific sex difference that has enjoyed wide popularity in both the scientific and popular presses as an example of an evolutionary adaptation: differential jealousy in response to distinct types of infidelity threats. In so doing, we call into question a phenomenon that has provoked one of the more vigorous debates surrounding the role, if any, played by evolved psychological mechanisms in human mating strategies.

The Evolutionary Theory of Romantic Jealousy

The theory that male and female jealousy is differentially aroused by specific kinds of infidelity threats has long been advocated by sociobiologists and evolutionary psychologists (Buss, Larsen, Westen, & Semmelroth, 1992; Daly, Wilson, & Weghorst, 1982; Symons, 1979). Like all evolutionary theories of human behavior, this one bases its tenets on the well-accepted view that random changes in certain aspects of morphology and cognition tend to be retained in the genetic progression of a species as a function of their ability to increase fitness (Buss & Kenrick, 1998; Daly & Wilson, 1983; Dawkins, 1976).[1] With respect to jealousy, the evolutionary theory of its origin and functions rests on a consideration of two specific factors relevant to human reproduction (Buss, 1996; Buss et al., 1992; Daly et al., 1982).[2]

First, given that humans are a species that uses internal fertilization, there is generally some doubt concerning the genetic link between a father and child due to the possibility of extradyadic matings by the mother. Such an event would lead to the cuckolding of the male, a severe blow to his fitness, given the divergence of his resources to raising the offspring of another at the expense of his own. For women, however, maternity need not be questioned, but a different factor considered. According to many theorists, humans are a biparental species (i.e., both parents contribute to the raising of offspring), and, therefore, women must ensure that their mates continue to invest in their offspring rather than form a new relationship with another woman (Buss et al., 1992; Daly et al.,

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[1] *Fitness* refers to the probability of the successful transmission of genetic material to subsequent generations and is consequently defined as the ability to raise offspring to the age of sexual maturity (Daly & Wilson, 1983; Dawkins, 1976).

[2] We use the term *evolutionary theory of jealousy* here to refer to the sex difference traditionally embraced by many sociobiologists and evolutionary psychologists, and as specified in particular by Buss et al. (1992). Different hypotheses based on an evolutionary framework could of course be generated with respect to jealousy. Consequently, the findings and claims presented in this article refer specifically to the aforementioned theory and should not be taken to imply acceptance or refutation of any other theories of jealousy using an evolutionary perspective different from the one described.

1982; Symons, 1979). Men are capable of inseminating multiple partners in short time periods; women, however, are capable of having many fewer offspring and, consequently, are expected to invest much more in the survival of each one.

Accepting this ancestral state of affairs, many evolutionary psychologists argue that continued confrontation of these sex-differentiated challenges to fitness led to the development of sex-specific, automatic decision algorithms, or evolved modules, that heighten sensitivity in men and women to instances of sexual and emotional infidelity, respectively. Such mechanisms should have increased the facility with which humans detected and thwarted their respective challenges, thereby increasing the probability of successful genetic transmission and consequent proliferation of these mechanisms throughout the species (Buss, 1996; Buss & Kenrick, 1998; Buss et al., 1992; Daly et al., 1982).

Empirical tests of this prediction have rested primarily on the use of a simple preference measure using a forced-choice response format wherein participants are asked to identify which of two types of infidelity scenarios would cause them more distress: one involving sexual contact or one involving emotional bonding. During the past decade, the pattern specified by the evolutionary theory of jealousy has proven to be quite robust. Studies enrolling participants of various ages and cultures have documented that women tend to identify instances of emotional infidelity by their partners as more distressing than instances of sexual infidelity; men have been found to do the reverse (Buss et al., 1992, 1999; Buunk, Angleitner, Oubaid, & Buss, 1996; DeSteno & Salovey, 1996a).

The one piece of evidence emanating from a different methodology measured electrodermal skin activity (EDA), pulse rate (PR), and electromyographic activity (EMG) of the corrugator supercilii in response to the two types of infidelity (Buss et al., 1992). Findings from this experiment provided mixed support for the evolutionary view, however. Although EDA data, and PR to a lesser extent, suggested the expected sex differences in arousal to sexual and emotional infidelity, no significant findings emerged with the EMG data. This absence is of great importance, for without EMG data, valence of the arousal state could not be determined. Indeed, men show increased physiological arousal to sexual imagery of any type, irrespective of its connotations of infidelity (Harris, 2000). Consequently, there is no way to determine whether the increased arousal derived from negatively valenced appraisals. These results demonstrate the difficulties encountered in attempting to use physiological indices to assess specific emotional states (cf. Cacioppo, Berntson, & Crites, 1996). It is exceedingly difficult to avoid the conflation of many sources of arousal that images of these infidelity events may generate and, therefore, to determine whether the same physiological signatures result from similar or distinct cognitive appraisals.

Challenges and Rebuttals

One major difficulty in attempting to attribute behavioral phenomena to genetic predispositions involves lack of random assignment to experimental "conditions." Participant gender cannot be assigned by the flip of a coin, and, therefore, participants arrive at the lab not only with specific pairs of chromosomes, but also with decades of socialization and learning, both of which typically correlate with gender and, in the present case, possibly exert influence on aversion to sexual and emotional infidelity. With this in mind, several researchers have suggested that the selection of an infidelity event as most distressing results from a rational analysis based on socially learned expectations about the behaviors of the opposite sex. For many individuals, the choice between sexual and emotional infidelity reflects a false dichotomy. That is, many people may believe that the existence of one event implies the existence of the other (DeSteno & Salovey, 1996a; Harris & Christenfeld, 1996). Thus, although both infidelity events would result in jealousy, if one is forced to choose between the two, one will most likely choose the event that also implies the occurrence of the other—a "double-shot" of infidelity. Indeed, we have documented the existence of such beliefs concerning the differential infidelity implications (DII) of each event and shown these beliefs to predict choice of the most distressing event both across *and* within genders (DeSteno & Salovey, 1996a). Of most importance, these beliefs were shown to account completely for the relation of participant gender to choice of the most distressing event; gender did not predict any variance in choice beyond that explained by DII.

Although these findings argue against the evolutionary theory of jealousy, they are not unassailable. Indeed, evolutionary psychologists have suggested that different beliefs concerning infidelity implications may themselves stem from evolved psychological mechanisms that influence perceptions of the mating habits of members of the opposite sex (Buss, Larsen, & Westen, 1996). That is, information regarding mating habits may be represented in memory and exert an automatic influence on assessments of the relevant infidelity events. In another challenge to these findings, Buss and his colleagues demonstrated that a sex difference occurs on the forced-choice jealousy measure even when the target infidelity scenarios are modified so as to describe sexual contact without the opportunity for emotional involvement and vice versa (Buss et al., 1999). This finding suggests that although the implicational beliefs explanation may underlie the choice of the most distressing infidelity event given certain jealousy-provoking scenarios, other mechanisms produce choices consistent with the evolutionary view given different contingencies.

A New Methodological Approach

In light of this exchange of findings and counterfindings, the debate concerning the existence of evolved jealousy modules remains unsettled. Without an ability to assess definitively the challenges and constraints that characterized the hominid ancestral environment, the current debate sometimes appears to focus on post hoc theorizing. As alternative cognitively, socially, or culturally derived mediating mechanisms are suggested to account for the sex difference in jealousy, they are reinterpreted, correctly or erroneously, as separate mechanisms shaped by evolutionary pressures (Buss et al., 1996, 1999; DeSteno & Salovey, 1996b). The argument becomes, in essence, circular and consequently does little to advance the understanding of the mechanisms responsible for jealousy.

Given this stalemate, it became clear to us that acceptance or rejection of the evolutionary theory of jealousy would necessarily depend on a stringent examination of the data purported to confirm the existence of the theorized evolved psychological mechanisms. That is, to the degree that decisions regarding distress resulting

from infidelity events conform to characteristics associated with the functioning of cognitive modules, greater acceptance of the evolutionary view would prevail. However, to the degree that these decisions fluctuate or respond in ways inconsistent with what would be expected to result from such automatic processes, important questions would be raised.

In examining the adequacy of claims that sex differences in response to sexual and emotional infidelity derive from evolved mechanisms, it is important to note that almost all findings supporting this position derive from the use of a single methodology: a forced-choice preference question. Although not systematically investigated, failures to find evidence of a sex difference using other measurement scales have been noted (DeSteno & Salovey, 1996a). The possible limitation of any finding to a specific assessment method necessarily raises the spectre of its candidacy as an artifact of measurement. This possibility takes on even greater weight when one considers that the use of a forced-choice response format, in comparison with other formats (e.g., Likert scales), is known to induce different and more effortful decision strategies in the production of preference judgments (Lichtenstein & Slovic, 1973; Payne, 1982). Moreover, given the use of the single term *distress* or *upset* to assess jealousy on the forced-choice measure, questions concerning the construct validity of this measure may also be raised; the phenomenological experience of jealousy has been shown to be more complex than simple distress (Parrott & Smith, 1993). Given these factors, we believed that the previous findings used to support the evolutionary view might not represent differential jealousy resulting from sex-specific evolved modules, but a methodological artifact resulting from a specific and effortful decision strategy invoked by the format of the question.

In the present article, therefore, we attempt to resolve the debate by pitting these two views against one another. In so doing, we made two assumptions. First, sex differences arising from evolved mechanisms should be reliably observed on all measures of jealousy involving sexual and emotional infidelity that are operationalized at the same level of description. In the present case, this simply means that the predicted sex difference should be evident on all self-report measures of jealousy, of which the forced-choice task is one. Second, we assume that the sex difference should occur under conditions established to enhance the influence of automatic processes on judgment. By their very definition, evolved modules constitute automatic mental processes that function efficiently and reflexively in response to specific triggering stimuli (Buss & Kenrick, 1998; Cosmides & Tooby, 1994; cf. Bargh, 1997; Fodor, 1983, 2000; Pinker, 1997). That is, these modules should function autonomously (i.e., without conscious direction) to link the perception of specific fitness threats to specific responses designed to thwart them.

To the extent that evidence of the predicted sex difference is found to generalize across measurement instruments and levels of cognitive constraint, the evolutionary view will be bolstered. If, as we suspect, however, no true, sex-specific differences in jealousy to the two types of infidelity exist on the automatic level, a clear dissociation will be found (a) between judgments based on different response formats and (b) between judgments produced under different levels of cognitive elaboration. In the following studies, we explore both issues. We begin with an examination of the limitation of the predicted sex difference to a single response format and follow with an examination of the nature of the cognitive processes that may underlie any dissociation between responses on the different measures. It is important to note that this analytic strategy avoids becoming mired in debate concerning the possible evolutionary shaping of suggested alternative mechanisms for the sex difference. Rather, it provides a clear and concise method for evaluating the evidence used to support the evolutionary theory on its own merit, and, thereby, has the potential to provide some closure to the continuing debate.

Study 1

The primary purpose of this study was to provide a systematic examination of the possible method-specific nature of the evolution-predicted sex difference (ESD).[3] To accomplish this goal, we modified the usual procedure for research in this area to include jealousy measures using multiple response formats in addition to the traditional forced-choice measure. This technique possessed the added benefit of allowing us not only to measure the simple level of distress that the two types of infidelity would create, but also to assess the impact of these events on the more complex emotional experience of jealousy (cf. Parrott & Smith, 1993; Sharpsteen, 1991).[4] As noted earlier, questions concerning the construct validity of the forced-choice measure of jealousy used in previous research (e.g., Buss et al., 1992, 1996) are warranted given its use of the single term *distress* or *upset* to assess jealousy.

To provide a complete analysis of these issues, we used both univariate and covariance structure modeling (CSM) techniques to examine participants' simple distress and jealousy intensities in response to the infidelity events. CSM allowed investigation of jealousy responses free from specific method variance, an important advantage given the possible influence of methodological factors underlying the ESD. If the ESD does represent a methodological artifact, as we suspect, then a clear dissociation should be evident between the findings from the forced-choice and other jealousy measures. However, absence of such a dissociation in the presence of clear and consistent sex differences would argue in favor of the evolutionary view.

Method

Participants

One hundred eleven undergraduate students at Northeastern University (50 men, 61 women; M_{age} = 19 years, SD_{age} = 1.50 years) participated in this study in partial fulfillment of course requirements.

Procedure

Participants were seated in individual cubicles containing personal computers. The experimenter informed them that they would be taking part in

[3] We use the acronym ESD to refer to the sex difference predicted by the evolutionary theory of jealousy as specified by Buss et al. (1992).

[4] The single item scale used in evolutionary psychology research typically asks participants to report which of the two infidelity events would cause them more "distress" or "upset" (Buss et al., 1992, 1999; Buunk et al., 1996). Although the supposition has been that this measure reflects the more complex experience of jealousy, more complete jealousy measures have not been used to assess responses to sexual and emotional infidelity.

an experiment designed to assess their responses to different types of infidelity events that could occur in romantic relationships. Participants were then told to face the computer and follow the instructions. From this point forward, all instructions, measures, and responses were presented/collected on computer using MediaLab (Jarvis, 2000). Participants were first instructed to think of a committed romantic relationship in which they had previously been involved, are currently involved, or would like to be involved. They were then told that the experiment would focus on their reactions to two possible types of infidelity: (a) one's partner having passionate sex with another person or (b) one's partner forming a deep emotional attachment to another person (cf. Buss et al., 1992; Buunk et al., 1996). Participants then completed the seven jealousy measures described below. Before completing each measure, they were asked to refocus their thoughts on the relationship.

For purposes of administration, the jealousy measures were divided into three blocks: the forced-choice jealousy measure, the continuous-scale jealousy measures in response to sexual infidelity, and the continuous-scale jealousy measures in response to emotional infidelity. Order of presentation of the forced-choice versus continuous measure blocks was counterbalanced. Half of the participants completed the forced-choice measure before the two sets of continuous measures; the remaining half followed the reverse ordering. Within the continuous measures blocks, order of presentation of the sexual and emotional infidelity subblocks was randomized across participants. However, within each subblock, participants always completed the Likert-scale measure first, followed by the agree–disagree scale, followed by the checklist. Upon completion of these measures, participants' demographic information was collected and a debriefing was provided.

Jealousy Measures

Forced-choice measure. This measure was similar to those used in previous research investigating sex differences in jealousy resulting from sexual and emotional infidelity (Buss et al., 1992; Buunk et al., 1996; DeSteno & Salovey, 1996a). Individuals were asked to indicate which of the following two events would cause them more distress: (a) finding out that one's partner had passionate sexual intercourse with another person or (b) finding out that one's partner had formed a deep emotional attachment to another person.

Likert-scale measures. Participants completed two versions of this measure, one for each of the infidelity scenarios described in the forced-choice measure. With the exception of the event descriptions, the two versions were identical. Participants were instructed to respond by indicating the degree to which they would experience various feeling states using 7-point scales. The target items for the jealousy measure consisted of: *angry, jealous, calm* (reverse scored), *threatened, relieved* (reverse scored), and *hurt*, and were presented in a random order along with distractor items (e.g., *interested, alert*). Each of the target terms has been shown to be highly related to the phenomenological experience of jealousy and, taken together, to distinguish it from other related emotional states (Parrott & Smith, 1993). The endpoints of each scale were anchored such that a score of 1 indicated an absence of the feeling state (e.g., *not angry*) and a score of 7 indicated a high intensity of the feeling state (e.g., *incredibly angry*). Participants' composite jealousy scores were calculated as the mean value for the target items. The internal consistency of the measure was acceptable (Cronbach $\alpha_{\text{sexual}} = .72$, $\alpha_{\text{emotional}} = .80$). Moreover, principal-components analyses of each version of the scale revealed a unitary factor structure. For both scales, only the first component possessed an eigenvalue exceeding unity; this factor accounted for 44% and 51% of the variance in the sexual and emotional jealousy scales, respectively. Given the extraction of a single component representing jealousy, it appeared clear that participants experienced little variation in the qualitative nature of their responses to the two types of infidelity events.

Agree–disagree measure. Participants also completed two versions of this scale that asked for their responses to the same instances of sexual and emotional infidelity, respectively. On this measure, participants were presented with specific statements to which they responded using a 7-point scale ranging from 1 (*strongly disagree*) to 7 (*strongly agree*), with the middle point indicating neither agreement nor disagreement (see the Appendix for the complete list of statements). The composite jealousy measure was calculated as the mean for the five items. Once again, the internal consistency of the measure was fairly acceptable (Cronbach $\alpha_{\text{sexual}} = .62$, $\alpha_{\text{emotional}} = .70$), and a principal-components analysis suggested that a single factor solution provided a parsimonious explanation for the covariation among the items. Only the first component of the emotional infidelity scale had an eigenvalue exceeding unity; this component explained 46% of the variance. For the sexual infidelity scale, two components exceeded unity (eigenvalues of 2.10 and 1.31, respectively). However, examination of the scree plot clearly suggested the diminishing returns of any solution with more than one component. Consequently, we retained a single component solution that explained 42% of the variance. As was the case with the Likert-scale measures, the qualitative experiences of jealousy appeared to be similar in response to both types of events.

Checklist measure. As with the previous two measures, participants were asked to complete a version of this scale in response to each of the two infidelity events. Specifically, participants were asked to place a check (using the computer mouse) next to each of the adjectives that described how they would feel. The target set of adjectives consisted of *angry, jealous, worried, suspicious, threatened, content*, and *distressed*. The composite jealousy score was calculated as the sum (with a check = 1 and no check = 0) of these items, with *content* reverse scored. The internal consistency of the measure was below conventional standards ($\alpha_{\text{sexual}} = .58$, $\alpha_{\text{emotional}} = .56$), but expected given the attenuation caused by the dichotomous format of the scale items. The use of dichotomous responses also precluded the submission of these data to a principal-components analysis. However, given the ability of CSM techniques to correct for measurement error, checklist scales (or others possessing moderate levels of reliability) remain useful in multi-indicator analyses because of the increased ability to estimate and remove correlated measurement error made possible by the use of several measurement techniques (cf. Green, Goldman, & Salovey, 1993).

Results

Forced-Choice Measure

As in previous experiments using this measure (e.g., Buss et al., 1992; Buunk et al., 1996), men and women were found to differ in their choice of the most distressing type of infidelity event, $\chi^2(1, N = 111) = 4.30$, $p = .04$, Cramer's $V = .20$. A majority of women believed emotional infidelity ($f = 40$ [66%]) to be more distressing than sexual infidelity ($f = 21$ [34%]); men, however, reported the reverse ($f_{\text{sexual}} = 27$ [54%]; $f_{\text{emotional}} = 23$ [46%]).

Continuous Measures

Given the availability of multiple measures of jealousy using different response formats, we decided to take a multipronged approach to examining the issue of sex differences in response to the two types of infidelity. Because previous research supporting the evolutionary view has operationalized jealousy using a measure of simple distress or upset (Buss et al., 1992; Buunk et al., 1996), we first present an analysis of single-item response scales assessing the level of upset, or synonymous states, caused by the two infidelity events. In an effort to generalize these findings to a more complete measure of jealousy, we next present individual univariate analyses for each of the continuous measure jealousy scales. Finally, to provide the most precise assessment of jealousy

that is also removed from the influence of specific format-induced errors of measurement, we present analyses of the continuous measure scales using a CSM approach. In selecting this strategy, we intentionally sought the most sensitive analysis applicable to the data to provide a stringent test of the opposing hypotheses.

Single-item measures of upset. The dependent variable for the first analysis was the first item from the agree–disagree scale; it simply asked for the level of agreement with the statement "I would be upset" in response to the two types of infidelity, respectively (see the Appendix). A 2 (gender) × 2 (infidelity event) mixed analysis of variance (ANOVA), with event being treated as the repeated factor, revealed only the existence of a main effect for type of infidelity, $F(1, 109) = 9.28$, $p = .003$, $d = 0.28$ ($M_{sexual} = 6.42$, $M_{emotional} = 6.01$). In contrast to the evolutionary view and the results of the forced-choice measure, gender did not moderate this effect ($F_{interaction} < 1$). As depicted in Figure 1, men and women were both more upset in response to sexual than to emotional infidelity.

The second single-item analysis uses ratings for *relieved* contained in the sexual and emotional infidelity Likert scales; *relieved* is, of course, a reverse-scored version of *distressed.* As expected, a pattern quite similar to that for *upset* emerged. A 2 (gender) × 2 (infidelity event) mixed ANOVA, with event being treated as the repeated factor, revealed only a main effect for type of infidelity, $F(1, 109) = 3.96$, $p < .05$, $d = 0.38$ ($M_{sexual} = 6.70$, $M_{emotional} = 6.53$). Once again, the interaction predicted by the evolutionary view did not emerge ($F_{interaction} < 1$). Women and men both reported more distress (i.e., less relief) when considering a sexual ($M_{men} = 6.64$, $M_{women} = 6.75$) as opposed to an emotional ($M_{men} = 6.38$, $M_{women} = 6.66$) event of infidelity; scores reflect the reverse scoring of the relief item.

The final item analysis involved *distress* from the two checklist measures. Given the dichotomous nature of these measures, it is not surprising that no difference due to type of infidelity emerged. Chi-square analyses revealed that the majority of both men and women reported that they would experience distress in response to both events; that is, gender did not appear to influence selection of the distress item in either case. Accordingly, submission of these data to a mixed ANOVA similar to those reported above revealed no sex difference in endorsement of the distress item as a function of infidelity type ($F_{interaction} < 1$). However, women were more likely than men to indicate feeling distress in response to both infidelity events, $F(1, 109) = 3.98$, $p = .05$, $d = 0.38$ ($M_{women} = 0.79$, $M_{men} = 0.64$).

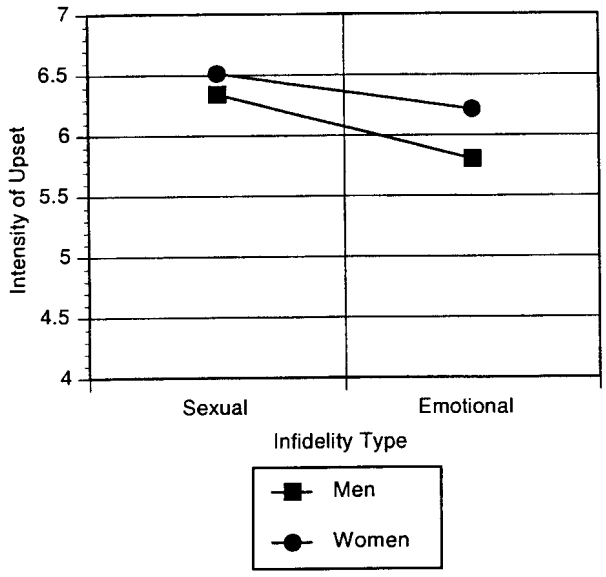

Figure 1. Mean ratings of intensity of *upset* as a function of gender and infidelity type.

Univariate analyses of individual jealousy scales. In an effort to extend these findings from a simple measure of distress to a truer measure of jealousy, we next examined whether this disparity between the forced-choice and continuous measure scales would be evident on each of the composite jealousy scales. A series of 2 (gender) × 2 (infidelity event) mixed ANOVAs, with event being treated as the repeated factor, revealed a similar pattern of effects across the three different measures. More specifically, respective analyses of the Likert and agree–disagree scales revealed a simple main effect for type of infidelity in the absence of any interaction involving gender, $F_{Likert}(1, 109) = 15.76$, $p < .001$, $d = 0.36$; $F_{agree-disagree}(1, 109) = 8.75$, $p = .004$, $d = 0.28$. Echoing the results from the single-item measures, both men and women reported more jealousy in response to sexual than to emotional infidelity, as seen in Table 1. It should be noted, however, that a marginal main effect for gender appeared in both cases, $F_{Likert}(1, 109) = 3.59$, $p = .06$; $F_{agree-disagree}(1, 109) = 3.86$, $p = .06$; women tended to report higher intensities of emotion across both types of infidelity, a finding consistent with previous research documenting that women often tend to report heightened levels of emotion intensity in general (Feldman Barrett, Robin, Pietromonaco, & Eyssell, 1998).

In similar fashion to the previous two analyses, examination of the checklist measure revealed an absence of any interaction involving type of infidelity and gender on jealousy and a main effect of gender such that women reported more intense jealousy than did men, $F(1, 109) = 6.66$, $p = .01$, $d = 0.44$. However, although a slight trend can be seen in the data suggesting a stronger aversion to sexual than to emotional infidelity on the part of both genders, this main effect did not reach statistical significance on the checklist measure, a fact that most likely stems from the reduced ability to report gradations of intensity in the specific emotion descriptors resulting from the dichotomous response format.

CSM analysis of jealousy. In an effort to provide the most sensitive test of the competing predictions free from the influence of specific response formats, we used CSM to investigate the existence of sex differences in jealousy. As stated earlier, the primary prediction of the evolutionary theory of jealousy involves differential sensitivity to the two types of infidelity. However, given that women, in comparison with men, tend to report higher intensities of most emotions, the possibility arises that women, in comparison with men, might have reported higher mean values of jealousy in response to both types of infidelity events. That is, even though women might have been more jealous of emotional infidelity than of sexual infidelity, gender (scored male = 0, female = 1) and jealousy to both events might positively covary simply because the mean emotional intensity reported by women to both events is greater than that reported by men. Such an occurrence has the potential to obfuscate support for the central prediction of the

Table 1
Mean Ratings and Standard Deviations of Jealousy in Response to Sexual and Emotional Infidelity

	Type of infidelity			
	Sexual		Emotional	
Measure and gender	*M*	*SD*	*M*	*SD*
Likert				
Male	5.82	0.86	5.38	1.04
Female	6.02	0.87	5.81	1.06
Agree–disagree				
Male	5.72	1.01	5.50	1.23
Female	6.07	0.85	5.84	0.94
Checklist				
Male	5.02	1.46	4.94	1.63
Female	5.66	1.24	5.56	1.34

Note. Higher numbers indicate greater jealousy.

evolutionary view by concealing any divergent preferences within members of each gender.

One way to circumvent this problem is through the use of analytic techniques that control for individual differences in mean response intensity. In the present case, such an analysis would control for individual differences in mean levels of jealousy and thereby allow a clearer examination of the influence of gender on responses to the two events. To accomplish this goal, we constructed a model with a single latent variable representing the difference in jealousy intensity between the two events. This latent variable had three indicators corresponding to the difference scores between the respective Likert, agree–disagree, and checklist jealousy scales; higher values indicated more jealousy in response to emotional infidelity. For purposes of identification, the path linking the latent variable to the Likert-scale difference score was fixed at 1. Finally, gender was specified as an exogenous variable with a causal path to the jealousy latent variable. Support for the evolutionary view, therefore, would be shown by a positive relation linking gender to jealousy; women, in this case, would be identified as having a more positive difference score, which corresponds to greater jealousy in response to emotional than to sexual infidelity. Absence of any influence of gender would support the previous, single-scale findings documenting a disparity between responses on the forced-choice and continuous measure scales.

Parameter estimation for the model was accomplished using AMOS (Arbuckle, 1999, Version 4.0) and resulted in an acceptable fit, $\chi^2(2, N = 111) = 2.22$, $p = .33$ (root-mean-square-error of approximation [RMSEA] = .03). As depicted in Figure 2, all three indicators loaded significantly onto the latent variable, thereby providing good evidence of its construct validity. However, in contrast to the evolutionary view, gender had no relation to jealousy differences in response to sexual and emotional infidelity; men and women responded similarly to both events.

The question, of course, then turned to an examination of the mean difference, if any, in response to the two types of infidelity. Put differently, although it was clear that no sex differences existed with respect to differential jealousy to sexual and emotional infidelity, whether a main effect showing greater jealousy in response to sexual infidelity existed remained an open question. The CSM analysis as specified was incapable of providing information concerning such mean differences. Consequently, the data were reanalyzed using a different CSM specification that could provide the relevant information.

To accomplish this goal, we subjected the data to a latent curve analysis (MacCallum, Kim, Malarkey, & Kiecolt-Glaser, 1997; Meredith & Tisak, 1990). In this technique, the curves of interest are specified using basis functions where the forms of the functions, and therefore the nature of the curves themselves, are commonly set in advance through the use of fixed factor loadings in a CSM analysis. In the present model, we specified linear curves that were defined by two basis functions: an intercept and a slope. The estimated intercepts represent each participant's mean level of jealousy collapsed across the two types of infidelity events; estimated slopes represent each participant's difference in jealousy intensity toward the two events. The resulting analysis is conceptually similar to a mixed-model ANOVA in which male and female participants complete measures of jealousy in response to both types of infidelity. It therefore allows for tests of the main effects of gender and infidelity type on jealousy, as well as for the interaction predicted by the evolutionary view.

Figure 3 presents the exact specification of the model. Here, two latent variables are depicted, with each having a direct influence on the six jealousy indicators. Paths from the intercept variable to the six indicators are fixed at 1, indicating a constant influence on all scales. Paths from the slope variable are fixed at −1 for the sexual infidelity indicators and 1 for the emotional infidelity indicators. This parameterization reflects a linear increase or decrease in jealousy from one type of event to the other. It also represents a centering (or effects coding) of the type of infidelity, thereby marking the intercept variable as indicating the mean jealousy level collapsed across event types.

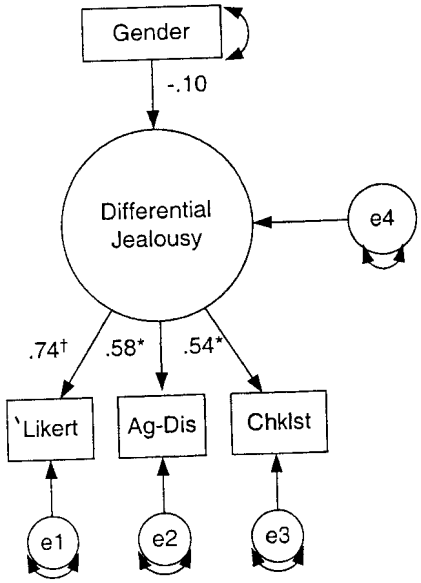

Figure 2. Parameter estimates for the covariance structure model of the relation of gender to differential jealousy in response to sexual and emotional infidelity. An asterisk denotes a coefficient that differs reliably from zero ($\alpha = .05$). A dagger denotes path fixed at 1. e1–e4 reflect correct error terms. Ag-Dis = agree–disagree; Chklst = checklist.

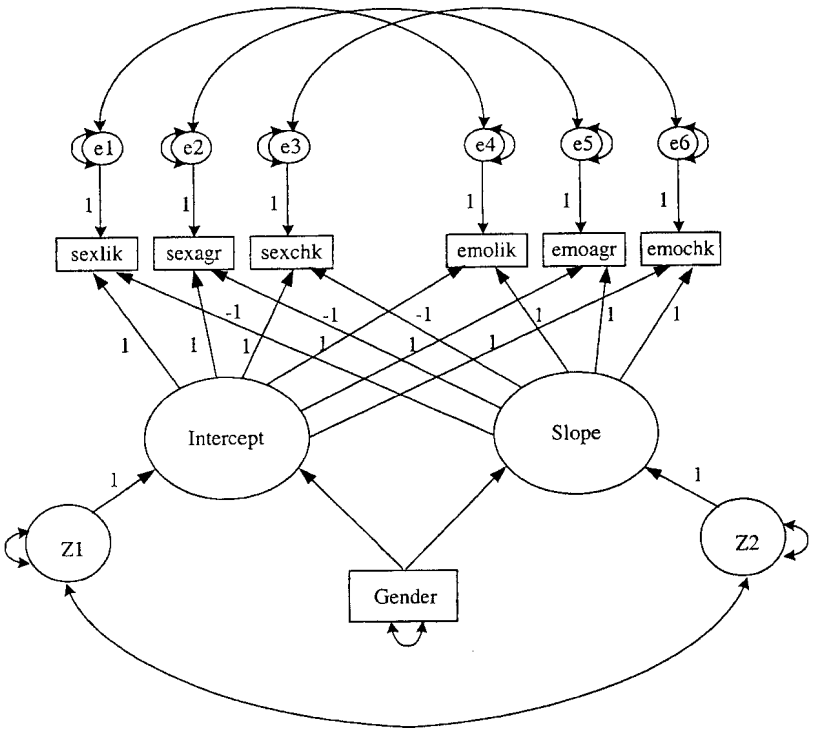

Figure 3. Specification of latent curve model. Sex/emolik, sex/emoagr, and sex/emochk indicate the jealousy scales for the two infidelity types assessed using Likert, agree–disagree, and checklist response formats, respectively. e1–e6 and Z1–Z2 represent the associated disturbance terms.

Complete specification of the model also involved the estimation of structured means. That is, the mean values (i.e., mean factor scores) of the latent variables were not constrained to be zero as in most applications of CSM, but were treated as free parameters.[5] Therefore, factor scores in the present model correspond to each participant's intercept and slope values. Gender was dummy coded (male = 0, female = 1), thereby setting the intercepts for the latent variables to represent jealousy characteristics for males.[6] Given this parameterization, positive slope values indicate greater jealousy in response to emotional infidelity; negative slope values indicate greater jealousy in response to sexual infidelity. The paths linking gender to these two latent variables consequently provide information regarding if and how gender influences both mean levels of jealousy and differential sensitivity to the two types of infidelity. With respect to error terms, the variances of the disturbance terms were designated as free, with the added provision for correlated errors between scales consisting of the same response formats and between the intercept and slope disturbance terms. Parameter estimation for the model was accomplished using AMOS (Arbuckle, 1999, Version 4.0). The resulting fit was not as good as the previous CSM model (RMSEA = .10), but this is to be expected in this latent curve analysis given the variance restrictions resulting from the fixed factor loadings.[7] Moreover, as will be evident, the results were very consistent with the previous CSM model.

A preliminary question of note concerned the influence of gender on mean levels of jealousy. As expected, the intercept for the intercept variable was positive (5.55, $t = 47.28$, $p < .001$), thereby indicating that men reported a nonzero level of jealousy in response to the two events. Also as expected, gender directly influenced the intercept variable (raw coefficient = .35, standardized coefficient = .22, $p < .05$), indicating that women reported significantly greater levels of jealousy across both types of infidelity.

[5] Correct specification also involved constraining the intercept terms for the manifest variables to be zero (MacCallum et al., 1997).

[6] When latent variables are endogenous, the term *intercept* refers to the predicted factor score contingent on the independent variable being set at a value of zero. In the present case, gender is the independent variable, hence the intercepts for the intercept and slope factors represent the respective values for males.

[7] This parameterization of the latent curve model is equivalent to that resulting from a multilevel model in which the six jealousy scales are nested within participants (cf. MacCallum et al., 1997). Therefore, a hierarchical linear model (HLM) wherein type of infidelity is treated as a level one predictor variable, gender of participants is treated as a level two predictor variable, and measurement errors for scales representing the same response format are allowed to correlate would produce the same results. Given that fit indices are not routinely considered in multilevel models, the decreased fit of the model in the present case is not of great concern; it primarily results from the inability to reproduce variance estimates due to the fixed path restrictions. The point estimates provide the primary information in HLM and the current model. Confidence in the current solution is also increased given that the results of this CSM analysis match those of the preceding model.

The second question pitted the two hypotheses of interest against one another by assessing differential responses to the two types of infidelity as a function of gender. The intercept for the slope variable was found to be negative (-0.15, $t = 3.11$, $p < .01$), thereby indicating that men found sexual infidelity to be more jealousy provoking than emotional infidelity. However, in contrast to the evolutionary prediction, no hint of a gender-based moderation of jealousy in response to the two types of infidelity was found; gender did not influence the slope variable (raw coefficient = .04, standardized coefficient = .08, *ns*). Echoing the results of the previous analysis, men and women responded similarly to the two events; as depicted by the latent curves in Figure 4, both men and women were more jealous of sexual than of emotional infidelity. This fact does not imply that individual variation in slopes did not exist; indeed it did ($t = 4.69$, $p < .001$). Variation was simply not associated with gender.

Finally, it should be noted that two of the three response formats revealed a moderate degree of correlated measurement error. Error terms for the sexual infidelity agree–disagree and checklist measures correlated with their respective error terms for the emotional infidelity measures ($r_{agree} = .55$, $p < .01$; $r_{chk} = .58$, $p < .01$). Error terms for the latent variables were also correlated ($r_{int/slope} = .32$, $p < .05$), indicating that after controlling for participant gender, greater mean levels of jealousy were associated with smaller differential responses to the two infidelity events.

Discussion

These findings demonstrate that support for the ESD appears to be limited to the standard forced-choice response format. Although participants evidenced the usual ESD effect on the forced-choice measure, these same individuals failed to show any hint of a sex difference in response to the two types of infidelity on measures using alternative response formats. Whether using measures of simple distress or jealousy, both men and women reported more intense negative states in response to sexual than to emotional infidelity. Most important, absence of the ESD was also found using a latent variable approach designed to remove any method-specific variance associated with each of the particular continuous measures. In short, the Gender × Infidelity Type interaction specifically predicted by the evolutionary view did not emerge, irrespective of how these data were analyzed.

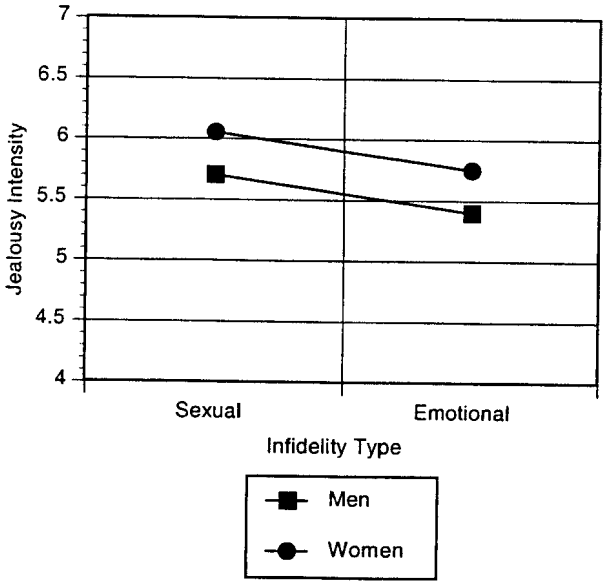

Figure 4. Latent curves depicting jealousy intensity as a function of gender and infidelity type.

This finding of parallel within-gender differences in aversion to the two types of infidelity not only argues against the evolutionary theory of jealousy, but also against previous condemnations of the use of continuous measure jealousy scales (e.g., Buss et al., 1996); it is not the case that reliable differences in jealousy intensity cannot be found because of ceiling effects. It is important to note, however, that women tended to report more intense levels of jealousy in response to both types of infidelity (cf. Feldman Barrett et al., 1998); therefore, use of continuous measures to examine sex differences in jealousy should involve the estimation and removal of this effect from the relevant data so as not to obscure possible sex differences.

One major difference between the measures using continuous scaling of jealousy intensity and the forced-choice measure is that the continuous measures assess jealousy following a simple presentation of the target stimuli (i.e., instances of sexual and emotional infidelity) as opposed to a simultaneous presentation. In this way, we believe, they more closely approximate the situations faced by our forebears. It was very unlikely that ancestral humans regularly confronted instances of both types of infidelity simultaneously and had to decide which was more distressing; it seems more probable that they encountered instances of one or the other (i.e., discovering their partner fraternizing with another or discovering the sexual act itself) and had to react accordingly. Consequently, there is every reason to expect that the predicted evolved mechanisms should engender sex-specific differential jealousy in response to simple presentations of the relevant events. However, this was patently not the case. Therefore, having demonstrated that the ESD is limited to a specific response format, a limitation not in accord with the theorized functioning of evolved jealousy modules, the question turned to an examination of mechanisms that could underlie this disparity.

Study 2

The findings of Study 1 lend support to our contention that the ESD is method specific. As noted earlier, there is no sound theoretical reason to assume that the evolved psychological mechanisms specified by the evolutionary theory of jealousy should limit their influence to a specific response format requiring simultaneous consideration of the relevant infidelity events. Therefore, the dissociation between responses on the two types of formats raises the possibility that one may represent an artifact of measurement. Given that findings on all jealousy measures, save the forced-choice, are parallel, we believe it likely to be the case that judgments recorded on the forced-choice measure may represent the influence of decision processes evoked specifically by the method of assessment. Nonetheless, it is necessary to consider the possibility that the forced-choice measure, as opposed to the others, represents the true response. Although we considered this situation unlikely, we nevertheless decided that the dissociation between the two types of measures needed to be resolved before

we could confidently argue that the ESD represents a measurement artifact.

The first step in this enterprise was to understand what processes might result in different preference judgments on distinct response formats. As research into decision making has revealed, different response formats give rise to different cognitive strategies for arriving at an answer. Indeed, as noted by Payne (1982, p. 388), "variations in response mode are responsible for many of the most striking examples of changes in decision behavior." Notably, the forced-choice response format has been shown to engender a decision strategy in which individuals effortfully and rationally consider the possible trade-offs of two presented options (Lichtenstein & Slovic, 1973; Tversky, Sattath, & Slovic, 1988). The use of continuous response formats wherein only a single stimulus object is considered at any one time does not lead to this decision strategy, but to a less effortful one wherein judgments arise from a simple consideration of the object at hand (Lichtenstein & Slovic, 1973; Payne, 1982).

These findings dovetail quite nicely with previous work on the ESD demonstrating that one way individuals arrive at their choice of the most distressing infidelity event is through consideration of the implications each event holds for subsequent occurrences of infidelity (DeSteno & Salovey, 1996a). That is, individuals arrive at their decision through an analysis of trade-offs. Of course, trade-offs regarding infidelity implications do not necessarily exhaust all the types of relevant trade-offs that may enter into the decision strategy. However, to the extent that they have been shown to explain variance in the ESD, they provide important support for the view that this sex difference may result from a decision strategy evoked by use of the forced-choice response format. As was noted earlier, some evolutionary psychologists have argued that the differential weighting of such trade-offs may itself derive from the functioning of evolved modules and not from an effortful, rational contemplation of the relevant stimuli, thereby extending the evolutionary view to embrace automatic processing of this information (Buss et al., 1996, 1999).

In light of these arguments, to claim that the ESD is an artifact requires not only a demonstration that its occurrence is limited to a specific measurement technique, but also that its existence in that circumstance is not likely produced by evolved psychological modules. Although there are various definitions of what constitutes a module, most theorists agree that a module can be understood as an innate cognitive mechanism designed to process domain-specific information in an automatic (i.e., not consciously directed) manner (Cosmides & Tooby, 1994; Fodor, 1983, 2000; Pinker, 1997; Pylyshyn, 1984). That is, modules respond to inputs of specific types to produce appropriate and adaptive outputs of a specific form. This processing functions without conscious initiation; however, controlled processing of the information output is certainly possible (Fodor, 1983, 2000).

Evolutionary psychologists have proposed that much as modules exist for the processing of sensory information, they may also exist for the processing of social information (Buss & Kenrick, 1998; Cosmides & Tooby, 1994); the processing of social cues, after all, is highly related to the fitness of organisms that live in social groups. Certain modules, therefore, can be viewed as evolved mechanisms that function to aid in the confrontation of challenges posed by the social environment (Cosmides & Tooby, 1992, 1994; Pinker, 1997). For example, Cosmides and Tooby (1992) have proposed a cheater-detection module (CDM) that functions to alert individuals to violations of social rules and contracts involving an exchange of resources or benefits (see Fodor, 2000, for a contrasting view). Individuals are unaware of how information related to cheating is processed differently in their minds and unable to initiate or terminate the computations involved. They are aware, however, of the output of these computations and can choose to use or override this output when making a final, deliberate assessment about a social target's honesty.

As noted earlier, because of the distinct mating challenges thought to confront men and women, several theorists have argued that the sexes should possess distinct jealousy modules similar in design to that of the CDM (Buss & Kenrick, 1998; Buss et al., 1992, 1996, 1999; Buunk et al., 1996; Daly et al., 1982). Such evolved modules, by their very definition, constitute automatic mental processes that are activated reflexively (i.e., preconsciously) in response to specific triggering stimuli and designed to produce specific cognitive, physiological, emotional, and/or behavioral output through specialized algorithms and/or decision rules (Buss, 1996; Buss & Kenrick, 1998; Cosmides & Tooby, 1994; cf. Bargh, 1997; Fodor, 1983; Pinker, 1997). In the present case, these modules should be sensitive to cues of sexual and emotional infidelity and function to produce specific outputs designed to meet these sex-specific challenges to fitness.

Given these properties of evolved modules, many paradigms used to investigate efficiency and automaticity can be used profitably to address the question of the origin of the ESD. Put simply, as evolved mechanisms are theorized to represent automatic processes that increase the facility with which organisms respond to environmental challenges relevant to their fitness potential, the functioning of these mechanisms should not be inhibited under conditions of cognitive constraint. That is, the functioning of jealousy modules, like all modules, needs no conscious direction or monitoring (cf. Fodor, 1983, 2000). Consciousness needs only to be aware of the resulting output to answer questions about distress in response to infidelity; it is not privy to the mechanisms underlying this response.

The presence of cognitive load, therefore, should, if anything, enhance the influence of automatic processes on judgment and behavior through the inhibition of corrective or deliberative processes reflecting the influence of conscious analysis (Bargh, 1994, 1997; Gilbert & Osborne, 1989; Wegner & Bargh, 1998). Indeed, this prediction would still hold even if one used a functional, as opposed to structural, definition of modularity (cf. Fodor, 2000; Pinker, 1997). That is, even if one assumed that the ESD derived from computations that, although outside awareness, were not encapsulated and could be interrupted by conscious intention, cognitive load should still not diminish the ESD, as deliberate intention and guidance is not necessary for the module to function. The ESD, therefore, should be magnified or unchanged under load if it stems from sex-specific evolved modules. However, if the ESD results from a method-induced effortful consideration of trade-offs, cognitive constraint should diminish the ESD because of the inhibited ability of individuals to consider carefully and systematically the socially learned trade-offs of the infidelity events, and thereby bring their responses into accord with those found using the continuous measure scales.

To put these competing predictions to the test, we conducted a simple experiment. We presented participants with the usual forced-choice measure under two conditions: half of the participants completed it while under a cognitive load and half did not. Our prediction was that given the constraints on processing ability induced by the load manipulation, individuals' responses on the forced-choice measure would match those previously found using continuous measures: men and women would both be more jealous of sexual than of emotional infidelity. Given no processing constraints, we expected the usual ESD finding to emerge. If confirmed, these predictions would argue strongly for the identification of the ESD as an artifact arising from a method-induced decision strategy and not innate processing algorithms.

Method

Participants

One hundred twenty-seven undergraduate students at Northeastern University (51 men, 76 women) participated in this study in partial fulfillment of course requirements. Six participants in the cognitive load condition had to be removed from subsequent analysis because of a failure to answer the target question during the allotted time (see description of manipulation below). The resulting sample, therefore, consisted of 121 individuals (51 men, 70 women).

Procedure

On arrival, participants were assigned randomly to either the cognitive load or control condition and then seated in individual cubicles containing personal computers. The experimenter informed participants that they would be taking part in an experiment designed to assess their responses to different types of actions by romantic partners. Participants then faced the computer and followed the instructions given. All subsequent instructions, measures, and responses were presented and collected using MediaLab (Jarvis, 2000).

Participants were first instructed to think of a committed romantic relationship in which they had previously been involved, are currently involved, or would like to be involved. They were then informed that they would be presented with a series of questions that would require them to select which of two options, if engaged in by their romantic partner, would cause them more distress. At this point, participants received one of two different sets of instructions based on their group assignment: cognitive load or control. Following these instructions, participants completed the jealousy measure and were then debriefed.

Manipulations and Measures

Cognitive load manipulation. Cognitive load was manipulated using a digit-string memory task (cf. Gilbert & Hixon, 1991). Participants in the load condition were informed that the experimenters were interested in how people make relationship-relevant judgments when they are distracted. To simulate distraction, they would be asked to remember a string of digits at the same time that they were responding to a series of preference questions. Participants were told that a string of seven digits would appear on the screen before each question. They would then have to answer a preference question concerning the actions of a relationship partner, immediately after which they would have to recall the digit string that had preceded the question. To guard against strategies involving extended rehearsals over long periods of time, participants were also told that they would only have 10 s to answer each preference question. In addition, participants were told that it was extremely important to provide the most accurate answers possible to both the recall and preference questions; debriefing interviews confirmed that participants strove to comply with this request.

The experiment consisted of five trials, each consisting of four segments. The first trial served as practice, with participants being asked after its completion to notify the experimenter if they were at all confused by the tasks. At the start of each trial, participants were told to prepare to receive the digit string (duration of the warning notice was 2 s). During the second segment of the trial, a string of seven randomly selected digits then appeared on the screen for 3 s. This string was then followed by a preference question. Upon a response, or a 10-s duration without a response, participants advanced to the fourth segment and were asked to recall the digit string; no feedback was provided concerning the accuracy of their response.

In the control condition, participants were told simply that they would be asked a series of questions. They were urged to consider carefully and fully their responses to each question. They then completed the five questions of the jealousy measure. As in the cognitive load condition, the first one served as a practice question, after which participants were offered the opportunity to contact the experimenter if they were at all confused regarding the task.

Jealousy measure. This measure consisted of five questions (one target and four distractors). Each question began with the following phrase: "It would upset me more if my partner ———." Participants were told to respond to each question by indicating which of the two presented options would cause them more distress. The five event pairs appeared in the following order: (a) was rude to my family, was rude to my friends; (b) lied to me, stole from me; (c) had passionate sex with someone else, formed a deep emotional bond to someone else; (d) forgot my birthday, forgot our anniversary; and (e) insulted me, ignored me. Question 3 is identical to the forced-choice measure used in the previous two studies and earlier research (e.g., Buss et al., 1992), and, therefore, served as the target item.

Results

The central prediction in this experiment was that constraints on cognitive resources would result in the elimination of the sex difference in response to sexual and emotional infidelity as measured with a forced-choice scale and, thereby, remove the apparent incongruity that appears between women's responses on this measure and all other response formats. That is, the attenuation of available cognitive resources was expected to result in women selecting sexual infidelity as most distressing on the forced-choice measure; load condition was not expected to affect men's choices because the majority of men usually report being more distressed in response to sexual infidelity.

In contrast to the evolutionary view, the findings presented in Table 2 clearly support our prediction. The presence or absence of cognitive load substantially influenced women's choices of the

Table 2
Frequency of Infidelity Choice as a Function of Cognitive Load and Gender

Gender and load condition	Type of infidelity	
	Sexual	Emotional
Male		
Cognitive load	24	2
No load	24	1
Female		
Cognitive load	20	11
No load	14	25

most distressing event, $\chi^2(1, N = 70) = 5.66, p = .02$, Cramer's $V = .28$. Women confronted with making a choice under cognitive constraint tended to select sexual infidelity as most distressing; women in the control condition, however, evidenced the usual bias toward emotional infidelity. Also as expected, load condition did not influence men's choices, $\chi^2(1, N = 51) = 0.31$, *ns*. To demonstrate the differential effect of load condition on men's and women's choices, we submitted the data to a 2 (load condition) × 2 (gender) × 2 (infidelity choice) log-linear analysis in which we specified a conditional independence model. That is, we tested a model in which the relation between load condition and infidelity choice was specified as independent of, or not contingent upon, gender. The resulting model provided a poor fit for the data, $LR(2) = 6.06, p < .05$, thereby confirming that the effect of load differed across men and women. Moreover, given that our primary prediction specified increased frequencies in the female/no-load/emotional infidelity cell as the source of the deviance driving this interaction, we again ran the above analysis having specified this cell as a structural void (see Wickens, 1989). In accord with our expectations, this alteration significantly increased the fit of the conditional independence model, $\Delta LR(1) = 5.74, p < .02$, and resulted in an acceptable fit overall, $LR(1) = 0.32, p = .57$. The implication of this finding is simply that with the removal of the identified cell, gender did not moderate the influence of load condition on choice. That is, women, when needing to make a quick decision, behaved exactly as men did; both genders were most distressed by sexual infidelity.

Discussion

The findings presented here offer the strongest evidence yet that the ESD results not from evolved psychological mechanisms, but from an effortful decision process induced by the presentation of the infidelity options as a forced choice. If the ESD did result from an evolved module, its magnitude should not have been diminished by the presence of cognitive constraints; the benefits of such mechanisms, after all, are theorized to stem from the increased efficiency they offer (Buss, 1996; Buss & Kenrick, 1998; Cosmides & Tooby, 1994; cf. Fodor, 2000). The fact that women's responses on the forced-choice measure under cognitive load mirrored those of men argues forcefully against the existence of innate sex differences in response to the two types of infidelity. Moreover, the fact that the disparity between women's responses on the forced-choice and continuous measure jealousy scales disappeared under cognitive load demonstrates that women's default distress response is greater to sexual infidelity. Only after a deliberate consideration of the possible trade-offs of the events do women tend to select emotional infidelity as more distressing than sexual infidelity. Effortful consideration by men, however, leads to the selection of sexual infidelity, mirroring their more automatic responses (cf. DeSteno & Salovey, 1996a).

One might object to this analysis by noting that the ability to weigh and consider consciously the relevant trade-offs of the infidelity events may itself represent an evolutionary benefit. That is, the human mind's capability to run simulations and reason about their outcomes most likely reflects one of the greatest evolutionary developments in our species' ability to confront environmental challenges. Therefore, does not the ability to select through deliberation the infidelity event most debilitating to one's fitness represent an evolutionary achievement? The answer, we would argue, is: it depends.

Although it is certainly true that the human mind's capability to abstract and manipulate volitionally information derived from sensory input is of immense benefit, it surely represents a generalized cognitive skill, not a module. That is, even though the exact mechanics by which reasoning operates may not be open to awareness, reasoning is not domain-specific in that it can use information arising from many stimuli and any sensory modality, and it is not automatic in that it is initiated and directed by will (cf. Fodor, 2000). Reasoning, therefore, is most properly understood as a generalized ability that, most likely, functions through the use of information processed and provided by modular mechanisms, but does not itself represent a domain-specific, automatic processor. Therefore, one could argue that reasoning ability provides a benefit to fitness with respect to reactions to sexual and emotional infidelity; however, it is also clear that the ability to reason did not derive from this benefit and is capable of operating on many types of information. In short, reasoning is not an evolved jealousy module, and, therefore, cannot be identified as an evolutionary mechanism underlying the ESD.

Issues of parsimony aside, one might push the argument by postulating an extra "reasoning" module that exists specifically to handle the case of these infidelity events. Such a claim is undercut, however, by the fact that the influence of this "jealousy reasoning module" was shown to disappear when not under effortful conscious direction; most definitions of modules explicitly assume automaticity in function. However, if one pushed the argument even further by adopting an older definition of a module as a corpus of innate knowledge separate from any claims regarding processing (cf. Chomsky, 1980), one is still unable to account for the limitation of the sex difference to a single response format that represents an artificial situation: a forced-choice between simultaneous consideration of the two types of infidelity. Innate knowledge about the horrendousness of sexual infidelity should drive an organism's responses to it whether or not emotional infidelity is also being simultaneously considered. That is, unless some other thought processes are also intervening, the absolute levels of aversion to each event should remain constant no matter how the infidelity events are presented.

One final comment is also worthy of consideration with reference to the present findings. In the control (i.e., no load) conditions, greater proportions of men and women tended to select sexual infidelity as more distressing than in previously published experiments using this paradigm. This fact, of course, raises a question concerning the viability of the control group. It is a concern, however, that can be put to rest with a simple rejoinder. First, the usual relative sex difference was found, even though the mean levels of the proportions choosing each event differed from that reported by Buss et al. (1992). In actuality, the exact levels of the proportions have been shown to evidence a high degree of variability (see Buunk et al., 1996). Nonetheless, the present increase in the choice of sexual infidelity among control-group participants can be explained, we believe, by the modification of the measurement technique.

Rather than presenting participants with the usual one-item questionnaire (e.g., Buss et al., 1992; Buunk et al., 1996; DeSteno & Salovey, 1996a), we presented them with a series of questions, one of which served as the target measure of infidelity choice. The

reason for this methodology was that we needed to ensure that participants in the cognitive load condition would become familiarized with the nature of the task (i.e., holding digits in memory while answering a question) before being presented with the target question. This necessitated the exposure of those in the control condition to the same set of questions. As one can readily imagine, participants would tend not to devote the same level of effort to answering an individual item in a multiquestion measure that they would to one in a single-question measure; they would move through the questions more quickly. This reduction in effort, then, most likely served as a mild load manipulation tilting the mean level of both men and women toward the selection of sexual infidelity. In spite of this event, the usual ESD was still obtained and shown to diminish under increased levels of load, thereby supporting our simple, directional hypothesis; any significant reduction in the ESD as a function of some increased level of cognitive constraint argues strongly against the evolutionary view.

General Discussion

The presented findings challenge the empirical basis for the evolutionary theory of jealousy by demonstrating that evidence of a sex difference in distress to sexual and emotional infidelity represents, in all likelihood, a methodological artifact. On all indices except the typically used forced-choice measure, whether measuring simple distress or jealousy, men and women responded similarly to the two infidelity events. In direct contradiction to the evolutionary view, both men and women appear to experience more distress in response to extradyadic sexual encounters than to emotional infidelities. The ESD only emerges when individuals (a) are forced to consider the two infidelity events in opposition to one another and (b) have ample cognitive resources to devote to this decision process. The presence of cognitive constraints that necessarily inhibit effortful consideration quickly removes the dissociation between judgments on the forced-choice measure and other response formats. Consequently, when needing to make a quick decision, women and men show indistinguishable aversion patterns. This finding, more than any other, demonstrates that the mediating mechanism driving selection of the most distressing infidelity event on the forced-choice measure is one involving deliberate, effortful reasoning and not efficient, automatic processing as would be expected given the functioning of an evolved module.

This finding fits well with previous work indicating that one variable driving selection of the most distressing infidelity involves the implications, or trade-offs, of each event. Such research has revealed that individuals' choices of the most distressing type of infidelity are influenced by the degree to which they believe one type of event implies the occurrence of the other (DeSteno & Salovey, 1996a). Although consideration of this specific trade-off cannot account for the existence of the ESD in all instances (Buss et al., 1999), it lends support to the claim that selection on the forced-choice measure represents an effortful decision process that, in all probability, involves consideration of many and varied *if–then* contingencies. Although past debate has centered on the possible evolutionary-shaping and efficient consideration of such contingencies when making judgments (see Buss et al., 1996, 1999), the present studies circumvent this thorny issue by demonstrating the lack of a sex difference in infidelity choice under conditions commonly conducive to the functioning of automatic processes (i.e., cognitive load; cf. Bargh, 1994; Wegner & Bargh, 1998). Put simply, at the most basic level of decision making, men and women respond similarly to sexual and emotional infidelity.

In asserting this claim, it is important to note that we are not implying that evolutionary pressures played no role in the shaping of jealousy, nor are we asserting that the current evolutionary theory is definitively incorrect. We are simply arguing that no credible experimental evidence exists to support the theory underlying the ESD. Empirical contradiction of this theory may seem somewhat surprising given the rationale presented to support it. However, careful consideration of the premises underlying the evolutionary view of jealousy raises certain questions concerning why the ESD would emerge at all. For example, the logic underlying the theory rests on the assumption that men and women habitually engage in different styles of reproductive effort, with men tending to focus their energies on mating and courting, and women focusing on pair bonding and provisioning offspring (cf. Buss et al., 1992; Daly et al., 1982). The validity of this assumption remains open to question, however. Evidence suggests that historical and cultural differences in within-gender parenting styles have varied considerably as a function of resource availability and stability (Belsky, Steinberg, & Draper, 1991; Chisholm, 1993; Draper & Harpending, 1982; Harpending & Draper, 1988; Hill, Ross, & Low, 1997; Hrdy, 1999). Consequently, parental investment and, therefore, sensitivity to infidelity threats, might more appropriately be expected to show a high degree of plasticity and vary within individuals of the same gender as a function of environmental contingencies.

A second difficulty with the current evolutionary theory lies in the impracticality and inefficiency of separating the two types of infidelity. Jealousy is theorized to be triggered by specific environmental cues signaling a threat to fitness (Buss et al., 1992; Daly et al., 1982). As a mechanism to signal the potential of such a threat, the act of infidelity itself is obviously not the best predictor of its possibility, especially because the unfaithful party is likely to try to conceal this event. If a male encounters his female partner in a sexual act with a rival, it is far too late to prevent this behavior; she may already have been inseminated. Consequently, although sexual infidelity may be the more abhorrent event, attention to cues of emotional infidelity would most likely serve as an efficient precursory cue to prevent cuckoldry and, consequently, might be expected to evoke heightened levels of distress.

The case for women may be different as well. For women who invest heavily in their offspring (as the evolutionary model assumes they do), extradyadic matings by their partner should indeed be a concern. Such actions have the potential to produce offspring that a male in a biparental species may feel obliged to support, thereby diluting precious resources. Male tendencies to engage in emotional infidelity without associated sexual contact would have been extinguished quickly in a strictly biparental species because of a diversion of resources from one offspring that are not directed toward another. Therefore, without the possibility of sexual contact, emotional infidelity should be relatively rare. Consequently, the central threat implied by emotional infidelity may be, in essence, subsequent sexual infidelity, and hence, sexual infidelity may be expected to evoke an equal or greater distress response.

As is becoming clear, many different patterns of distress can be derived on the basis of evolutionary theorizing. To our mind,

however, evidence of the sculpting of jealousy by the evolutionary chisel, if it does exist, is most likely not to emerge in a sex-differentiated fashion in humans. The ability to form and maintain relationships is important for humans of both genders at all stages of life (Baumeister & Leary, 1995; Leary, Tambor, Terdal, & Downs, 1995). Whether it is the young seeking to attain their parents' attention and resources at the expense of siblings, members of specific coalitions seeking to ensure rewards from superiors, or graduate students seeking to be the favored advisee in a lab, jealousy functions to alert individuals to their status vis-à-vis their partners and rivals so that they can maintain these important relationships and the benefits inherent in them. In the present case, we expect that sexual infidelity evoked greater distress in all individuals, whether it was due to evolved mechanisms or socially shaped responding, simply because the intimate contact involved in this event presents one of the clearest signals that the rival has been elevated by the partner to a position equal to or greater than that of the jealous individual. Of importance, we would expect jealousy to arise in response to all such relationship threats, whether these threats are innately designated or culturally derived, as a function of the degree of affiliation implied between the partner and rival by the relevant event.

Jealousy, according to this view, would function as a social emotion that is responsive to cues indicating a specific relationship threat (i.e., interest by one's partner in another). Such cues, of course, can occur in many situations and take many forms. To the degree that certain cues signify behaviors panculturally accepted to imply relationship threats, it may be sensible to investigate the existence and operation of evolved psychological mechanisms in the perception and processing of this information. We would argue that investigation into the possibility of automatic activation of emotional and behavioral responses to threats to all types of relationships stands as a fertile area for inquiry in the pursuit of jealousy-relevant evolved mechanisms. Such endeavors, we suspect, may reveal that men and women, at least with respect to the green-eyed monster, may be from the same planet after all.

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Appendix

Statements Comprising the Agree–Disagree Jealousy Scale

1. I would become very upset.
2. I would feel rejected by my partner.
3. I would not feel angry with my partner or with the person he/she was with. [reverse scored]
4. I would feel extremely jealous.
5. I would feel anxious.

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