Special Section

EVOLUTIONARY ORIGINS OF SEX DIFFERENCES IN JEALOUSY? Questioning the "Fitness" of the Model

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Abstract—*Evolutionary psychology has become a popular framework for studying jealousy Much of this popularity can be attributed to work by Buss and his colleagues showing an apparent relation between an individual's sex and jealousy for certain types of infidelity (i e , sexual vs emotional) that is consistent with evolutionary theory (Buss, Larsen, Westen, & Semmelroth, 1992) In two studies, we take issue with these findings and argue that the relation between sex and jealousy reported by Buss and his colleagues is more properly explained by considering individuals' beliefs concerning the covariation between sexual and emotional infidelity*

Evolutionary psychology has become a popular perspective from which to study jealousy In accord with this perspective, the origins of jealousy are ascribed to the evolutionary history of humans (Buss, 1991, 1995), and the psychological mechanisms thought to be responsible for the evocation of jealousy are evaluated with respect to their present or past adaptive benefits (e g , Wiederman & Allgeier, 1993) The popularity of the evolutionary perspective among investigators studying jealousy can be attributed in part to an influential article by Buss and his colleagues showing a sex difference in the intensity of jealousy in response to different types of infidelity (Buss, Larsen, Westen, & Semmelroth, 1992) Men reported more jealousy in situations involving sexual rather than emotional infidelity, but women reported more jealousy in situations involving emotional, as opposed to sexual, infidelity

These sex differences in the elicitors of jealousy arise, according to the evolutionary model, as a consequence of their fitness-enhancing capabilities (Buss et al , 1992) Fitness refers to the ability to pass on genetic material by raising offspring to the age of sexual maturity (Daly & Wilson, 1983) Briefly stated, evolutionary theory predicts that males in species employing internal fertilization are vigilant of possible sexual contact by their mates with other males this behavior is designed to prevent cuckoldry Females of biparental species with internal fertilization have no doubt concerning their genetic link to offspring and are therefore predicted to be vigilant of threats concerning the absconding of the male, not of the sexual act itself, the male's continued presence aids in the successful rearing of the offspring (Buss et al , 1992, Daly & Wilson, 1983)

In order to evaluate these predictions for human jealousy, Buss et al (1992) conducted three studies In all the studies, the dependent variable of interest was which of two types of infidelity (sexual or emotional) would evoke more intense jealousy As defined by Buss et al (1992), sexual infidelity involves actual sexual contact between individuals, emotional infidelity involves the expression of a deep affection for and attachment to another individual Participants in these studies were asked to imagine situations representing each type of infidelity It was expected that men would be more distressed by sexual than by emotional infidelity and women would be more distressed by emotional than by sexual infidelity

Two of the three studies presented subjects with a forced-choice question asking them simply to indicate which of the two types of infidelity would cause them more distress In accordance with the evolutionary perspective, Buss and his colleagues found a significant sex difference in the choice of infidelity type, women were much more likely than men to indicate that the emotional infidelity event resulted in more distress Also, physiological data were collected as a measure of emotional arousal in response to imagining each type of infidelity Men showed significant elevations in electrodermal activity in response to imagining the sexual as compared with the emotional infidelity situation, the reverse pattern was found in women Data from other physiological indices (pulse rate and electromyographic activity of the *corrugator supercilii*) were not as clear (Buss et al , 1992)

Based on these findings, Buss et al (1992) concluded that their predictions were supported, and that only the "evolutionary psychological frameworks generated the sex-differentiated predictions in advance and on the basis of sound evolutionary reasoning" (p 255) We challenge this interpretation of these findings

A major threat to the credibility of results based on a paradigm that does not use random assignment of participants to conditions is the influence of unmeasured variables (Abelson, 1995, Bollen, 1989) Such misspecification can lead to the acceptance of spurious results When individuals are not assigned randomly to conditions, there is less assurance that the other dimensions upon which the individuals vary are balanced within the ensuing analyses Consequently, causal claims with reference to the measured independent variable (or variables) may be compromised

In the case at hand, individuals, of course, entered the study as men or women, sex cannot be assigned randomly Therefore, the specter that variables correlated with sex were not balanced in subsequent analyses must be a concern This situation is not usually problematic when examining sex differences in a descriptive manner, if men behave a certain way because of a third variable that is correlated with sex, it may still make sense to speak in terms of a sex difference However, when claims are attributed to sex based solely on genetically influenced predispositions, as opposed to other socially derived influences, lack of random assignment signals possible problems, there can be

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little confidence that observed sex differences are not due to other nongenetic variables correlated with sex Extra care must be taken in such situations to examine the influence of alternative explanatory variables

We suspect that the findings presented by Buss et al (1992) can be explained by what we term the *double-shot hypothesis* Simply stated, some individuals believe that emotional and sexual infidelity are not independent events Consequently, they will select the type of infidelity that more implies the occurrence of the other when asked to indicate which one would make them more jealous For instance, emotional infidelity, for certain individuals, may imply that sexual infidelity has occurred or soon will occur These perceptions of nonindependence, moreover, may be correlated with sex in some samples, with women more likely than men to expect that emotional infidelity by their partners implies associated sexual infidelity If the double-shot hypothesis is correct, it might explain the results obtained in the forced-choice paradigm used by Buss et al (1992) According to this hypothesis, women select emotional infidelity as more distressing in the forced-choice paradigm because emotional infidelity really represents two types of infidelity as opposed to one Certain types of infidelity bother individuals more than others because they represent a double shot of infidelity, the occurrence of both these types of infidelity is no doubt more troubling than either individually and also signals a greater threat to the relationship

Such beliefs concerning the nonindependence of these two types of infidelity cannot be traced to genetic causes according to the usual evolutionary arguments in this domain, females should always be concerned with loss of attention and resources, whether or not males engage in extradyadic sexual activity Instead, it seems more likely that perceptions of the nonindependence of these types of infidelity are derived through socialization, men and women, because of past experience, may hold differing beliefs concerning the implications of the each of the two types of infidelity Moreover, perceptions of the nonindependence of sexual and emotional infidelity seem likely to vary not only across, but also within, sex To the extent that this is the case, and to the extent that these perceptions account for variance in jealousy reported by individuals, perceptions of nonindependence would seem to create a more powerful and parsimonious account of jealousy than would an account based on evolution

The following two studies were designed to evaluate this alternative explanation for the findings reported by Buss et al (1992) In each case, we expected to show that the reported relation between biological sex and jealousy for certain types of infidelity was due to the association of sex with differing perceptions of the nonindependence of the two types of infidelity We predicted that sex would provide no unique explanatory ability beyond that associated with these perceptions of nonindependence, and because sex is not the causal agent of such perceptions, but may simply covary with them, confirmation of these predictions would identify the relation between sex and infidelity choice as misspecified

STUDY 1

We collected two measures from participants a forced-choice measure identical to the one used by Buss et al (1992), asking which type of infidelity they would find more distressing, and a measure estimating participants' beliefs concerning the independence of the two types of infidelity In accordance with the double-shot hypothesis, we predicted that any association between sex and selection of infidelity type would be accounted for by perceptions of the nonindependence of the types of infidelity

Method

Participants

The participants in this study were 114 undergraduate students (53 male and 61 female, mean age = 19 8, SD = 1 40) They took part in the study voluntarily

Materials

As in the study by Buss et al (1992), participants were asked to reflect on a present or past romantic relationship and then to indicate which of the following two events would distress them more (a) their partner having passionate sexual intercourse with another person or (b) their partner forming a deep emotional attachment to another person

So that we could measure the perceived nonindependence of the two types of infidelity, participants were told that the following two questions would ask them how likely typical members of the opposite sex were to behave in certain ways as a result of specific situations They were also told to assume that the initials B F referred to a typical member of the opposite sex Question 1 asked, "If B F develops a deep emotional attachment to someone of your gender, how likely is it that B F and this other individual are now, or soon will be, sleeping together?" Question 2 asked, "If B F has slept with someone of your gender, how likely is it that B F is forming, or will form, a deep emotional attachment to this individual?" Responses were recorded on 9-point scales ranging from "unlikely" to "very likely "

Procedure

Participants completed these materials in groups They completed the forced-choice measure first, followed by the measure of infidelity nonindependence

Results and Discussion

Evolutionary prediction

As Buss et al (1992) found, women were more likely than men to indicate that emotional infidelity produced greater distress than did sexual infidelity, $\chi^2(1, N = 114) = 8\ 46$, $p = .004$ It is important to note, however, that only women showed a sizable difference in choosing between the two types of infidelity (46 women selected emotional infidelity as more distressing, 15 women selected sexual infidelity), the men were nearly evenly split (27 men selected sexual infidelity as more distressing, 26 men selected emotional infidelity), a pattern similar to that reported in Buss et al (1992, Study 1) This pattern indi-

cates that the predicted effect was driven primarily by women There is little reason, according to the evolutionary perspective, to expect that men should not show a differential preference for the infidelity types as well

Alternative explanation

According to the double-shot hypothesis, to the extent that individuals believe that emotional infidelity implies the occurrence of sexual infidelity, but not vice versa, they will report that emotional infidelity is the more distressing of the two Moreover, to the extent that individuals perceive the two types of infidelity as equally likely to imply the occurrence of one another, their probability of selecting either should hover near 50 To index the differential likelihood of one type of infidelity implying the other, we subtracted participants' likelihood judgments of sexual infidelity implying emotional infidelity from their judgments of emotional infidelity implying sexual infidelity This composite variable, hereafter referred to as the *differential infidelity implication* (DII), was positive if participants believed that emotional infidelity implied sexual infidelity more than the converse A value of zero indicated that each type was as likely to follow the other, and a negative value of DII indicated that sexual infidelity implied emotional infidelity more than the converse Thus, the more an individual's value of DII diverged from zero, the less that individual believed that the two types of infidelity imply one another equally

If the double-shot hypothesis is true, then based on the reported relation between sex and infidelity choice, we would expect to find that women have a positive mean value of DII, but the value for men is approximately zero, women showed a preference for selecting emotional infidelity, and men showed no differential preference in the forced-choice data Indeed, women reported a greater DII value (M = 2 62, SD = 3 10) than did men (M = 0 25, SD = 3 55), $t(112)$ = 3 82, $p < .001$

Test of misspecification

To demonstrate that the relation between sex and infidelity choice reported by Buss et al (1992) is due to a specification error, we conducted the series of logistic regression analyses reported in Table 1 In all models, the logits refer to the probability of selecting emotional infidelity as the more distressing type of infidelity The first model outlined in Table 1 depicts the reported relation between sex and infidelity choice The second model shows a strong relation between participants' DII values and their choice of infidelity type Consonant with the double-shot hypothesis, increasingly positive values of DII corresponded to greater probabilities of selecting emotional infidelity as more distressing, to the extent that individuals believed emotional infidelity was more likely to imply sexual infidelity than the converse, they were more likely to select emotional infidelity as more distressing (see Fig 1a) Moreover, as predicted, a zero value of DII, indicating a belief that the two types of infidelity imply one another equally, was associated with a 55 probability of selecting emotional infidelity in this sample

The third model regressed infidelity choice on both sex and DII In this model, only participants' DII scores remained a reliable predictor of infidelity choice Adding DII to Model 1 resulted in increased explanatory power ($\Delta\chi^2[1, N = 114]$ = 13 29, $p < .001$), but adding sex to Model 2 did not ($\Delta\chi^2[1, N = 114]$ = 2 69, p = 10), sex accounted for little unique variance in choice of the more distressing infidelity situation beyond the variance explained by DII Thus, any significant association between sex and choice of the more distressing infidelity situation is explained by the differing expectations of men and

Table 1 *Summary of hierarchical logistic regression analysis for variables predicting choice of infidelity type as more distressing in Study 1*

Variable	Parameter estimate	Standard error	Standardized parameter estimate	χ^2	p
Model 1					
Sex	1 158	0 405	320	8 19	0042
Model 2					
DII	0 265	0 067	512	15 82	0001
Model 3					
Sex	0 722	0 443	199	2 65	1037
DII	0 233	0 068	450	11 61	0007

Note For all models, −2 log likelihood probabilities are less than 05 Constant parameters for the models were −1 20, 0 21, and −0 83, respectively In the coding of sex, male = 1 and female = 2 Logits (i e , linear combinations of the parameter estimates) refer to the probability of selecting emotional infidelity as more distressing than sexual infidelity Exact probabilities can be calculated as follows

$$p = \frac{e^{\beta}}{1 + e^{\beta}},$$

where β represents the unstandardized parameter estimate(s) DII = differential infidelity implication (see the text)

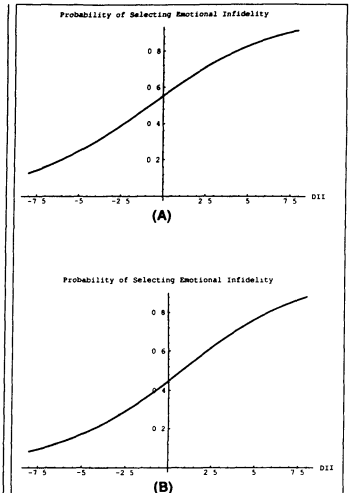

Fig 1 Logistic regression curves representing estimates of the probability of selecting emotional infidelity as more distressing than sexual infidelity as a function of differential infidelity implication (DII) score for participants of Study 1 (a) and Study 2 (b)

women concerning the independence of the two types of infidelity

Moreover, within-sex logistic regressions of infidelity choice on DII showed that most men and women selected the infidelity event that they believed more implied the subsequent occurrence of the other as well (DII parameters were 0 20, $p < 03$, and 0 28, $p < 01$, for men and women, respectively) These results further imply that perceptions of infidelity nonindependence constitute a more complete and parsimonious explanation of infidelity choice than does sex

STUDY 2

Study 2 was designed as a replication of Study 1 The primary goal was again to show that the relation between sex and infidelity choice results from their correlation with a third variable, DII Moreover, to increase the generalizability of these findings, we recruited a sample of nonstudent adults ranging in age from 17 to 70

Method

Participants

A total of 938 individuals volunteered to take part in this study They were residents of several Midwestern cities and had enrolled in continuing education classes concerning health care Of the 938 volunteers, 80 were male In order to keep the gender distribution approximately equal for subsequent analyses, we selected a random sample of 80 women from the set of female participants Of this set, 7 men and 12 women were removed from analyses because of missing data The final sample consisted of 141 individuals (73 male and 68 female, mean age = 45 20, SD = 10 71)

Materials

We used the same materials as in Study 1

Procedure

Participants completed the measures voluntarily as part of their continuing education class and in the same order as in Study 1

Results and Discussion

Evolutionary prediction

As expected, we again replicated the findings reported by Buss et al (1992) Women were more likely than men to indicate that emotional infidelity produced greater distress than did sexual infidelity, $\chi^2(1, N = 141) = 5\ 25$, $p = 02$ Forty-two women selected emotional infidelity as more distressing, and 26 women selected sexual infidelity as more distressing Forty-two men selected sexual infidelity as more distressing, and 31 men selected emotional infidelity as more distressing

Test of misspecification

To replicate our demonstration that the link between sex and infidelity choice is due to a third variable, we conducted the series of logistic regression analyses reported in Table 2 Again, in all models, the logits refer to the probability of selecting emotional infidelity as more distressing than sexual infidelity The first model depicts the reported relation between sex and infidelity choice The second model again shows a strong relation between participants' DII scores and their choice of infidelity type As predicted, increasing positive values of DII corresponded to greater probabilities of selecting emotional infidelity as more distressing, indicating again that to the extent individuals believed emotional infidelity was more likely to imply sexual infidelity than the converse, they were more likely to select emotional infidelity as more distressing (see Fig 1b) A zero value of DII indicated a 45 probability of selecting emotional infidelity in this sample

The third model in Table 2 regressed infidelity choice on both sex and DII As in Study 1, only participants' DII scores remained a reliable predictor of their choice of the more distressing type of infidelity Once again, adding DII to Model 1 resulted in increased explanatory power ($\Delta\chi^2[1, N = 141] = 13\ 49, p < 001$), but adding sex to Model 2 did not ($\Delta\chi^2[1, N = 141] = 0\ 87, p = 35$) Sex accounted for virtually no unique

Table 2 *Summary of hierarchical logistic regression analysis for variables predicting choice of infidelity type as more distressing in Study 2*

Variable	Parameter estimate	Standard error	Standardized parameter estimate	χ^2	p
Model 1					
Sex	0 783	0 344	217	5 18	0228
Model 2					
DII	0 275	0 070	442	15 50	0001
Model 3					
Sex	0 349	0 376	097	0 86	3524
DII	0 256	0 073	410	12 33	0004

Note For all models, -2 log likelihood probabilities are less than 05 Constant parameters for the models were -0 30, -0 21, and -0 35, respectively In the coding of sex, male = 1 and female = 2 Logits (i e , linear combinations of the parameter estimates) refer to the probability of selecting emotional infidelity as more distressing than sexual infidelity Exact probabilities can be calculated as follows

$$p = \frac{e^{x\beta}}{1 + e^{x\beta}},$$

where β represents the unstandardized parameter estimate(s) DII = differential infidelity implication (see the text)

variance in choice of the more distressing infidelity situation beyond the variance explained by DII, again identifying the relation between sex and choice of infidelity type as misspecified Moreover, within-sex logistic regressions of infidelity choice on DII again showed that most men and women selected the infidelity event that they believed more implied the subsequent occurrence of the other as well (DII parameters were 0 28, $p < 01$, and 0 23, $p < 03$, for men and women, respectively)

GENERAL DISCUSSION

The studies presented here show that the reported relation between sex and choice of the more jealousy-provoking infidelity type is rooted in a different sex difference perceptions of the nonindependence of these two types of infidelity Both men and women selected the infidelity event that they believed was more likely to signal the occurrence of the other type of infidelity as well, thereby supporting the double-shot hypothesis Moreover, in both samples, the belief that emotional infidelity implies sexual infidelity was held to a greater degree by women than men This reliable covariation between sex and beliefs about the nonindependence of the two types of infidelity accounts for the widely cited relation between biological sex and jealousy for the two types of infidelity

In light of these findings, we assert that the choice between sexual infidelity and emotional infidelity is a false dichotomy for many individuals Consequently, research that uses a forced choice between these two types of infidelity as the primary dependent variable without examining the influence of other variables is open to question This argument extends to the use of physiological data as well Although such procedures circumvent the error due to self-report, there remains no way to ensure that asking individuals to imagine an instance of emotional infidelity may not also trigger them to think about the possible sexual implications of such an event as well

One further point is also worthy of note Although the sex difference in infidelity choice reported by Buss et al (1992) is readily replicable using the forced-choice paradigm, we have been unable to replicate it using continuous measures asking individuals to rate the amount of distress experienced in response to each type of infidelity [1] Failures to find this effect using both manifest and latent multiple measures of jealousy led us to question the robustness of the originally reported sex difference outside of the forced-choice paradigm It may be that the effect is dependent on choosing one type of infidelity over

1 A study recently conducted in our laboratory illustrates the case Sixty-five participants (34 men 31 women) completed the standard forced-choice measure as well as a six-item jealousy measure (Cronbach's $\alpha = 90$) for each of the two types of infidelity Ratings were recorded on 9-point scales with the sum representing each participant's jealousy score As expected, we replicated the usual relation between sex and choice of infidelity type for the forced-choice measure, $\chi^2(1, N = 65) = 10\ 20$, $p = 001$ The majority of women reported that emotional infidelity ($f = 27$) would cause more distress than sexual infidelity, only 4 women selected sexual infidelity as more distressing Men, however, showed no such differential preference for sexual ($f = 17$) or emotional ($f = 17$) infidelity Again, the lack of a differential preference in men is difficult to explain from the perspective of evolutionary psychology More important analyses of the continuous measures failed to show a relation between sex and the intensity of jealousy in response to the two types of infidelity A 2 (sex) X 2 (infidelity type) mixed analysis of variance provided no evidence for the predicted interaction (for men, $M_{\text{sexual infidelity}} = 43\ 62$, $SD = 12\ 16$, and $M_{\text{emotional infidelity}} = 42\ 21$, $SD = 12\ 32$, for women, $M_{\text{sexual infidelity}} = 47\ 03$, $SD = 8\ 97$, and $M_{\text{emotional infidelity}} = 48\ 47$, $SD = 7\ 67$, $F[1, 62] = 1\ 78$, $p = 19$)

the other In this case, if a person is forced to choose, we believe that he or she will choose the infidelity event that is more likely to result in a double shot

The data presented here argue against an evolutionary interpretation of sex differences in jealousy (Buss et al , 1992, Daly & Wilson, 1983), there is no evidence that sex exerted any direct influence on the choice between sexual or emotional infidelity as more distressing Rather, this relation appears to be due to a specification error, sex is correlated with perceptions of the nonindependence of these types of infidelity, and it is these perceptions, we argue, that influence choice of infidelity type Evolutionary psychology provides no basis for differential jealousy based on the nonindependence of types of infidelity, rather, each sex is theorized to focus on a specific type of fitness threat The data presented here argue for an interpretation of infidelity choice based on expectations of subsequent behavior, infidelity events that imply the occurrence of other types of infidelity as well evoke more intense jealousy in both men and women specifically because of this augmentation

In addition, unlike the psychological mechanism postulated in the evolutionary model, our findings show that the double-shot hypothesis not only explains differential choices of infidelity between men and women, but also explains variance in these choices among individuals of the same sex The evolutionary model is incapable of explaining such within-sex differences Consequently, we believe that our model provides a clear and parsimonious explanation of infidelity choice that is also more general than the one posed by Buss et al (1992)

Jealousy, we believe, is a multifaceted phenomenon (DeSteno & Salovey, 1994, 1995, Salovey & Rothman, 1991) Evolutionary psychologists certainly share our view that socialization plays a role in shaping jealousy (Buss et al , 1992) In kind, we do not deny that jealousy may possess some adaptiveness with respect to fitness, nor are we arguing against the utility of the evolutionary perspective to study behavior in animals and humans However, we do believe that, at present, conclusive empirical evidence has not been put forward to support the notion of evolutionary-based sex differences in the elicitation of jealousy

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