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Review Article

Sex differences in jealousy: a meta-analytic examination

Brad J. Sagarin[a,*], Amy L. Martin[a], Savia A. Coutinho[a], John E. Edlund[b], Lily Patel[a], John J. Skowronski[a], Bettina Zengel[a]

[a]Northern Illinois University, DeKalb, IL 60115, USA
[b]Rochester Institute of Technology, Rochester, NY 14623, USA

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Abstract

The theory of evolved sex differences in jealousy predicts sex differences in responses to sexual infidelities and emotional infidelities. Critics have argued that such differences are absent in studies that use continuous measures to assess responses to hypothetical infidelities or in studies that assess responses to real infidelities. These criticisms were tested in two random-effects meta-analyses of 40 published and unpublished papers (providing 209 effect sizes from 47 independent samples) that measured sex differences in jealousy using continuous measures. A significant, theory-supportive sex difference emerged across 45 independent samples using continuous measures of responses to hypothetical infidelities, g^*=0.258, 95% confidence interval (CI) [0.188, 0.328], p<.00001. Measured emotion significantly moderated effect size. Effects were strongest when measures assessed distress/upset (g^*=0.337) and jealousy (g^*=0.309). Other commonly measured negative emotions yielded weaker effects, including hurt (g^*=0.161), anger (g^*=0.074), and disgust (g^*=0.012). Across the 45 independent samples, six significant moderators emerged: random sampling, population type (student vs. nonstudent samples), age, inclusion of a forced-choice question, number of points in the response scale, and year of publication. A significant, theory-supportive effect also emerged across seven studies assessing reactions to actual infidelities, g^*=0.234, 95% CI [0.020, 0.448], p=.03. Results demonstrate that the sex difference in jealousy neither is an artifact of response format nor is limited to responses to hypothetical infidelities.

Keywords: Jealousy; Evolution; Sex differences; Meta-analysis

1. Introduction

Men and women both react with jealousy in response to either a partner's sexual infidelity or his/her emotional infidelity. However, according to the theory of evolved sex differences in jealousy (Buss, Larsen, Westen, & Semmelroth, 1992; Daly, Wilson, & Weghorst, 1982; Symons, 1979), the challenge of ensuring paternal investment exerted selective pressures on women that boosted their jealousy response to emotional infidelity. In comparison, the theory suggests that the challenge of paternal uncertainty exerted selective pressures on men that boosted their jealousy response to sexual infidelity. Hence, the sexes are theorized to differ in the patterns of jealousy exhibited in response to emotional infidelities and sexual infidelities.

As evidenced by citation rates (336 for Buss et al. and 284 for Daly et al. according to the Web of Science as of this writing), the theory has been influential and has inspired a number of additional predictions and studies (Buss & Haselton, 2005). However, the theory has also caused substantial controversy. Indeed, many papers critical of the theory have appeared in some of psychology's flagship journals, including *Psychological Science* (e.g., DeSteno, 2010; Harris, 2002), *Journal of Personality and Social Psychology* (e.g., DeSteno, Bartlett, Braverman, & Salovey, 2002), *Personality and Social Psychology Bulletin* (e.g., Berman & Frazier, 2005), *Personality and Social Psychology Review* (e.g., Harris, 2003a), and *Trends in Cognitive Sciences* (e.g., Buller, 2005).

One source of controversy lies in methodology. A primary methodology used to test the theory of evolved sex differences in jealousy is the forced-choice dilemma pioneered by Buss et al. (1992). This methodology instructs women and men to think about a hypothetical situation in which their romantic partner has become interested in

* Corresponding author. Department of Psychology, Northern Illinois University, DeKalb, IL 60115, USA. Tel.: +1 815 753 7067; fax: +1 815 753 8088.
E-mail address: bsagarin@niu.edu (B.J. Sagarin).

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someone else and to indicate which type of infidelity (sexual or emotional) would cause greater distress. For example, Buss et al. presented participants with the following choice:

> Please think of a serious committed romantic relationship that you have had in the past, that you currently have, or that you would like to have. Imagine that you discover that the person with whom you've been seriously involved became interested in someone else. What would distress or upset you more (*please circle only one*):
>
> (A) Imagining your partner forming a deep emotional attachment to that person.
>
> (B) Imagining your partner enjoying passionate sexual intercourse with that other person. (p. 252)

Consistent with predictions of the theory of evolved sex differences in jealousy, a significantly greater proportion of men (60%) than women (17%) indicated that the sexual infidelity would cause them greater distress. Subsequent research using this method has generally duplicated this effect, so much so that results from Harris' (2003a) meta-analysis demonstrated that the sex difference in jealousy when assessed via the forced-choice method is reliable and robust.

However, evidence favoring the theory has proven elusive when jealousy is assessed using continuous measures (e.g., when response scales separately assess jealousy responses to sexual infidelity and emotional infidelity). Such elusiveness has led critics to suggest that the sex difference in jealousy is an artifact of the forced-choice method. For example, DeSteno (2010) argues:

> When jealousy related to sexual and emotional infidelity is assessed using various non-forced-choice response formats, no sex differences emerge; men and women both report greater jealousy in response to sexual infidelity (DeSteno et al., 2002; Harris, 2003a). Yet a sex difference in jealousy readily emerges from these same people when they complete a forced-choice measure (DeSteno & Salovey, 1996; DeSteno et al., 2002)….

A second perceived shortcoming stems from the hypothetical scenarios used in most studies examining responses to infidelity. These studies essentially assess participants' predictions about how they would feel, not their emotional responses to actual infidelity. Citing potential errors in affective forecasts, critics have cast doubt on the results of such research. Indeed, as noted by DeSteno (2010), Gilbert, Wilson, and their colleagues have documented systematic errors in people's predictions of how they will feel in response to future events (Wilson & Gilbert, 2003). Thus, as Harris (2002, 2003a) suggests, the nature of the jealousy that individuals experience when confronting actual infidelities may differ markedly from the predictions they make about how they will feel in response to hypothetical infidelities.

Such criticisms are not without support. For example, several studies that used continuous measures to assess jealousy (e.g., DeSteno et al., 2002; Green & Sabini, 2006) have failed to replicate the sex difference typically obtained with forced-choice measures. Similar nonreplications have been reported when participants reported their reactions to actual infidelity experiences (e.g., Harris, 2002). However, the data in these domains are mixed. For example, results of some studies using continuous measures do evince significant sex differences (e.g., Edlund & Sagarin, 2009). Moreover, sex differences have emerged in some studies assessing responses to actual infidelity experiences (e.g., Edlund, Heider, Scherer, Farc, & Sagarin, 2006).

As noted by Edlund and Sagarin (2009, p. 76), both proponents and opponents of the theory of evolved sex differences in jealousy have tended to overgeneralize the results yielded by their own studies:

> Researchers on both sides of the debate regarding sex differences in jealousy have often pointed to single studies as providing sufficient support for their position. Opponents of the theory have sometimes considered a single failure to replicate the sex difference as sufficient evidence to refute the theory. Likewise proponents of the theory have often considered a single significant sex difference as firmly establishing the theory. We suggest that both sides should be wary of placing too much weight on the results of a single study—a tendency Tversky and Kahneman (1971) labeled *the belief in the law of small numbers*.

When the debate was first enjoined, the small number of studies that had been conducted made it difficult to definitively assess the conclusions offered by both sides in the debate. However, one consequence of the debate was that people kept on doing research, and the number of empirical studies examining sex differences in jealousy is now sufficient to statistically address the controversy. To this end, we conducted several meta-analyses that serve to synthesize the corpus of studies that examined sex differences in jealousy using continuous measures. These meta-analyses pursued three main objectives: (a) to determine whether there is or is not a sex difference in jealousy when jealousy is assessed with continuous measures, (b) to determine whether the sex difference appears in response to actual infidelity experiences (and whether the effects observed in those studies differ from those obtained in the hypothetical scenario studies), and (c) to identify moderators that can help to explain the diversity present in past findings.

Before describing the meta-analyses, one issue needs to be addressed: the proper statistical interpretation of the results from the studies that have employed continuous measures. This is discussed in the section that follows.

2. Statistical interpretation of studies using continuous measures

2.1. The interaction vs. simple effects controversy

One controversy in this area stems from a proper assessment of the predictions made by the theory of evolved sex differences in jealousy. For example, consider a study in

which women and men indicate using continuous measures how much jealousy they would feel in response to emotional infidelity and in response to sexual infidelity. Sagarin (2005) and Edlund and Sagarin (2009) have argued that the only effect relevant to the theory is the Participant Sex×Infidelity Type interaction: Men should show a relatively greater *difference* than women in their responses to sexual infidelity and emotional infidelity (i.e., men's responses to sexual infidelity minus their responses to emotional infidelity are predicted to be greater than women's responses to sexual infidelity minus their responses to emotional infidelity).

Let us review the logic underlying this claim. Most studies examining sex differences in jealousy using continuous measures employ a 2×2 (Participant Sex)×(Infidelity Type) mixed model factorial design with Participant Sex as the between-subjects factor and Infidelity Type as the within-subject factor (e.g., DeSteno et al., 2002; Edlund et al., 2006). Each participant provides two measures: jealousy in response to sexual infidelity and jealousy in response to emotional infidelity (other emotion terms are sometimes used, a factor that turns out to be important in our meta-analyses). A 2×2 analysis of variance performed on such data often produces a main effect of Participant Sex, a main effect of Infidelity Type, and a Participant Sex×Infidelity Type interaction.

The theory of evolved sex differences in jealousy suggests that, because of the decreased likelihood that highly jealous men would be cuckolded compared to their less jealous intrasexual competitors, selection pressures selected for men who felt more jealousy in response to sexual infidelity over men who felt less jealousy in response to sexual infidelity. Similarly, the theory suggests that, because of the decreased likelihood that highly jealous women would lose paternal investment in their children compared to their less jealous intrasexual competitors, selection pressures selected for women who felt more jealousy in response to emotional infidelity over women who felt less jealousy in response to emotional infidelity. Put another way, the theory argues that selection pressures gave men (but not women) a boost in their jealous response to sexual infidelity. Likewise, selection pressures gave women (but not men) a boost in their jealous response to emotional infidelity. Importantly, because reproductive competitions were intrasexual (i.e., women competed with other women, whereas men competed with other men for reproductive success), the theory does *not* imply that selection pressures boosted men's jealous response to sexual infidelity above women's jealous response to sexual infidelity or that selection pressures boosted women's jealous response to emotional infidelity above men's jealous response to emotional infidelity. Instead, the theory simply implies that selection pressures *altered the relative patterns of jealousy responses* produced in different situations.

To illustrate the empirical implications of this theory (from Edlund & Sagarin, 2009), consider a study in which women and men indicate how jealous they would feel on a 1 to 10 scale in response to a sexual infidelity scenario and in response to an emotional infidelity scenario. Fig. 1 illustrates the means in each condition assuming: (a) a baseline response of 5 on the scale and (b) the evolved sex difference manifests as a 1-point increase in men's jealousy in response to sexual infidelity and as a 1-point increase in women's jealousy in response to emotional infidelity (the specific values are arbitrary, of course; but alternative values would produce an analogous pattern). This pattern of results shows an interaction in the theory-supportive direction—men, relative to women, report greater jealousy in response to sexual infidelity than in response to emotional infidelity. In addition, all four simple effects show patterns seemingly supportive of the theory: (a) men report greater jealousy in response to sexual infidelity than in response to emotional infidelity, (b) women report greater jealousy in response to emotional infidelity than in response to sexual infidelity, (c) men report greater jealousy than women report in response to sexual infidelity, and (d) women report greater jealousy than men report in response to emotional infidelity.

	Men	Women	
Sexual infidelity	6 (5 baseline +1 evolved sex difference)	5 (5 baseline)	5.5
Emotional infidelity	5 (5 baseline)	6 (5 baseline +1 evolved sex difference)	5.5
	5.5	5.5	

Fig. 1. Pattern of jealousy responses influenced only by evolved sex differences (reprinted from Edlund & Sagarin, 2009).

However, it would be foolish to think that sexually dimorphic selection pressures comprised the only factor impacting responses to the scenarios. Indeed, past research has identified a variety of factors likely to impact the overall levels of jealousy reported by women versus men or the overall levels of jealousy reported in response to sexual versus emotional infidelity. For example, Feldman Barrett, Robin, Pietromonaco, and Eyssell (1998) found that women report more intense emotions than men on global, retrospective measures, and Sagarin and Guadagno (2004) found that women report higher levels of jealousy than men on one commonly used response scale because of a differential interpretation of the upper anchor of the scale. Furthermore, research results suggest that if researchers operationalize jealousy as a willingness to commit overt acts of physical aggression toward the rival, one might expect men to exhibit higher levels of jealousy than women (Daly & Wilson, 1988; Daly et al., 1982; Kaighobadi, Shackelford, & Goetz, 2009). Moreover, the exact operationalization of sexual versus emotional infidelity within a particular study is likely to have an impact on responses. For example, Buss and colleagues (1992) used two operationalizations of each type of infidelity. They operationalized sexual infidelity as either "enjoying passionate sexual intercourse" or "trying different sexual positions" and emotional infidelity as either "forming a deep emotional attachment" or "falling in love." The results

suggest that both women and men found passionate sexual intercourse more jealousy provoking than different sexual positions, falling in love more jealousy provoking than development of a deep emotional attachment, or both.

The potential action of these additional factors on responses necessitates caution when examining typical results from a jealousy study. For example, consider a study in which the phrase "passionate sexual intercourse" operationalizes sexual infidelity, the phrase "a deep emotional attachment" operationalizes emotional infidelity, and the response scale uses *extremely jealous* as the upper anchor on the scale. Consistent with the results provided by Buss and colleagues (1992), these specific operationalizations of sexual versus emotional infidelity might cause an increase in both women's and men's responses to sexual infidelity compared to emotional infidelity. Moreover, consistent with results provided by Sagarin and Guadagno (2004), the *extremely jealous* upper anchor might cause an increase in women's responses to both types of infidelities compared to men.

Fig. 2 uses these ideas to illustrate a hypothetical data pattern that might emerge from the convergence of these forces. The means in each condition assume: (a) a baseline response of 5 on the scale, (b) the evolved sex difference manifests as a 1-point increase in men's jealousy in response to sexual infidelity and as a 1-point increase in women's jealousy in response to emotional infidelity, (c) the operationalizations of the infidelities manifest as a 2-point increase in both women's and men's jealousy in response to sexual infidelity, and (d) the upper anchor manifests as a 2-point increase in women's jealousy in response to both types of infidelity. The pattern of results shows an interaction in the theory-supportive direction—men, relative to women, report greater jealousy in response to sexual infidelity than in response to emotional infidelity. However, at first glance, two of the simple effects might seem to refute the theory. Women report greater jealousy than men in response to sexual infidelity, and women report greater jealousy in response to sexual infidelity than in response to emotional infidelity. Both of these effects, however, stem from other factors impacting the scores, factors that are in no way incompatible with the theory of evolved sex differences in jealousy.

	Men	Women	
Sexual infidelity	8 (5 baseline +2 infidelity operationalization +1 evolved sex difference)	9 (5 baseline +2 infidelity operationalization +2 upper anchor)	8.5
Emotional infidelity	5 (5 baseline)	8 (5 baseline +2 upper anchor +1 evolved sex difference)	6.5
	6.5	8.5	

Fig. 2. Pattern of jealousy responses influenced by evolved sex differences and other factors (reprinted from Edlund & Sagarin, 2009).

This analysis indicates that in the usual research designs, the Participant Sex×Infidelity Type interaction represents the only relevant test of the theory of evolved sex differences in jealousy. Tests of main effects or of simple effects in these interactions, though intuitively appealing, are irrelevant and, worse, are potentially misleading. We acknowledge that, as noted by Harris (2005), many evolutionary psychologists working in this area have analyzed their data with tests other than the interaction (e.g., Buss et al., 1992, Study 2). Indeed, early work from one of this paper's authors (Sagarin, Becker, Guadagno, Nicastle, & Millevoi, 2003) includes analyses of simple effects. To this, we can only say that our own thinking on the issue has, over the years, become more theoretically precise: Sagarin et al. (2003) included an analysis of both the interaction and simple effects; Sagarin (2005) included an initial argument for the sole relevance of the interaction; Edlund and Sagarin (2009) included an expanded argument for the sole relevance of the interaction; and Edlund and Sagarin (2009) presented results only for the interaction. Thus, because of our contention that the interaction is the only relevant test of the theory of evolved sex differences in jealousy in the usual designs that have been used to conduct research in the area, the meta-analyses reported in this article focus exclusively on the interaction.

2.2. The interaction and the scaling controversy

Harris (2005) argues that due to the ordinal nature of the continuous measure jealousy scales, many statistically significant interactions obtained from standard designs searching for sex differences in jealousy are uninterpretable:

> [I]nteractions observed in self-report measures of variables like distress, even when statistically significant, may or may not reflect true underlying interactions (Bogartz, 1976; Krantz & Tversky, 1971; Loftus, 1978). This is because instruments such as Likert-type scales offer at best a monotonic relationship to the underlying state being measured. With this kind of scale, the only interpretable interactions are crossover interactions or others where the sign of the effect of one independent variable is reversed by a change in the other independent variable. Many of the interactions Sagarin argues support JSIM fall squarely within the uninterpretable category, even if they had been statistically significant, which most are not (compare Figures 1 and 2 with Loftus, 1978, Figure 3, Panel C, "Uninterpretable Interactions").

It turns out that if one can only assume ordinality and not true equal-interval continuity (as in an interval scale) on response measures, the situation is actually worse than Harris (2005) describes. That is, when response options on a scale only possess the property of ordinality, even crossover and sign-change interactions are uninterpretable. This state of affairs occurs because, although crossovers and sign changes survive monotonic transformations at the individual level, they do not necessarily survive at the aggregate level. For

Table 1
Raw and monotonically transformed data demonstrating a reversal of a crossover, sign-change interaction

Sex	V1	V2
Raw data		
Male	2	1
Male	2	1
Male	14	19
Female	4	5
Female	4	5
Female	13	8
Transformed data		
Male	3	1
Male	3	1
Male	15	16
Female	4	6
Female	4	6
Female	10	9

example, the top half of Table 1 contains data representing a crossover, sign-change interaction with mean scores of 6 and 7 for men and mean scores of 7 and 6 for women on V1 and V2, respectively. The bottom half of Table 1 contains the same data subject to a monotonic transformation (1→1, 2→3, 4→4, 5→6, 8→9, 13→10, 14→15, 19→16). The transformed data also reflect a crossover, sign-change interaction, but the form of the interaction has reversed completely, with mean scores of 7 and 6 for men and mean scores of 6 and 7 for women on V1 and V2, respectively. Furthermore, an examination of only the scores for men (or only the scores for women) demonstrates that even the ordering of means is uninterpretable under an assumption of ordinality (but not equal-interval continuity). Thus, if we are unwilling to make any assumptions about response scales that go beyond ordinality, nearly every parametric test performed on nearly every response scale used in psychological research is essentially uninterpretable. This would include vast quantities of psychological research, including all attitudes research that used Likert and semantic differential scales, all personality research that used standard response scales to measure self-esteem, the Big 5, self-monitoring, and other individual difference constructs, all emotion research that used the Positive and Negative Affect Scale (PANAS) and similar instruments to assess affect, and so on. This seems to be a lot to sacrifice at the altar of a measurement taxonomy.

Of course, the fact that "we've always done it this way" does not provide a strong defense for continuing a potentially flawed practice. However, there is reason to believe that the flaws cited by Harris (2005) reflect unnecessary adherence to dogma. A useful source for alternative perspectives is provided by Velleman and Wilkinson (1993). They review Stevens's (1946) hierarchy of measurement scales and present a range of criticisms of Stevens's proscriptions, including critiques by Guttman (1977) and Tukey (1961). For example, they note that Tukey attacked Stevens's proposals as dangerous to good statistical analysis, especially in degree to which scaling absolutely determined statistical methods. In fact, even Stevens himself wavered on this issue (1951, p. 26):

> As a matter of fact, most of the scales used widely and effectively by psychologists are ordinal scales. In the strictest propriety the ordinary statistics involving means and standard deviations ought not to be used with these scales... On the other hand,... there can be invoked a kind of pragmatic sanction: in numerous instances it leads to fruitful results.

Tukey (1962, p. 397) echoed this pragmatism, noting that it reflects an important difference separating data analysis from mathematical statistics. Tukey argued that experience has shown in a wide range of situations that the application of proscribed statistics to data can yield results that are scientifically meaningful, useful in making decisions, and valuable as a basis for further research. In his view, such utility fully justified the use of such statistics.

These arguments are powerful. However, even more powerful would be a statement from the data themselves that parametric analyses of data from response scales in this area are appropriate. Toward this end, we conducted preliminary analyses using nonparametric tests on a sample of studies. The sample consisted of the 15 studies included in the meta-analyses reported below for which we both had raw data available and that showed significant interactions on the emotion of "jealousy." For each study, we created a new categorical dependent variable (DV) coded with a value of −1 if the participant reported greater jealousy in response to emotional infidelity than in response to sexual infidelity, a value of 0 if the participant reported equal jealousy in response to both types of infidelity, and a value of 1 if the participant reported greater jealousy in response to sexual infidelity than in response to emotional infidelity. We then analyzed the sex difference across this DV in each study using a χ^2.

Of the 15 studies we reanalyzed, 12 showed significant χ^2s. The patterns of proportions exhibited in these studies exactly fit the predictions of the theory of evolved sex differences in jealousy. Analyses of the three remaining studies yielded nonsignificant χ^2s (p=.13, p=.15, p=.22), but all evinced theory-supportive patterns of proportions. Given the strong match between the results offered by the parametric tests and the nonparametric tests, these results offer compelling statistical evidence that the sex difference in jealousy is not an artifact of parametric tests misapplied to ordinal data.

3. The meta-analyses: an overview

The goals of the meta-analyses that we conducted were to determine whether the sex difference in jealousy manifests when jealousy is assessed using continuous measures and to identify moderators of the magnitude of the sex difference. One moderator of special interest was whether studies assessed responses to hypothetical infidelity scenarios or real-life infidelity experiences.

To this end, we sought the published and unpublished literature on sex differences in jealousy, calculated effect

sizes from relevant studies, and coded a series of moderators for each effect size. Our sample includes studies that assessed responses to hypothetical infidelity scenarios and to actual infidelity experiences. Dependent variables consisted primarily of emotions (e.g., jealousy, anger, distress) but also included the dependent measure of focus, as this was the measure used in a majority of studies measuring responses to actual infidelity experiences. For the emotions, the studies typically asked participants how much of the emotion participants felt in response to the sexual infidelity and in response to the emotional infidelity. For focus, the studies asked participants how much they focused on the sexual aspects of their partner's infidelity and how much they focused on the emotional aspects of their partner's infidelity (see the Discussion for an empirical examination of participants' interpretation of "focus").

Effect sizes represent the magnitude of the Participant Sex×Infidelity Type interaction, with positive effect sizes representing interactions whose patterns yielded support for the notion that there are evolved sex differences in responses to different kinds of infidelities as predicted by the theory and negative effect sizes representing interactions that are opposite to the interaction direction predicted by the theory.

We coded 23 moderators for each effect size. Some moderators were included to examine the generalizability of the sex difference (e.g., whether the study used random sampling, age, and nationality of participants; whether participants reported responses to hypothetical infidelity scenarios or actual infidelity experiences). Other moderators were included to test for researcher and publication bias (e.g., whether the study was published or unpublished, sex of the first author, whether one of the meta-analysis authors conducted or supervised the study). Finally, some moderators were included to determine whether various methodological or psychometric differences could account for the diversity of past findings (e.g., medium of study delivery, whether a forced-choice question was included, emotion measured, number of points on the response scale).

4. Method

4.1. Identification of articles

Candidate articles were identified from four sources: (a) electronic database searches of PsycINFO and the Web of Science using the keywords *jealousy* or *infidelity* in combination with *sex*, *gender*, *sex differences*, or *gender differences*; (b) Internet searches for relevant articles; (c) requests for unpublished and in-press studies sent to the Society for Personality and Social Psychology LISTSERV, the sexnet LISTSERV, and known authors in this area of research; and (d) lists of references from other articles within our sample as well as from review articles on this topic (Harris, 2003a, 2005; Sagarin, 2005). Data collection ended in 2008. Citation years for two studies (Edlund & Sagarin, 2009; Guadagno & Sagarin, 2010) were updated to reflect their subsequent publication. Similarly, the citation year for one study (Pudalov & Edlund, 2009) was updated to reflect its subsequent presentation. One additional study, Kimeldorf (2009), was added on the recommendation of a reviewer.

4.2. Inclusion criteria

To be included in the meta-analysis, studies needed to satisfy the following inclusion criteria:

1. The study assessed women's and men's reactions to sexual infidelity and to emotional infidelity. Studies that included participants of only one sex or that assessed reactions to only one type of infidelity were excluded as they could not provide evidence pertaining to the Participant Sex×Infidelity Type interaction that is of interest to this article. Studies that manipulated Infidelity Type within subject and studies that manipulated Infidelity Type between subjects were included.
2. Study participants were (or were presumed to be) heterosexual. Participants reported their reactions to infidelities in which their opposite sex romantic partners became involved with a rival of the same sex as the participant. Thus, studies of infidelities in same-sex relationships and studies of infidelities involving a rival of the same sex as the partner were excluded.
3. Emotional (e.g., jealousy, distress) or cognitive (e.g., focus) reactions to sexual and emotional infidelities were assessed on a response scale with a non-forced-choice response format. Other types of reactions (e.g., perceived likelihood of the relationship breaking up) were not included.
4. Behaviors constituting sexual infidelities needed to state or imply sexual intercourse (e.g., "sexual intercourse," "sex," "slept with," but not "kissing," "flirting," "oral sex").
5. The article or authors needed to supply sufficient statistical information to calculate an effect size for the Participant Sex×Infidelity Type interaction.

4.3. Sample of studies

A review of titles and abstracts of articles obtained through keyword searches, listserv requests, reference tracking, and recommendations yielded 91 candidate articles. Of these, 40 satisfied the inclusion criteria listed above. The 40 articles included 47 independent samples. Within each of the independent samples, between 1 and 103 separate reactions were measured. This yielded a total of 209 effect sizes. Of these, 199 effect sizes from 45 independent samples represent responses to hypothetical infidelity scenarios, and 10 effect sizes from 7 independent samples represent responses to actual infidelity experiences.

Of concern was the potentially disproportionate influence of the study with 103 separate reactions (Shackelford, LeBlanc, & Drass, 2000). However, most of the analyses we conducted average across multiple responses within each

independent sample. Thus, for most of the analyses, each independent sample (including Shackelford et al., 2000) provided a single average effect.

4.4. Variables coded from each study

For each article, independent sample, or effect size (depending upon the variable), we coded four types of variables: researcher variables, sample variables, study variables, and response scale variables. Researcher variables consisted of (a) whether the article was published or unpublished; (b) for published articles, the year of publication; (c) the sex of the first author; and (d) whether one of the authors who conducted the meta-analyses that we report conducted or supervised the research. Sample variables consisted of (a) whether the participants were obtained through random sampling, (b) mean age of participants, (c) whether participants were undergraduates, (d) whether undergraduate participants were Introduction to Psychology students, (e) country in which data collection took place (subsequently coded as USA vs. non-USA and individualistic vs. collectivistic), and (f) whether participants reported their sexual orientation. Study variables consisted of (a) medium of scenario delivery (written vs. audio/video/picture, etc.); (b) for written scenarios, delivery via paper vs. delivery via computer/web; (c) whether Infidelity Type was manipulated within subject or between subjects; (d) responses to hypothetical infidelity scenarios vs. retrospective reports of actual infidelity experiences; (e) whether hypothetical infidelity scenarios were direct adaptations of the scenarios of Buss et al. (1992); and (f) whether forced-choice responses were also assessed and, if so, whether the forced-choice question preceded the continuous-measure questions. Response scale variables consisted of (a) emotion measured, (b) number of points on response scale, (c) start point of response scale (0 or 1), (d) unipolar vs. bipolar response scale, (e) lower anchor of response scale (none of the emotion vs. a small amount of the emotion), (f) upper anchor of the response scale (incredibly, extremely, very, or completely), and (g) response scale point labeling (end points only, end and midpoint, vs. all points labeled).

Variables were coded initially by two independent coders. However, during the coding process, a number of discussions were necessary to clarify the coding protocol and to add and modify coding categories. As a result, we recruited a third coder to independently code all variables using the revised categories. Interrater reliability represents the comparison of the consensus of the first two coders with the independent codes provided by the third coder. Interrater reliabilities ranged from .65 to 1.00 (Cohen's kappa). Disagreements were resolved through discussion.

4.5. Calculation of effect sizes

We calculated effect sizes using statistical information provided in the articles combined, in most cases, with additional data or analyses provided by the original researchers. The statistical program CMA2 (Borenstein, Hedges, Higgins, & Rothstein, 2005) was used to calculate effect sizes and to perform the statistical analyses. Sufficient information to calculate an effect size was available for all studies included in the meta-analysis with one exception: For DeSteno et al. (2002), means, standard deviations, and sample sizes for female and male participants' responses to emotional and sexual infidelities were available, but the correlation between responses to emotional and sexual infidelities was not. We imputed a correlation for DeSteno et al. (2002) by averaging the correlations from Bassett (2005), which used the same response scale.

Effect sizes reflect the Participant Sex×Infidelity Type interaction, with positive effect sizes representing effects in the direction predicted by the theory of evolved sex differences in jealousy and negative effect sizes representing effects in the opposite direction. Thus, positive effect sizes reflect interactions in which men, relative to women, report a stronger negative reaction in response to sexual infidelity than in response to emotional infidelity. Negative effect sizes, in contrast, reflect interactions in which women, relative to men, report a stronger negative reaction in response to sexual infidelity than in response to emotional infidelity (effect directions were reversed when calculating effect sizes for positive emotions).

If the Infidelity Type variable was manipulated within subject, then effect sizes were calculated using Infidelity Type as a within-subject variable. For one study (Green & Sabini, 2006), responses to emotional infidelities and sexual infidelities were counterbalanced, and the original article focused on the between-subjects analysis of participants' first responses. The effect size used in the meta-analysis, in contrast, consisted of a within-subject analysis of both the first and second responses from participants. Thus, for Green and Sabini (2006), effect sizes used in the meta-analysis differ from those reported in the original article.

For studies that manipulated Infidelity Type as a purely between-subjects variable, effect sizes were calculated based on the pattern of contrast coefficients that represents an interaction in a 2×2 factorial design. This was accomplished by (a) combining the responses of male participants to sexual infidelity with the responses of female participants to emotional infidelity (by averaging the means and pooling the standard deviations), (b) combining responses of female participants to sexual infidelity with responses of male participants to emotional infidelity (again, by averaging the means and pooling the standard deviations), and (c) comparing (a) to (b).

Because meaningful between-study variance was anticipated, we used a random effects model to analyze the data. Effect sizes were calculated as g^*, an unbiased version of *Hedges's g*.

Finally, the present paper meets Simmons, Nelson, and Simonsohn's (2011) six requirements for authors. We chose and reported our a priori rule for terminating data

collection. Our synthesis included far more than 20 observations per cell. We presented all variables analyzed as part of the meta-analyses. We presented all results including nonsignificant results. When we eliminated effect sizes (typically due to concerns with independence), we reported alternate results that retain the effect sizes. None of our analyses included covariates.

5. Results

5.1. Responses to hypothetical infidelity scenarios

5.1.1. Do the sexes differ in their emotional responses to different infidelities?

Our first set of analyses addressed the basic question of whether a sex difference emerges in responses to different infidelities when responses are assessed using continuous measures. We first examined the effect across all 199 effect sizes representing responses to hypothetical infidelity scenarios, ignoring nonindependence (Fig. 3). Across all 199 effect sizes, a significant theory-supportive effect emerged, g^*=0.098, 95% confidence interval (CI) [0.074, 0.121], z=8.06, p<.00001. Of the 199 individual effects, 59 were statistically significant, 56 were in the theory-supportive direction and 3 were in the opposite direction ("disgusted," "undesirable," and "ashamed" from Shackelford et al., 2000).

To avoid violating the assumption of independence, we next examined the effect across the 45 independent samples, averaging across multiple outcomes within each sample (Fig. 4). Across the 45 independent samples, a significant theory-supportive effect emerged, g^*=0.258, 95% CI [0.188, 0.328], z=7.25, p<.00001. Of the 45 individual samples, 21 showed statistically significant effects, all in the theory-supportive direction (Table 2). In addition, the classic fail-safe N indicated that 2276 null studies would be needed to bring the overall p value to >.05. A Q-test for heterogeneity (run within a fixed effect model) revealed significant heterogeneity of effect sizes, Q_{44}=171.04, p<.00001. This significant heterogeneity offers statistical support for our decision to use a random effect model.

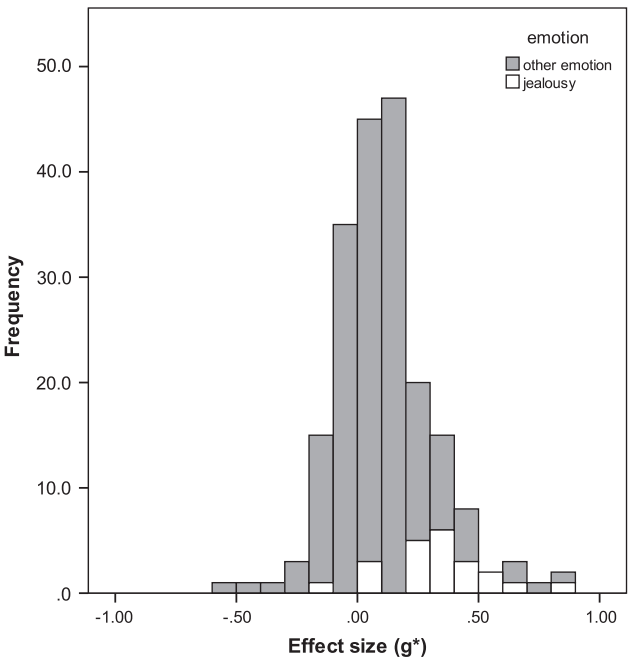

Fig. 3. Effects across the 199 effect sizes representing responses to hypothetical infidelity scenarios, with jealousy differentiated from other emotions.

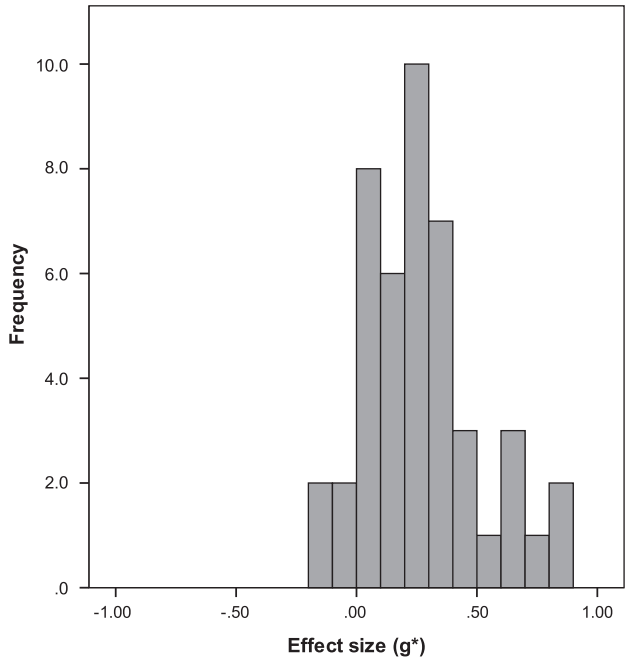

Fig. 4. Effects across the 45 independent samples (collapsing across multiple emotions within each sample) representing responses to hypothetical infidelity scenarios.

5.1.2. Does the magnitude of the sex difference effect depend upon the emotion measured?

Next, we examined whether the emotional response that was measured moderated the effects obtained. A total of 109 emotions were measured. A Q-test revealed that emotion significantly moderated the magnitude of the sex difference, Q_{108}=233.73, p<.00001 (Table 3). As can be seen in Table 3, the strongest effects emerged for distress/upset (g^*=0.337, 95% CI [0.207, 0.466], p<.00001), jealousy (g^*=0.309, 95% CI [0.231, 0.386], p<.00001), and a composite of emotions (g^*=0.256, 95% CI [0.016, 0.495], p=.04). Effect sizes for distress/upset and jealousy did not differ significantly, Q_1=0.14, p=.71. Other commonly measured negative emotions yielded weaker effects, including hurt (g^*=0.161, 95% CI [0.076, 0.246], p=.0002), anxiousness (g^*=0.085, 95% CI [−0.047, 0.218], p=.21), anger (g^*=0.074, 95% CI [−0.002, 0.150], p=.06), and disgust (g^*=0.012, 95% CI [−0.194, 0.217], p=.91; see Fig. 3 for the comparative

Table 2
Independent samples that assessed responses to hypothetical infidelity scenarios

Source	Emotion(s)	# women	# men	g*	95% CI	z	p
Bassett (2005)	Anger, calm, hurt, jealous, relieved, threatened	197.33[a]	68	0.276	[0.000, 0.552]	1.96	.0498
Bassett, Cole, and Vanman (2003)	Distress/upset	108	60	0.431	[0.114, 0.749]	2.66	.01
Becker, Sagarin, Guadagno, Millevoi, and Nicastle (2004)	Anger, disgust, hurt, jealous	102.75	91	0.082	[−0.200, 0.363]	0.57	.57
Bohner and Wänke (2004)	Jealous	54	71	0.634	[0.274, 0.995]	3.45	<.01
Brase (2005) study 2	Distress/upset	62	25	0.839	[0.362, 1.316]	3.45	<.01
Brase (2005) study 3	Distress/upset	456	180	0.445	[0.271, 0.619]	5.01	<.01
Buunk (1982) study 1	Bipolar unpleasant/pleasant	125	125	0.131	[−0.117, 0.378]	1.03	.30
Buunk (1982) study 2	Bipolar unpleasant/pleasant	125	125	−0.043	[−0.290, 0.204]	−0.34	.73
Buunk (1982) study 3	Bipolar unpleasant/pleasant	138	242	0.224	[0.014, 0.433]	2.09	.04
Cann and Baucom (2004)	Distress/upset	73	67	0.186	[−0.145, 0.516]	1.10	.27
Cann, Mangum, and Wells (2001)	Distress/upset	90	66	0.723	[0.397, 1.050]	4.35	<.01
Couto (2004)	Anger, hurt, jealous, nervous, relieved, threatened	103	89	−0.108	[−0.391, 0.175]	−0.75	.45
Demirtaş (2004)	Jealous	246	168	0.265	[0.068, 0.462]	2.64	.01
DeSteno et al. (2002)	Composite	61	50	0.266	[−0.107, 0.639]	1.40	.16
DeSteno and Salovey (1996)	Composite	31	34	0.327	[−0.157, 0.812]	1.33	.19
Edlund et al. (2006) study 1	Jealous	150	50	0.626	[0.301, 0.951]	3.78	<.01
Edlund et al. (2006) study 2	Jealous	47	20	0.462	[−0.061, 0.985]	1.73	.08
Edlund and Sagarin (2006)	Jealous	215	217	0.000	[−0.188, 0.188]	0.00	1.00
Edlund and Sagarin (2009)	Jealous	600	480	0.281	[0.160, 0.401]	4.57	<.01
Geary, DeSoto, Hoard, Sheldon, and Cooper (2001)	Anger, hurt, jealous	165.67	143	0.094	[−0.130, 0.318]	0.83	.41
Geary, Rumsey, Bow-Thomas, and Hoard (1995) study 1	Anger, hurt, jealous	300.67	206.33	0.137	[−0.040, 0.314]	1.51	.13
Geary et al. (1995) study 2	Anger, hurt, jealous	297	187	0.048	[−0.135, 0.231]	0.52	.61
Green and Sabini (2006)	Anger, distress/upset, hurt	189.67	175.33	0.129	[−0.077, 0.334]	1.23	.22
Guadagno and Sagarin (2010)	Anger, disgust, hurt, jealous	100	64	0.268	[−0.045, 0.582]	1.68	.09
Harris (2003b)	Distress/upset	219	139	0.183	[−0.030, 0.396]	1.69	.09
Haselton, Buss, Oubaid, and Angleitner (2005)	Distress/upset	237	236	0.348	[0.167, 0.529]	3.76	<.01
Johnson (2006)	Jealous	123	194	0.582	[0.352, 0.812]	4.96	<.01
Kimeldorf (2009)	Distress/upset	940	673	0.660	[0.558, 0.761]	12.74	<.01
Landolfi, Geher, and Andrews (2007)	Composite	53	40	0.192	[−0.216, 0.600]	0.92	.36
Parkhill (2004)	Distress/upset	144	68	0.300	[0.011, 0.589]	2.04	.04
Phillips (2006)	Anger, anxious, hostile, insecure, scared, threatened	74.83	74.83	−0.059	[−0.379, 0.260]	−0.36	.72
Pines and Friedman (1998)	Jealous	140	82	0.384	[0.110, 0.658]	2.75	<.01
Ponnampalam, Stokes, and Tooley (2005)	Anger, anxious, betrayed, hurt, rage, scared	543.83	176.17	0.046	[−0.124, 0.216]	0.53	.60
Pudalov and Edlund (2009)	Jealous	253	269	0.231	[0.059, 0.403]	2.64	<.01
Sabini and Green (2004)	Anger, distress/upset, hurt, jealous	80	102	0.067	[−0.225, 0.359]	0.45	.65
Sabini and Silver (2005)	Anger, hurt	75	73	0.363	[0.040, 0.687]	2.20	.03
Sagarin et al. (2003) study 1	Anger, disgust, hurt, jealous	120.75	83.25	0.383	[0.102, 0.663]	2.67	<.01
Sagarin et al. (2003) study 2	Anger, anxious, disgust, hurt, jealous	212.8	138	0.223	[0.009, 0.438]	2.04	.04
Sagarin and Guadagno (2004)	Jealous	56	24	0.803	[0.313, 1.292]	3.21	<.01
Shackelford et al. (2000)	103 emotions[b]	321.87	329.77	0.046	[−0.108, 0.199]	0.58	.56
St. Pierre (2006)	Distress/upset	496	667	0.046	[−0.070, 0.162]	0.78	.44
Susskind, O'Bryan, and Parkin (2005)	Distress/upset	171	70	0.207	[−0.071, 0.485]	1.46	.14
Takahashi et al. (2006)	Anger, anxious, disgust, jealous, sad, scared, surprised	11	11	−0.156	[−0.965, 0.653]	−0.38	.71
Wade and Fowler (2006)	Distress/upset	47	38	0.351	[−0.076, 0.778]	1.61	.11
Wiederman and Allgeier (1993)	Distress/upset	120	103	0.315	[0.051, 0.578]	2.34	.02

[a] Fractional numbers of participants can occur when some emotions contain missing data.

[b] The 103 emotions assessed in Shackelford et al. (2000) were abandoned, abused, afraid, aggressive, alarmed, alone, aloof, anger, anguish, annoyed, anxious, aroused, ashamed, astonished, at ease, beaten, betrayed, bitter, blameworthy, bored, boring, calm, confused, content, deceived, delighted, depressed, disappointed, disbelief, disgust, disrespected, distress/upset, droopy, duped, embarrassed, empty, enraged, excited, foolish, forgiving, frustrated, glad, gloomy, guilty, happy, hatred, heartbroken, helpless, homicidal, hopeless, hostile, humiliated, hurt, inadequate, incompetent, inept, inferior, insecure, jealous, let-down, lonely, miserable, nauseated, neglected, numb, outraged, physically unattractive, pleased, powerless, rejected, relaxed, relieved, repulsed, responsible, sad, satisfied, self-conscious, self-hate, serene, sexually aroused, shattered, shocked, sickened, sleepy, spiteful, suicidal, surprised, tense, tired, unappreciated, understanding, undesirable, unforgiving, unimportant, unloved, unwanted, used, vengeful, violated, violent, weepy, worried, and worthless.

Table 3
Effect sizes across emotions in response to hypothetical infidelity scenarios

Emotion	# studies	g*	95% CI	z	p
Abandoned	1	0.211	[0.057, 0.365]	2.69	.01
Abused	1	−0.004	[−0.157, 0.149]	−0.05	.96
Afraid	1	0.028	[−0.125, 0.181]	0.36	.72
Aggressive	1	0.066	[−0.087, 0.219]	0.84	.40
Alarmed	1	0.009	[−0.145, 0.163]	0.11	.91
Alone	1	0.008	[−0.145, 0.161]	0.10	.92
Aloof	1	−0.015	[−0.170, 0.141]	−0.18	.85
Anger	16	0.074	[−0.002, 0.150]	1.92	.06
Anguish	1	0.098	[−0.056, 0.252]	1.24	.21
Annoyed	1	−0.141	[−0.295, 0.013]	−1.80	.07
Anxious	5	0.085	[−0.047, 0.218]	1.26	.21
Aroused	1	0.053	[−0.100, 0.207]	0.68	.50
Ashamed	1	−0.183	[−0.337, −0.030]	−2.34	.02
Astonished	1	0.112	[−0.042, 0.265]	1.43	.15
At ease	1	0.019	[−0.134, 0.173]	0.25	.80
Beaten	1	0.176	[0.022, 0.331]	2.24	.02
Betrayed	2	0.009	[−0.263, 0.280]	0.06	.95
Bipolar unpleasant/pleasant	3	0.114	[−0.040, 0.268]	1.45	.15
Bitter	1	−0.060	[−0.213, 0.094]	−0.76	.45
Blameworthy	1	−0.090	[−0.244, 0.063]	−1.15	.25
Bored	1	−0.042	[−0.195, 0.112]	−0.53	.59
Boring	1	−0.019	[−0.172, 0.135]	−0.24	.81
Calm	2	0.156	[0.022, 0.290]	2.28	.02
Composite	3	0.256	[0.016, 0.495]	2.09	.04
Confused	1	0.126	[−0.027, 0.279]	1.61	.11
Content	1	−0.047	[−0.200, 0.106]	−0.60	.55
Deceived	1	0.005	[−0.148, 0.158]	0.07	.95
Delighted	1	0.034	[−0.119, 0.187]	0.43	.66
Depressed	1	0.063	[−0.090, 0.216]	0.80	.42
Disappointed	1	0.160	[0.006, 0.313]	2.04	.04
Disbelief	1	0.239	[0.085, 0.392]	3.04	<.01
Disgust	6	0.012	[−0.193, 0.217]	0.11	.91
Disrespected	1	−0.082	[−0.235, 0.071]	−1.05	.30
Distress/upset	17	0.337	[0.207, 0.466]	5.10	<.01
Droopy	1	0.170	[0.015, 0.324]	2.15	.03
Duped	1	0.115	[−0.042, 0.272]	1.44	.15
Embarrassed	1	0.130	[−0.023, 0.283]	1.66	.10
Empty	1	0.194	[0.040, 0.348]	2.47	.01
Enraged	1	0.039	[−0.114, 0.192]	0.50	.62
Excited	1	0.027	[−0.126, 0.181]	0.35	.73
Foolish	1	−0.035	[−0.188, 0.118]	−0.45	.65
Forgiving	1	0.116	[−0.037, 0.270]	1.49	.14
Frustrated	1	0.026	[−0.127, 0.179]	0.33	.74
Glad	1	0.019	[−0.134, 0.172]	0.24	.81
Gloomy	1	0.181	[0.028, 0.335]	2.31	.02
Guilty	1	−0.139	[−0.292, 0.014]	−1.78	.08
Happy	1	−0.084	[−0.238, 0.069]	−1.08	.28
Hatred	1	0.125	[−0.029, 0.278]	1.59	.11
Heartbroken	1	0.152	[−0.001, 0.305]	1.94	.05
Helpless	1	0.100	[−0.053, 0.253]	1.28	.20
Homicidal	1	0.140	[−0.013, 0.294]	1.79	.07
Hopeless	1	0.159	[0.005, 0.312]	2.02	.04
Hostile	2	0.075	[−0.063, 0.213]	1.06	.29
Humiliated	1	−0.007	[−0.160, 0.147]	−0.09	.93
Hurt	14	0.161	[0.076, 0.246]	3.72	<.01
Inadequate	1	0.019	[−0.134, 0.173]	0.25	.80
Incompetent	1	−0.010	[−0.163, 0.143]	−0.13	.90
Inept	1	0.157	[0.000, 0.315]	1.95	.05
Inferior	1	0.189	[0.035, 0.342]	2.40	.02
Insecure	2	−0.041	[−0.415, 0.334]	−0.21	.83
Jealous	22	0.309	[0.231, 0.386]	7.83	<.01
Let-down	1	0.055	[−0.098, 0.208]	0.70	.48

Table 3 (*continued*)

Emotion	# studies	*g**	95% CI	*z*	*p*
Lonely	1	0.221	[0.067, 0.374]	2.81	<.01
Miserable	1	0.032	[−0.121, 0.185]	0.41	.68
Nauseated	1	0.023	[−0.130, 0.176]	0.29	.77
Neglected	1	0.134	[−0.019, 0.288]	1.71	.09
Nervous	1	−0.091	[−0.374, 0.192]	−0.63	.53
Numb	1	0.205	[0.051, 0.358]	2.62	.01
Outraged	1	0.089	[−0.065, 0.242]	1.13	.26
Physically unattractive	1	−0.013	[−0.166, 0.141]	−0.16	.87
Pleased	1	−0.109	[−0.263, 0.044]	−1.40	.16
Powerless	1	0.120	[−0.033, 0.273]	1.53	.12
Rage	1	−0.166	[−0.337, 0.005]	−1.91	.06
Rejected	1	0.141	[−0.012, 0.295]	1.80	.07
Relaxed	1	0.145	[−0.009, 0.298]	1.85	.06
Relieved	3	0.120	[−0.001, 0.241]	1.95	.05
Repulsed	1	−0.128	[−0.282, 0.026]	−1.63	.10
Responsible	1	−0.074	[−0.227, 0.079]	−0.95	.34
Sad	2	−0.023	[−0.223, 0.176]	−0.23	.82
Satisfied	1	0.043	[−0.110, 0.196]	0.55	.58
Scared	3	0.115	[−0.034, 0.264]	1.52	.13
Self-conscious	1	−0.064	[−0.217, 0.090]	−0.81	.42
Self-hate	1	−0.073	[−0.226, 0.081]	−0.93	.35
Serene	1	−0.027	[−0.181, 0.128]	−0.34	.74
Sexually aroused	1	−0.011	[−0.164, 0.142]	−0.14	.89
Shattered	1	0.190	[0.036, 0.343]	2.42	.02
Shocked	1	0.097	[−0.057, 0.250]	1.24	.22
Sickened	1	−0.098	[−0.252, 0.055]	−1.26	.21
Sleepy	1	−0.074	[−0.228, 0.079]	−0.95	.34
Spiteful	1	0.064	[−0.090, 0.217]	0.81	.42
Suicidal	1	0.100	[−0.054, 0.253]	1.28	.20
Surprised	2	0.153	[0.002, 0.304]	1.99	.047
Tense	1	0.138	[−0.016, 0.291]	1.76	.08
Threatened	3	−0.037	[−0.403, 0.329]	−0.20	.84
Tired	1	−0.024	[−0.177, 0.130]	−0.30	.76
Unappreciated	1	−0.067	[−0.220, 0.087]	−0.85	.39
Understanding	1	0.050	[−0.103, 0.203]	0.64	.52
Undesirable	1	−0.191	[−0.344, −0.037]	−2.43	.01
Unforgiving	1	0.073	[−0.080, 0.226]	0.93	.35
Unimportant	1	−0.093	[−0.246, 0.061]	−1.18	.24
Unloved	1	0.140	[−0.014, 0.293]	1.78	.07
Unwanted	1	−0.013	[−0.166, 0.140]	−0.16	.87
Used	1	−0.086	[−0.240, 0.067]	−1.10	.27
Vengeful	1	0.044	[−0.109, 0.198]	0.57	.57
Violated	1	−0.061	[−0.215, 0.092]	−0.78	.43
Violent	1	0.139	[−0.014, 0.292]	1.78	.08
Weepy	1	0.000	[−0.153, 0.153]	0.00	1.00
Worried	1	−0.028	[−0.181, 0.126]	−0.35	.72
Worthless	1	0.023	[−0.130, 0.176]	0.30	.77

distributions of effect sizes for jealousy and for other emotions).

These results suggest that the sex difference manifests most strongly when distress/upset or jealousy is assessed and that the magnitude of the sex difference decreases when other emotions are assessed. In an effort to determine whether the decrease in the magnitude of the sex difference is related to the distance of the assessed emotion from jealousy, we coded each emotion according to its distance from jealousy on Plutchik's (1980) emotion circumplex (a configuration in which emotion terms are assigned angular placements on a circle based on their relative similarity to each other). Jealousy was coded as 0, with other emotions coded as the absolute value of the difference between the code for that emotion and the code for jealousy (distress/upset did not appear on Plutchik's circumplex). For this analysis, effect sizes for positive emotions retained their original signs (i.e., they were not reversed as they were for all other analyses). Meta-regressing effect size on distance from jealousy revealed a significant effect of distance, with greater distance from jealousy associated with smaller effects, b=−0.00121, S.E.$_b$=0.00021, z=−5.80, p<.01. However, removing jealousy rendered this meta-regression nonsignificant, b=−0.00025, S.E.$_b$=0.00025, z=−1.01, p=.31. Thus,

the effect stemmed from jealousy evincing both the lowest distance and the largest effect size.

5.1.3. What moderates the magnitude of the Participant Sex×Infidelity Type interaction?

We tested 19 categorical moderators and 3 continuous moderators of responses to hypothetical infidelity scenarios. The primary tests involved all 45 independent samples, with the effect size from each sample representing the average effect size across the 1 to 103 measured emotions (Table 4). Because emotion itself significantly moderated the magnitude of the sex difference, a supplemental set of tests was run using just the effect sizes corresponding to the emotion of jealousy across the 22 independent samples that measured jealousy (see last two columns of Table 4). Three studies included one or more moderators as independent variables

Table 4
Potential moderators of responses to hypothetical infidelity scenarios

Moderator	Group	All emotions (45 samples)							Jealousy only (22 samples)	
		# studies	*g**	95% CI	*z*	*p*	*Q*	*p*	*Q*	*p*
Published	Published	31	0.241	[0.178, 0.304]	7.50	<.01	0.09	.76	1.53	.22
	Unpublished	14	0.268	[0.112, 0.423]	3.37	<.01				
Gender of first author	Female	10	0.319	[0.163, 0.474]	4.02	<.01	1.10	.29	1.26	.26
	Male	35	0.228	[0.161, 0.295]	6.67	<.01				
Laboratory	Meta-analysis authors	11	0.314	[0.192, 0.436]	5.05	<.01	1.00	.32	1.54	.21
	Other researchers	34	0.238	[0.154, 0.323]	5.52	<.01				
Sampling	Nonrandom	41	0.270	[0.195, 0.346]	7.04	<.01	4.39	.04	9.94	<.01
	Random	3	0.111	[−0.018, 0.240]	1.69	.09				
Sample	Nonstudent	7	0.104	[−0.022, 0.229]	1.62	.10	7.23	<.01	2.19	.14
	Student	33	0.309	[0.227, 0.391]	7.39	<.01				
Student type	Introduction to psychology	19	0.288	[0.198, 0.378]	6.28	<.01	0.23	.63	0.41	.52
	Other	14	0.330	[0.184, 0.475]	4.44	<.01				
Country[a]	Non-USA	9	0.180	[0.065, 0.295]	3.07	<.01	1.99	.16	0.89	.35
	USA	36	0.281	[0.201, 0.361]	6.85	<.01				
Country type[a]	Collectivistic	4	0.240	[0.093, 0.388]	3.20	<.01	0.05	.82	0.14	.71
	Individualistic	42	0.260	[0.186, 0.334]	6.86	<.01				
Sexual orientation	Heterosexual	13	0.229	[0.110, 0.348]	3.77	<.01	0.25	.61	0.06	.80
	Not assessed	31	0.267	[0.181, 0.353]	6.08	<.01				
Scenario medium	Nonwritten	2	0.110	[−0.128, 0.347]	0.90	.37	1.47	.23	0.01	.92
	Written	42	0.263	[0.190, 0.336]	7.06	<.01				
Paper vs. computer	Computer	7	0.176	[0.014, 0.338]	2.14	.03	1.60	.21	2.80	.09
	Paper	34	0.292	[0.212, 0.373]	7.15	<.01				
Infidelity Type manipulation	Between subjects	5	0.129	[−0.055, 0.313]	1.37	.17	2.03	.15	0.43	.51
	Within subject	40	0.273	[0.199, 0.347]	7.22	<.01				
Scenario	Buss et al. (1992)	19	0.298	[0.182, 0.414]	5.02	<.01	1.66	.20	0.14	.71
	Other	25	0.207	[0.132, 0.282]	5.41	<.01				
Forced choice[b]	After	8	0.439	[0.283, 0.594]	5.52	<.01	8.37	.02	6.58	.04
	Before	15	0.244	[0.144, 0.344]	4.80	<.01				
	Not included	20	0.180	[0.099, 0.261]	4.34	<.01				
Start point	0	8	0.153	[0.034, 0.272]	2.51	.01	2.02	.15	0.04	.84
	1	33	0.259	[0.175, 0.343]	6.03	<.01				
Scale type	Unipolar	40	0.267	[0.191, 0.343]	6.88	<.01	3.04	.08	—[e]	
	Bipolar	3	0.114	[−0.040, 0.268]	1.45	.15				
Lower anchor	None	37	0.266	[0.185, 0.348]	6.39	<.01	0.24	.63	—[e]	
	A small amount	2	0.310	[0.151, 0.469]	3.83	<.01				
Upper anchor[c]	Completely	4	0.228	[−0.010, 0.466]	1.88	.06	1.67	.64	3.84	.15
	Extremely	35	0.292	[0.204, 0.381]	6.48	<.01				
	Incredibly	2	0.289	[−0.006, 0.585]	1.92	.06				
	Very	14	0.201	[0.090, 0.313]	3.54	<.01				
Labeling[d]	All points labeled	2	−0.080	[−0.406, 0.246]	−0.48	.63	4.40	.11	5.62	.06
	End points only	45	0.271	[0.193, 0.348]	6.86	<.01				
	Ends and middle	9	0.290	[0.143, 0.436]	3.87	<.01				

[a] Chinese and US subsamples from Geary et al. (1995) were analyzed separately.

[b] Kimeldorf (2009) included two pairs of continuous-measure questions with a forced-choice question after each pair. The moderator analysis for forced choice included Kimeldorf in the "after" category. An alternative analysis excluding this study produced similar results.

[c] Subsamples with different upper anchors from Edlund and Sagarin (2009) and Sagarin and Guadagno (2004) were analyzed separately.

[d] Subsamples with different point labeling from Edlund and Sagarin (2009) were analyzed separately.

[e] Jealousy only results listed as "—" indicate that all effects occurred in one category, so no test was run.

Table 5
Correlations between moderators

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
1: Published	–																							
2: Gender of first author	−.22	–																						
3: Laboratory	.05	−.06	–																					
4: Sampling	.02	−.09	−.05	–																				
5: Sample	−.31	−.07	−.11	−.37*	–																			
6: Student type	.00	−.30	.39*	.21	—[b]	–																		
7: Country	.01	−.08	−.28	−.12	.26	−.38*	–																	
8: Country type	−.09	.16	−.13	.06	−.08	−.22	.50*	–																
9: Sexual orientation	−.02	.04	.32*	.18	−.14	−.10	−.01	.09	–															
10: Scenario medium	.14	−.11	−.13	.06	.20	−.21	−.10	−.05	−.14	–														
11: Paper vs. computer	−.20	−.08	.02	−.37*	.60*	−.31	.01	.19	.14	−.10	–													
12: Infidelity Type manipulation	−.07	−.02	−.20	.10	−.15	.32	−.17	−.08	.08	−.08	−.15	–												
13: Scenario	.10	−.04	.66*	−.12	−.16	.38*	−.40*	−.19	.03	−.20	.09	−.31*	–											
14: Forced choice[a]	.16	.16	.23	.29	.37	.12	.09	.20	.08	.20	.22	.28	.41*	–										
15: Start point	.16	−.14	.26	.14	−.24	.38*	−.21	−.10	.05	−.12	−.23	.05	.30	.40*	–									
16: Scale type	−.18	.15	.16	.28	−.19	.20	−.62*	.06	.19	.06	.14	.09	.24	.29	.14	–								
17: Lower anchor	−.16	−.15	.15	−.05	.11	.04	.09	.06	.16	.05	.12	−.30	.22	.26	.13	—[b]	–							
18: Upper anchor[a]	.25	.28	.38	.30	.50*	.27	.26	.20	.34	.42	.42	.21	.44	NS[c]	.37	.49*	.17	–						
19: Labeling	−.04	−.20	.18	−.09	−.11	.29	−.06	−.30	.22	−.69*	.16	.10	.28	.33	.17	−.09	.30	.21	–					
20: Age	.09	−.10	.19	.75*	−.81*	.31	−.09	.06	.00	−.24	−.56*	.17	.06	.27	.21	—[b]	−.15	.60*	.04	–				
21: Scale length	.22	.10	.05	−.03	−.35*	−.31	−.07	.06	−.24	.06	−.34*	.07	.14	.18	.05	−.02	−.03	.47*	−.08	.45*	–			
22: Publication year	—[b]	−.22	−.37*	−.24	.20	−.01	.62*	−.12	−.37*	−.17	−.22	−.17	−.24	.23	.03	−.84*	.12	.35	.23	.19	−.26	–		
23: Distress/upset	.17	−.14	.44*	.02	−.16	.24	.21	.18	.08	−.06	−.06	.13	.37*	.16	.22	−.21	.29	.20	.08	.34	.21	.17	–	
24: Jealousy	−.18	.10	−.58*	−.09	.18	−.27	.05	−.24	−.25	.00	.08	.06	−.41*	.21	−.36*	−.27	−.25	.38	.02	−.25	−.16	.33	−.49*	–

[a] Forced choice and upper anchor are categorical variables with more than two levels. Relationships between these variables and other variables represent multiple *R*s. The significant relationships between forced choice and scenario and start point stemmed from a greater tendency for studies that included the forced-choice question before the continuous-measure questions (compared to studies that included the forced-choice question after the continuous-measure questions and studies that did not include the forced-choice question) to use the scenarios from Buss et al. (1992) and a start point of 0. The significant relationships between upper anchor and sample and age stemmed from a greater tendency for studies with older, nonstudent participants (compared to studies with younger, student participants) to use "completely" and "very" as the upper anchor. The significant relationship between upper anchor and scale type stemmed from all three studies with bipolar scales using "very" as the upper anchor. The significant relationship between upper anchor and scale length stemmed from the study with the 100-point scale using "completely" as the upper anchor.

[b] Results listed as "—" indicate that one variable had no variance when correlated with the other variable.

[c] The relationship between forced choice and upper anchor was tested with χ^2, which was nonsignificant, χ^2_6=10.369, N=39, p=.11.

* Indicates significant relationships, p<.05. All relationships except those involving forced choice and upper anchor are correlations. Categorical moderators are coded starting with 0 in the order that the categories appear in Table 4. For example, the significant positive correlation between laboratory (coded 0: meta-analysis authors, 1: other researchers) and student type (coded 0: introduction to psychology, 1: other) indicates that studies conducted or supervised by meta-analysis authors were significantly more likely to use introduction to psychology students (versus other types of students) compared to studies conducted by other researchers. Distributions of categorical moderators can be found in Table 4. Descriptives for continuous moderators are as follows: M_{age}=22.6, S.D.$_{age}$=6.2, $M_{scale\ length}$=9.8, S.D.$_{scale\ length}$=14.2, $M_{publication\ year}$=2000.8, S.D.$_{publication\ year}$=7.4. Distress/upset and jealousy are dichotomous variables indicating whether or not the emotion was measured in a particular study (coded 0: not measured, 1: measured).

[Edlund & Sagarin (2009) manipulated number of points, upper anchor, and labeling of the response scale; Geary et al., (1995) included Chinese and US samples; Sagarin & Guadagno (2004) manipulated the upper anchor of the response scale]. For tests of these moderators, the subsamples were included as independent samples. For tests of other moderators (and for the overall tests presented above), the subsamples were combined into a single sample (see Table 5 for correlations between moderators).

Across the 45 independent samples, collapsing across emotion, three significant and one marginally significant moderators emerged. Studies with nonrandom samples produced significantly larger effects (g*=0.270, 95% CI [0.195, 0.346], p<.01) than did studies with random samples (g*=0.111, 95% CI [−0.018, 0.240], p=.09), Q_1=4.39, p=.04. Studies with student samples produced significantly larger effects (g*=0.309, 95% CI [0.227, 0.391], p<.01) than did studies with nonstudent samples (g*=0.104, 95% CI [−0.022, 0.229], p=.10), Q_1=7.23, p<.01. Effect sizes differed significantly between studies that asked the forced-choice question after the continuous-measure questions (g*=0.439, 95% CI [0.283, 0.594], p<.01), studies that asked the forced-choice question before the continuous-measure questions (g*=0.244, 95% CI [0.144, 0.344], p<.01), and studies that did not ask the forced-choice question (g*=0.180, 95% CI [0.099, 0.261], p<.01), Q_2=8.37, p=.02. Studies with unipolar scales produced marginally larger effects (g*=0.267, 95% CI [0.191, 0.343], p<.01) than did studies with bipolar scales (g*=0.114, 95% CI [−0.040, 0.268], p=.15), Q_1=3.04, p=.08.

Of these moderators, two also emerged when examining the 22 independent samples that assessed jealousy: random versus nonrandom sampling and the inclusion (and placement) versus exclusion of the forced-choice question. Student versus nonstudent sample was nonsignificant across the 22 independent samples that assessed jealousy. Unipolar versus bipolar scale was not tested across the 22 independent samples that assessed jealousy because all studies that assessed jealousy used unipolar scales.

In addition, two moderators emerged across the 22 independent samples that assessed jealousy but not across the 45 independent samples, collapsing across emotion. Studies administered on paper produced marginally larger effects than did studies administered on a computer, Q_1=2.80, p=.09. Effect sizes differed marginally based on whether response scales labeled end and middle points, end points only, or all points, Q_2=5.62, p=.06.

The three continuous moderators (age, number of points in the response scale, and year of publication) were tested using CMA2′s meta-regression analysis. As with the categorical moderators, continuous moderators were analyzed across the 45 independent samples, collapsing across emotion, and across the 22 independent samples that measured jealousy.

Meta-regressing effect size on age in the 45 independent samples, collapsing across emotion, yielded a significant effect of age, b=−0.0071, S.E.$_b$=0.0026, z=−2.74, p<.01; as average age of the sample increased, the effect size decreased. The same meta-regression in the 22 independent samples that measured jealousy yielded a nonsignificant effect of age, b=0.0084, S.E.$_b$=0.0118, z=0.71, p=.48.

Meta-regressing effect size on number of points in the response scale in the 45 independent samples, collapsing across emotion, yielded a significant effect of number of points, b=−0.0027, S.E.$_b$=0.0006, z=−4.23, p<.01; as number of points in the response scale increased, effect size decreased. This effect remained when two studies with response scales with very large numbers of points (100 and 101) were removed, b=−0.0401, S.E.$_b$=0.0106, z=−3.78, p<.01. However, the meta-regression in the 22 independent samples that measured jealousy yielded nonsignificant effects whether response scales with very large numbers of points were included, b=−0.0037, S.E.$_b$=0.0025, z=−1.48, p=.14, or excluded, b=0.0162, S.E.$_b$=0.0147, z=1.11, p=.27.

Meta-regressing effect size on year of publication in the 45 independent samples, collapsing across emotion, yielded a significant effect of year of publication, b=0.0072, S.E.$_b$=0.0029, z=2.49, p=.01; as year of publication increased,

Table 6
Independent samples that assessed responses to actual infidelity experiences

Source	DV	# women	# men	g*	95% CI	z	p
Edlund and Sagarin (2006)	Jealousy	452	333	0.034	[−0.107, 0.176]	0.48	.63
Edlund, Heider, Scherer, Farc, and Sagarin (2006) study 1	Combined	81	23	0.475	[0.011, 0.940]	2.01	.04
	Focus			0.458	[−0.006, 0.922]	1.93	.05
	Jealousy			0.493	[0.028, 0.958]	2.08	.04
Edlund, Heider, Scherer, Farc, and Sagarin (2006) study 2	Combined	49	20	0.615	[0.091, 1.140]	2.30	.02
	Focus			0.564	[0.041, 1.087]	2.11	.03
	Jealousy			0.666	[0.140, 1.192]	2.48	.01
Harris (2002)	Focus	30	29	−0.172	[−0.677, 0.332]	−0.67	.50
Harris (2003b)	Focus	81	46	0.058	[−0.302, 0.418]	0.32	.75
Johnson (2006)	Combined	65	66	0.533	[0.186, 0.880]	3.01	<.01
	Focus			0.584	[0.236, 0.932]	3.29	<.01
	Jealousy			0.482	[0.136, 0.827]	2.73	<.01
Kimeldorf (2009)	Upset	47	21	0.272	[−0.239, 0.783]	1.04	.30

the effect size increased. The same meta-regression in the 22 independent samples that measured jealousy yielded a nonsignificant effect of year of publication, b=0.0090, S.E.$_b$=0.0058, z=1.56, p=.12.

5.2. Responses to actual infidelity experiences

Seven independent samples measured responses to actual infidelity experiences. Of these, one sample assessed jealousy, two samples assessed focus, three samples assessed both jealousy and focus, and one sample assessed upset (Table 6).

Across the seven independent samples, collapsing across DV, a significant, theory-supportive effect emerged, g*=0.234, 95% CI [0.020, 0.448], p=.03, with three out of seven individual effects statistically significant, all in the theory-supportive direction. However, the classic fail-safe N indicated that only 12 null studies would be needed to bring the overall p value to >.05. When the DVs were examined separately, significant effects emerged for jealousy, g*=0.370, 95% CI [0.031, 0.709], p=.03, and focus, g*=0.303, 95% CI [0.013, 0.594], p=.04, but not upset, g*=0.272, 95% CI [−0.239, 0.783], p=.30.

Finally, a comparison of responses to actual infidelity experiences (g*=0.234) against responses to hypothetical infidelity scenarios (g*=0.258) (treating both measures as independent in the five studies that measured both) revealed no significant differences, Q_1=0.04, p=.83. A parallel analysis that met the independence assumption by excluding the hypothetical infidelity results from studies that measured responses to both hypothetical and actual infidelities also revealed no significant differences, Q_1=0.02, p=.88.

6. Discussion

The theory of evolved sex differences in jealousy has inspired numerous studies and provoked intense criticism. Two major areas of criticism center on the question of whether the sex difference in jealousy is an artifact of the forced-choice method and whether the effect is an artifact stemming from affective forecasting errors in response to the hypothetical scenarios that have been used in the research. The meta-analyses that we report were designed to address these criticisms by (a) determining whether there is or is not a sex difference in jealousy when jealousy is assessed with continuous measures, (b) determining whether the sex difference appears in response to actual infidelity experiences, and (c) comparing the effect obtained in responses to the hypothetical experiences and the real-life experiences. An additional goal of our meta-analyses was to identify moderators of the sex difference in jealousy. Below, we summarize the results of the meta-analyses, discuss limitations of the results, and consider the state of the evidence for and against the theory. We begin with the basic questions that motivated the meta-analyses.

6.1. Is the sex difference in jealousy an artifact of the forced-choice response format?

No. One of the clearest findings in the meta-analyses is the existence of a sex difference in negative emotional responses to hypothetical infidelity scenarios using continuous measures. This sex difference appears (a) when the effect is examined across the 199 effect sizes (ignoring independence) (g*=0.098, 95% CI [0.074, 0.121], p<.00001), (b) when considering the significance of the individual effects (59 out of 199 effects were statistically significant, 56 in the theory-supportive direction and 3 in the opposite direction), (c) when the effect is examined across the 45 independent samples (averaging across multiple outcomes within each sample) (g*=0.258, 95% CI [0.188, 0.328], p<.00001), and (d) when considering the significance of the individual independent effects (21 out of 45 effects were statistically significant, all in the theory-supportive direction).

6.2. What moderates the magnitude of the sex difference effect?

A primary moderator identified in the meta-analyses is the emotion measured, with distress/upset (the emotion measured by Buss et al., 1992, and a number of subsequent studies) and jealousy (arguably, the most central emotion to the theory) producing the largest effects. Other negative emotions, including emotions theorized to accompany episodes of jealousy (e.g., fear, anxiety, and anger; Parrot & Smith, 1993), produced smaller effects. Thus, although a range of negative emotions have been used as the dependent variables in studies of sex differences in jealousy, the present evidence suggests that jealousy is meaningfully different from these other negative emotions. Indeed, the choice of emotion measured helps to explain the diversity of past findings, with studies that measured distress/upset and jealousy producing significantly larger effects than studies that measured other emotions.

We tested 21 additional moderators in two ways: within the 45 independent samples (averaging across emotions within each sample) and within the 22 independent samples that measured jealousy. The former analysis has the advantage of including all independent samples for which the moderator could be assessed, but it has the disadvantage of including a heterogeneous set of emotions, which introduces the risk that levels of the moderator might be confounded with measured emotions. The latter analysis addresses this risk by including only the emotion of jealousy, but at the cost of reducing the number and diversity of independent samples included. Moderators that emerge only in the former analysis should be interpreted with caution because of the risk of confounding. Moderators that emerge only in the latter analysis should be interpreted with caution because of the reduced generalizability of the subsample of studies included. Moderators that emerge across both analyses can be interpreted with greater confidence.

Two moderators yielded consistent effects across both the 45 independent samples (collapsing across emotion) and the

22 independent samples that measured jealousy. In both analyses, studies using nonrandom samples (typically student samples) produced significantly larger effects than studies using random samples. This is a troubling finding for the theory of evolved sex differences in jealousy, as it shows that the studies with the greatest generalizability (those with random selection) yielded smaller effects. We should note, however, that only three studies used random sampling, and these three studies yielded a marginal average effect, g^*=0.111, 95% CI [−0.018, 0.240], z=1.69, p=.09. Nevertheless, this result highlights the need for further investigation into the generalizability of the sex difference in jealousy and into potential demographic moderators of the magnitude of the sex difference.

In addition, the inclusion of a forced-choice question significantly impacted effect sizes. Given the robustness of the sex difference when jealousy is assessed using the forced-choice measure (Harris, 2003a), it seems plausible that, if participants use their forced-choice answer as an anchor when answering the continuous-measure questions, the inclusion of the forced-choice measure might yield larger effects on those continuous measures. However, the largest effects occurred in the eight studies in which the forced-choice question appeared after the continuous-measure questions, reducing the plausibility of this explanation. Furthermore, a significant, theory-supportive sex difference appeared across the studies that did not include a forced-choice measure, offering further evidence that the sex difference in jealousy is not an artifact of the forced-choice response format. Nevertheless, the fact that the largest effects appeared in studies in which the forced-choice question appeared after the continuous-measure questions remains one of the more puzzling findings of the meta-analyses—one that might merit further psychometric investigation.

Four moderators showed effects across the 45 independent samples (collapsing across emotion) but not across the 22 independent samples that measured jealousy: (a) student samples yielded significantly larger effects than nonstudent samples, (b) younger samples yielded significantly larger effects than older samples, (c) samples with a smaller number of points in the response scales yielded significantly larger effects than samples with a larger number of points, and (d) more recent studies yielded significantly larger effects than earlier studies. The first two of these findings (larger effects in younger samples and student samples) align with similar findings in Harris' (2003a) meta-analysis of forced-choice studies and are consistent with the prediction of Buss et al. (1992) "that male sexual jealousy will diminish as the age of the male's mate increases because her reproductive value decreases" (p. 254). More generally, this finding aligns with other mating-related mechanisms that appear to manifest most strongly at or after puberty when people are most actively involved in mate competition and that diminish as people get older and further from such competition (Buss, 2008). The finding that response scales with larger numbers of points yielded smaller effects might stem from the fact that the shortest response scales in the meta-analysis were 5-point scales and that reliability for unipolar scales appears to be maximized with 5-point scales (Krosnick, 1999). The finding that more recent studies yielded larger effects is reassuring in the context of evidence that certain observed relationships tend to attenuate over time (Jennions & Møller, 2002; Schooler, 2011).

One moderator showed an effect across the 45 independent samples but could not be tested across the 22 independent samples that measured jealousy: scale type. Because only one type of bipolar scale was included in the meta-analysis (unpleasant/pleasant), it is difficult to determine if this effect stems from the unipolar versus bipolar nature of the response scale or the specific bipolar scale used.

Two moderators showed effects across the 22 independent samples that measured jealousy but not across the 45 independent samples (collapsing across emotion). Studies administered on a computer yielded marginally smaller effects than did studies administered on paper. It is certainly possible that medium of administration impacts responses, although verifying this would require additional research that systematically manipulated this factor. In addition, type of response scale labeling marginally impacted effect sizes, with response scales with all points labeled producing smaller effects than response scales with end and middle points labeled and response scales with end points only labeled. Given the intense jealousy likely to be generated by both sexual and emotional infidelity, it is possible that all-point labeling of a jealousy scale restricts the usable portion of the scale to just the upper points, attenuating the magnitude of the effect (Edlund & Sagarin, 2009). More generally, researchers using continuous scales to measure jealousy in response to intensely jealousy-provoking situations should be mindful of the possibility of ceiling effects and take steps to develop scales that will minimize ceiling effects or, at minimum, to assess the presence and impact of such effects.

6.3. Is there a sex difference in jealousy in response to actual infidelity experiences?

Yes. Across the seven independent samples that measured responses to actual infidelity experiences, a significant, theory-supportive effect emerged (g^*=0.234, 95% CI [0.020, 0.448], p=.03) with three individual effects statistically significant, all in the theory-supportive direction. Moreover, from a statistical perspective, the data yielded by these studies is not substantially different from the data yielded by the studies that have assessed jealousy responses to hypothetical scenarios, lending credence to the results that have emerged from both types of studies.

Nevertheless, relatively few studies have examined sex differences in jealousy in response to actual infidelity experiences, and these studies have produced disparate effects. Thus, although the results tend to support the theory of evolved sex differences in jealousy, the support is fairly fragile, as indicated by the fail-safe N of only 12. In addition,

an examination of the individual samples reveals two troubling items of note. First, the largest study—and the only study with a random sample—showed a very small, nonsignificant effect, g*=0.034, 95% CI [−0.107, 0.176], p=.63. Second, all three studies that produced significant effects were performed or supervised by authors of the meta-analyses that we report.

As can be seen in Table 6, this "laboratory effect" emerged most strongly for the DV "focus," with Edlund et al. (2006) Studies 1 and 2 and Johnson (2006) reporting marginal or significant effects (p=.05, p=.03, and p<.01, respectively) and Harris (2002, 2003b) reporting nonsignificant effects (p=.50 and p=.75, respectively). One methodological difference between these studies was the inclusion of "jealousy" questions prior to the "focus" questions in Edlund et al. (2006) and Johnson (2006). To test whether this methodological difference can account for the different results of these studies, we conducted a follow-up experiment in which 66 female and 37 male victims of infidelity (ages 25 to 62, M=40.1, S.D.=11.2) reported how much they focused on the sexual and the emotional aspects of the infidelity. Participants were randomly assigned to one of two conditions: (a) focus questions alone or (b) focus questions preceded by questions that asked how jealous participants felt about the sexual and the emotional aspects of the infidelity. After answering these questions, participants were asked, "When you answered the previous questions, what did the word 'focus' mean to you?" with participants providing open-ended responses. The expected Participant Sex×Infidelity Type×Condition interaction did not emerge, $F_{1,99}$=0.32, p=.57. Instead, a significant Participant Sex×Infidelity Type interaction appeared, $F_{1,99}$=4.46, p=.04, g*=0.430, with a theory-supportive pattern of means (men's focus on the sexual aspects of the infidelity: M=5.41, S.D.=1.54; men's focus on the emotional aspects: M=5.22, S.D.=1.69; women's focus on the sexual aspects of the infidelity: M=5.06, S.D.=1.79; women's focus on the emotional aspects: M=5.55, S.D.=1.35). Furthermore, the effect was larger when the focus questions were asked alone, g*=0.412, p=.045, than when they were preceded by jealousy questions, g*=0.210, p=.30. These results suggest that the presence of the jealousy questions in Edlund et al. (2006) and Johnson (2006) cannot account for the larger effects in these studies compared to the effects in Harris (2002, 2003b). Finally, an analysis of the open-ended responses indicated that most participants interpreted "focus" as asking about cognition rather than emotion (e.g., "Focus meant thinking about something the most").

Given the paucity of studies examining sex differences in jealousy in response to actual infidelity experiences and the limited number of laboratories that have performed these studies, attempts at replication by other researchers would be especially valuable. Nonetheless, the preliminary conclusions to be derived from our meta-analyses of the data conducted so far are that the interaction predicted by the theory of evolved sex differences in jealousy emerges both in hypothetical scenario studies and in data collected assessing real-life reactions to infidelities, and the effects that emerge from both types of studies seem to be comparable.

6.4. Limitations

One of the major limitations of meta-analysis involves the studies not included. Indeed, one of our frustrations was that we identified at least five studies that employed relevant methodologies but were not included in our meta-analyses because we could not obtain the data needed to calculate the studies' effect sizes. In all cases, however, these missing studies measured responses to hypothetical infidelity scenarios, and given the reliability of the sex difference in response to hypothetical infidelity scenarios we observed, it seems unlikely that the inclusion of these missing studies would have altered the basic conclusion derived from the meta-analyses regarding the existence of the sex difference. The evidence for moderation by measured emotion was also robust and unlikely to be altered by these missing studies. The evidence for the other moderators, in contrast, was not as strong, and it seems more plausible that the inclusion of missing studies might alter some of these conclusions.

In addition, although we examined a large number of possible moderators, important moderators might have been missed. Of the 22 studies that measured jealousy, effect sizes ranged from −0.159 to 0.803, highlighting the substantial variance yet to be explained.

6.5. The state of the theory

By demonstrating that a reliable sex difference emerges when jealousy is assessed using continuous measures, these meta-analyses have addressed one of the major criticisms of the theory of evolved sex differences in jealousy. We can conclude that the sex difference in jealousy is not an artifact of the forced-choice response format. In addition, the results highlight the fact that the theory is a theory of evolved sex differences in *jealousy*. It is not a theory of evolved sex differences in anger; hurt; disgust; or, for that matter, distress or upset. Thus, the present results support the perspective that jealousy is a unique, functional emotion that is not isomorphic with other negative emotions. Furthermore, the present results offer researchers some assurance that they can incorporate continuous measures into their studies without undermining their effects as long as care is taken in choosing which emotion to measure. The present results also demonstrate that the sex difference manifests cross-culturally—a finding of particular importance, given the evolutionary psychological basis of the theory. However, the present results demonstrate that the sex difference is moderated by the age of the respondent—a result consistent with Harris's (2003a) meta-analysis of forced-choice studies. Future work examining why the sex difference is attenuated in older samples would be valuable.

The meta-analyses also offered some evidence relevant to the criticism that the sex difference appears only in response to hypothetical infidelity scenarios and not in response to

actual infidelity experiences (Harris, 2002). Across seven studies that measured responses to actual infidelity experiences, a significant, theory-supportive sex difference emerged. Furthermore, the one study that "[tracked] people's actual experiences with infidelity as they unfolded" (Kimeldorf, 2009) showed an effect (g*=0.272) close to the average effect of the other actual infidelity studies (g*=0.233) and the average effect of the hypothetical infidelity scenario studies (g*=0.258).

The convergence of the results of the actual infidelity studies and the hypothetical scenario studies helps to address DeSteno's (2010) concern regarding the ecological validity of the hypothetical scenarios. All research methods are imperfect, of course. But when one triangulates in on a problem using two methods and both methods lead to the same conclusion, one gains increased confidence in both the conclusion and the methods. Thus, an argument for the invalidity of the hypothetical scenario results would need to explain why the data from the real-life studies are correct while the data from the scenario studies are wrong, despite the fact that (as indicated by the results of our meta-analyses) both lead to the same conclusion.

The theory of evolved sex differences in jealousy has also been tested using physiological measures, with mixed results. Buss et al. (1992) found significant effects, particularly in men. This result was challenged by Harris (2000), who offered an alternative explanation for the physiological data of Buss et al. In particular, Harris demonstrated that men showed equivalently greater physiological reactions when imagining themselves having sexual intercourse with their partner (compared to imagining themselves falling in love with their partner) as when imagining their partner having sexual intercourse with a rival (compared to imagining their partner falling in love with a rival). Furthermore, Grice and Seely's (2000) attempt to replicate Buss et al. resulted in successful replication for only one of three measures. The other measures produced a null result and a marginally significant result in the direction opposite of that obtained by Buss et al. In their physiological studies, Pietrzak, Laird, Stevens, and Thompson (2002) found significant effects for both women and men, but Harris (2005) provided evidence that the sample of Pietrzak et al. may have been an outlier, based on the unusual magnitude of the sex difference observed on another measure. Finally, Takahashi et al. (2006) provide an intriguing demonstration of different patterns of brain activation when women and men imagine sexual and emotional infidelity, although this was on a sample of only 22 women and men. Future studies employing physiological measures—particularly studies that took into account the concerns raised by Grice and Seely (2000) and Harris (2002, 2003a, 2005)—would be of great value in testing the theory of evolved sex differences in jealousy.

The theory of evolved sex differences in jealousy has not yet been tested using actual jealousy generated in the lab. Such tests would be quite valuable, but they raise both methodological and ethical challenges. Fortunately, DeSteno, Valdesolo, and Bartlett (2006) and Harmon-Jones, Peterson, and Harris (2009) have developed effective and ethical methods of generating jealousy in the laboratory. These methodologies avoid the potential limitations inherent in studies of hypothetical scenarios and the potential biases inherent in retrospective reports of past experiences, and can further attempts to triangulate in on the Participant Sex×Infidelity Type interaction that is predicted by the theory of evolved sex differences in jealousy. With creatively implemented, theory-driven jealousy provocations (and care taken to protect the well-being of participants), we believe that these methods offer a particularly exciting direction for future theory testing.

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