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Can Manipulations of Cognitive Load Be Used to Test Evolutionary Hypotheses?

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D. DeSteno, M. Y. Bartlett, J. Braverman, and P. Salovey (2002) proposed that if sex-differentiated responses to infidelity are evolved, then they should be automatic, and therefore cognitive load should not attenuate them. DeSteno et al. found smaller sex differences in response to sexual versus emotional infidelity among participants under cognitive load, an effect interpreted as evidence against the evolutionary hypothesis. This logic is faulty. Cognitive load probably affects mechanisms involved in simulating infidelity experiences, thus seriously challenging the usefulness of cognitive load manipulations in testing hypotheses involving simulation. The method also entails the assumption that evolved jealousy mechanisms are necessarily automatic, an assumption not supported by theory or evidence. Regardless of how the jealousy debate is eventually settled, cognitive load manipulations cannot rule out the operation of evolved mechanisms.

Keywords: evolutionary psychology, cognitive load, modularity, jealousy, automaticity

DeSteno, Bartlett, Braverman, and Salovey (2002) proposed a new method for evaluating hypotheses about evolved cognitive mechanisms. They assumed that evolved cognitive mechanisms are necessarily automatic in their operation, accepting no input from deliberative or effortful processes. On this basis, they suggested that adding a cognitive load manipulation to a task (remembering a long string of digits and producing a response in less than 10 s) should "enhance the influence of automatic processes on judgment and behavior through the inhibition of corrective or deliberative processes reflecting the influence of conscious analysis" (DeSteno et al., 2002, p. 1111). Because cognitive load is purported to affect only deliberative processes, they proposed that if an effect observed under no load conditions is reduced or eliminated under cognitive load, the initial effect can be inferred to have been the result of effortful, rather than evolved, cognition. They argued that by comparing performance under cognitive load and no load, they could provide a crucial test of hypotheses about evolved cognitive mechanisms that can "resolve the stalemate" (DeSteno et al., 2002, p. 1104) over the role of specialized evolved mechanisms in jealousy.

Here we suggest that this reasoning is faulty for two reasons. First, it assumes that evolved jealousy mechanisms do not process information from other cognitive mechanisms (e.g., controlled processes, working memory, etc.) that might themselves be influenced by cognitive load manipulations. We propose that this is an incorrect assumption about jealousy mechanisms. It is likely that many evolved mechanisms rely on processes affected by cognitive load, making the cognitive load method inappropriate as a way to test for the existence of these mechanisms. Second, the reasoning of DeSteno et al. (2002) embodies incorrect assumptions about the way evolution-minded researchers conceive of evolved cognitive architectures. In particular, the conceptualization of modularity and automaticity presented by DeSteno et al. (2002) builds a false dichotomy between evolutionary models, which are said to entail "automaticity," and nonevolutionary models, which entail "effortful decisions" (see Barrett & Kurzban, in press; Pinker, 1997; Sperber, 2005).

For these reasons, we argue that the cognitive load method, in particular as applied by DeSteno et al. (2002), is not a valid test of whether a particular experimental result reflects an "automatic . . . response shaped by evolution" (DeSteno et al., 2002, p. 1003) or the presumed alternative, a "nonautomatic response not shaped by evolution." We wish to stress that although we believe that DeSteno et al. have not falsified the hypotheses about jealousy that they claim to have falsified, the problems we have raised with their method exist independent of the debate about sex differences in response to different types of infidelity. No matter how current debates about jealousy are resolved, the cognitive load method as used by DeSteno et al. is based on faulty assumptions about evolved mechanisms and cannot be used to test for their existence.

A Brief History of the Problem

DeSteno et al. (2002) used the cognitive load method to test a proposal by Buss, Larsen, Westen, and Semmelroth (1992) about evolved sex differences in jealousy. On the basis of parental investment theory (Trivers, 1972), Buss et al. (1992) predicted there would be sex differences in the degree of distress caused by imagined sexual and emotional infidelity. In brief, they reasoned

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that there was an asymmetry in the fitness costs of these kinds of infidelity for men and women. Because of internal fertilization, women can be certain that their child is genetically their own, whereas men are uncertain of paternity. Investment in the offspring of another man was an event with high fitness costs, leading to the evolution of anticuckoldry adaptations in men. One prediction of this account is that, relative to women, men should be more distressed by real or imagined sexual infidelity by their mates.

The fitness costs to women of infidelity by a male partner would also have been high. Unlike men, women were certain of the genetic relatedness of their offspring. However, female fitness would have been significantly influenced by male investment in offspring (Hill & Hurtado, 1996; Hurtado & Hill, 1992; Marlowe, 2003). Thus, women stood to lose less from sexual infidelity per se than did men, but more, relative to men, if their partners were to divert investment to other mates and their offspring. If becoming emotionally involved with another woman led to diverted investment by ancestral men, then one prediction that follows from this hypothesis is that emotional infidelity should induce more jealousy in women than in men.[1] Thus, both women and men should be concerned with infidelity, but jealousy should be elicited more by cues to sexual infidelity in men than in women and more by cues to resource diversion in women than in men.[2]

Note that these predictions entail little regarding the cognitive structure of the mechanisms underlying jealousy. The predicted sex differences could be realized in many possible cognitive designs guiding decision making about infidelity. We return to this question below.

The Cognitive Load Method

DeSteno et al. (2002) gave participants 10 s to indicate whether the idea of their partner committing sexual infidelity or the idea of their partner being emotionally unfaithful was more distressing. Half of the participants were placed under cognitive load. They were asked to remember a long string of digits while attempting to simulate what it would be like to experience these types of infidelity and choosing which one was more distressing. The rationale for the use of a cognitive load manipulation was that it "should, if anything, enhance the influence of automatic processes on judgment and behavior through the inhibition of corrective or deliberative processes reflecting the influence of conscious analysis" (DeSteno et al., 2002, p. 1111). According to DeSteno et al.'s (2002) reasoning, if performance on the jealousy task is influenced by conscious analysis, then a cognitive load manipulation, which is presumed to disrupt conscious analysis, should have an effect on the outcome of the judgment task. Thus, in their view, if the sex difference in jealousy reactions is attenuated or eliminated, then the sex difference (under no load conditions) must have been due to deliberative processes disrupted by cognitive load rather than because of the operation of a module. DeSteno et al. (2002) reported precisely this result: an attenuation of sex differences in the choice of sexual versus emotional infidelity.[3]

Assumptions Underlying the Cognitive Load Method

The rationale for the use of a cognitive load manipulation is that it should reveal the operation of automatic processes if automatic processes are influencing judgments on a task, such as judgments about infidelity scenarios. Because DeSteno et al. (2002) believed that the evolution-predicted sex difference hypothesis implies an automatic process, they reasoned that if the cognitive load manipulation has the predicted effect, it undermines the evolutionary hypothesis.[4]

The reasoning behind this claim turns on two assumptions. First, it assumes that the evolution-predicted sex difference hypothesis implies the existence of jealousy modules whose operation includes automatic processes but no other (conscious, deliberative) processes. This assumption is necessary because if the evolved jealousy systems could include deliberative systems and not just automatic ones, their experiments would not rule out any hypothesis of interest to DeSteno et al. (2002). An evolved system that took input from deliberative systems would also be affected by cognitive load manipulations, so even if cognitive load effects were observed, the evolutionary hypothesis could not be ruled out.

Second, the reasoning of DeSteno et al. (2002) assumes that cognitive load manipulations do not interfere with cognitive processes used by purported jealousy modules. If and only if both assumptions are correct—that the jealousy module is automatic and that it cannot be influenced by processes sensitive to cognitive load—then cognitive load manipulations should have no effect on judgment tasks relying on an evolved jealousy module.

Assumptions About Cognitive Architecture

Are these assumptions valid? The rationale for cognitive load as a test of the evolution-predicted sex difference hypothesis is based

[1] Note that although these predictions focus on differences between the sexes, Buss and others (Buss, 2000; Symons, 1979) discussed both similarities and differences in jealous responses by men and women. For example, both men and women face a complete loss of their valued mate to a reproductive competitor if he or she is lured away.

[2] These are only predictions about sex differences. It is often claimed that the evolutionary perspective predicts that men should be more upset by sexual than emotional infidelity, whereas women should be more upset by emotional than sexual infidelity (e.g., DeSteno et al., 2002, p. 1114; C. R. Harris, 2003, 2005, p. 77, Table 1), but these predictions do not follow from the evolutionary logic described above nor were they advanced by Buss et al. (1992; see also Buss & Haselton, 2005). For example, the finding in certain cultures that men and women both rate emotional infidelity as more upsetting than sexual infidelity, but that men find sexual infidelity more upsetting than women do, is consistent with the hypothesis (e.g., Buunk, Angleitner, Oubaid, & Buss, 1996). Although not required by the hypothesis, certain patterns of rank ordering effects within sexes would also be consistent with the existence of predicted differences between sexes. For example, Buss et al. (1992) observed greater increases in electrodermal activity from baseline in men's response to sexual than to emotional infidelity, whereas the reverse was found for women. This pattern is consistent with differential responses by men and women to sexual infidelity (men greater than women) and differential responses by men and women to emotional infidelity (women greater than men; but see C. R. Harris, 2000).

[3] DeSteno et al. (2002) claimed that the sex differences "disappeared" (p. 1103) under cognitive load (see also C. R. Harris, 2003, p. 117, for the same claim). In fact, as Sagarin (2005) documented, the sex difference is smaller but still statistically significant.

[4] As we explain below, although DeSteno et al. (2002) and others treat the evolutionary hypothesis as a single hypothesis, it actually consists of multiple hypotheses.

on a model of cognitive processing endorsed by Fodor (1983, 2000). This model holds that to the extent that modules exist, their influence on information processing occurs early in the processing stream and is immune to top-down or horizontal influence. In this view, when higher level or central systems interact with the modules, it is only to receive the modules' outputs. However, as we discuss in more detail below, there are good evolutionary reasons to suppose that this is not an adequate model of all or most evolved cognitive systems and certainly not of the kind underpinning jealousy judgments (Barrett, 2005; Barrett & Kurzban, in press; Pinker, 1997, 2005; Sperber, 1994, 2005).

Evolutionary psychologists have been explicit about what they mean by modularity, and this does not include a commitment to automaticity (e.g., see Pinker, 1997, pp. 27–31). In fact, somewhat ironically, evolutionary psychologists have argued against automaticity as a design feature of certain cognitive mechanisms in domains in which many social psychologists have committed themselves to automaticity, such as automatic categorization of individuals by race (Kurzban, Tooby, & Cosmides, 2001). Instead, evolutionary psychologists have proposed that individual cognitive systems will have design features that reflect their function; features like automaticity, encapsulation, and speed could be features of some systems (e.g., snake detection), but only when such features are appropriate for the problems the system evolved to solve (Barrett & Kurzban, in press; Sperber, 1994, 2005; Tooby & Cosmides, 1992). These are not features that are likely to be appropriate for a system regulating jealousy reactions.

Fodor (1983) claimed that modular systems should accept only narrow classes of inputs (usually, only perceptual ones) and should process these automatically. Evolutionary psychologists have argued, on the other hand, that many evolved inference and decision-making systems should be expected to use background knowledge and contextual information, stored in what Fodor (1983) would call "central" systems, as part of their normal operation (Barrett, 2005; Sperber, 1994, 2005; Tooby & Cosmides, 1992). We believe that this is also the case for a jealousy system, which would be close to useless if it had to rely only on direct perceptual evidence of infidelity. Instead, as we will argue in more detail below, it is likely that a specialized jealousy system, if it exists, would have evolved to rely heavily on background knowledge and contextual information—including information generated by deliberative or so-called central processes—in generating jealousy.

Consider the jealousy tasks used by Buss et al. (1992) and DeSteno et al. (2002). Is the Fodorian model of modularity likely to account for processes underlying performance on these tasks? This seems very unlikely because, in order to complete the task, even as originally designed by Buss et al. (1992), deliberatively processed information must be used: namely, the mental simulations of jealousy scenarios that subjects are instructed to perform. Although there is healthy debate surrounding imaginary and counterfactual scenarios (P. L. Harris, 2000; Sperber, 2000), there is little doubt that these mechanisms could include ones that come under the rubric of what DeSteno et al. (2002) called "deliberative processes" and that these would, because of the nature of the task, have to operate before any jealousy judgments were made.

Why does this matter for the cognitive load method? If the cognitive load manipulation interferes with deliberative conscious processes, as DeSteno et al. (2002) proposed, then it could also interfere with the capacity to generate the imagined scenarios on which the subjects are asked to base their jealousy judgments. Failure to realistically simulate an experience hypothesized to evoke evolved mechanisms would interfere with the operation of such mechanisms. This precludes conclusions about the origins of the sex differences that are observed under no load conditions. This would be true in both Buss et al.'s (1992) account, in which a jealousy module is triggered by imagining infidelity events, or in DeSteno et al.'s (2002) account, in which no jealousy module is involved, but imagined infidelity events are still the basis for judgment. The manipulation would disrupt the results in either case, ruling it out as a means of discriminating between the two hypotheses.

Assumptions About Evolution and Modularity

Using the cognitive load method as a test of evolutionary psychological hypotheses rests entirely on the assumption that all evolved modular systems must be automatic. If this assumption is incorrect, then the cognitive load method is not a valid test of evolutionary psychological hypotheses in general.[5] Here we discuss why the assumption of automaticity as a general property of evolved systems and as a specific property of jealousy mechanisms is likely to be incorrect.

As mentioned above, there is a substantial difference between the standard Fodorian view of modularity and that endorsed by evolutionary psychologists. Evolutionary psychologists are interested in evolved psychological specializations, and the central concept that they invoke is functional specialization, not the checklist of features, including automaticity, endorsed by Fodor (1983). It is true that many evolutionary psychologists use the term *module* to refer to evolved specializations, thereby evoking by association the Fodorian modularity concept (though, ironically, given DeSteno et al.'s [2002] heavy use of the term, "module" does not appear in Buss et al. [1992]). However, because evolutionary theories are centered on functional specialization and not Fodorian features per se, evolutionary psychologists have been explicit in rejecting features such as automaticity and encapsulation as necessary properties of evolved modules (see, e.g., Barrett, 2005; Pinker, 1997, 2005; Sperber, 1994, 2005).[6]

The split between evolutionary psychologists and Fodor (1983) on modularity properties is not merely a semantic quibble but is based on evolutionary logic. Assume that the argument of Buss et

[5] We are not claiming that cognitive load could never be used to test an evolutionary hypothesis in a sensible way. What we are claiming is that because automaticity in the sense intended by DeSteno et al. (2002) is not mandatorily entailed by evolutionary hypotheses, the cognitive load method is not a global litmus test for evolved mechanisms. We could imagine cognitive load as a test of specific hypotheses (evolutionary or not) that posit lack of interaction between a given system and systems impaired by cognitive load. However, isolation of systems is not a general property of evolved systems nor of the putative systems being investigated by DeSteno et al.

[6] Although it could be argued that DeSteno et al. (2002) intended only the Fodorian view of modularity, this is contradicted by the fact that they cite Buss and Kenrick (1998), Cosmides and Tooby (1994), and Pinker (1997) for their claim that "modules constitute automatic mental processes" (DeSteno et al., 2002, p. 1105). These authors diverge from Fodor (1983) in multiple ways (see, e.g., Pinker, 1997, pp. 30–31) and, it is important to note, never state that automaticity is a necessary feature of evolved psychological mechanisms.

al. (1992) is sound and that natural selection favored men who reacted strongly to sexual infidelity and women who reacted strongly to resource diversion. What does this tell us about the design features of the cognitive mechanisms that might evolve under these conditions? Minimally, it implies only that each sex should have cognitive mechanisms that cause them to be sensitive to cues indicating these events and to adjust their behavior to minimize the probability of these events occurring. Nothing about the effortfulness or automaticity of the processes guiding behavior is mandated by the logic of the hypothesis.

In fact, in the case of detecting infidelity, a system designed to be activated automatically and only by perceptual cues—that is, only by directly observing one's mate engaged in an act of sexual intercourse—would probably be a poor one. Instead, given that infidelity would often have to be inferred via a variety of indirect contextual cues and central reasoning processes, we would expect the system to be sensitive to a wide range of cues and to be sensitive to knowledge stored in and manipulated by central systems.

Imagine, for example, a married man whose wife works at an office and comes home promptly at seven every evening. One day, his wife mentions that a young male coworker has joined the firm, and 2 days later, she fails to come home. If jealousy ensues, it is not because of the direct observation of infidelity. Rather, a process of inference, integrating both circumstantial evidence and background knowledge, had to have occurred in order to trigger the jealousy response. In turn, additional contextual information, such as knowledge of a public transportation strike on the night in question, might mitigate the jealousy response. It is to be expected that jealousy reactions would accept as input the output of many reasoning and inference processes, including deliberative and effortful ones, given that direct evidence of infidelity would have been rare in ancestral environments.

It is incorrect to assume that natural selection favors a single type of cognitive system, one that is strictly bottom-up, automatic, encapsulated, and perceptually driven. We also note that just as it is fallacious to make the inference from evolved to automatic, it is also fallacious to make the converse inference from automatic to evolved. There is a large psychological literature demonstrating apparent automaticity for diverse processes, such as the activation of culturally local stereotypes about Black men (Eberhardt, Goff, Purdie, & Davies, 2004; Payne, Lambert, & Jacoby, 2002), perception of the layout of a chess board by experts (Chase & Simon, 1973), and other skills, including medical diagnosis and solving physics problems (Bédard & Chi, 1992), cases in which few would argue for evolved modules specifically dedicated to the processes in question.

Interpreting the Results of DeSteno et al. (2002)

We wish to stress, to avoid possible misinterpretations of our claims, that there is an asymmetry entailed by the use of cognitive load as a critical test of hypotheses about cognitive architecture. For cognitive load to be valid as a critical test, very specific conditions must hold: The hypothesized system in question must have no interaction with processes that might be influenced by cognitive load manipulations. On the other hand, for it to be rendered invalid as a critical test requires only that there be a potential for cognitive load to impact some other interacting system that might influence the results. In the present case, there are likely to be many processes involved in the jealousy task, which begins with reading instructions in written English and ends with the participant indicating a response. Although there is uncertainty about the exact nature of the processes involved—as with any experimental task in psychology—this uncertainty weighs against cognitive load as a critical test. Our present conjectures about the role of mental simulation are just that—conjectures—but they show that it is not hard to imagine quite plausible ways in which cognitive load could have effects without ruling out the operation of an evolved jealousy system.

Nonetheless, it is worth considering why cognitive load manipulations might produce the observed effects on the jealousy task. DeSteno et al. (2002) did not find that cognitive load produced mere random behavior. Instead, they found that in the cognitive load condition, women's judgments became more similar to men's. There was an increase in the proportion of women who deemed sexual infidelity to be more distressing than emotional infidelity.

Suppose the conjectures we have offered above are correct, and the jealousy system takes as input the output of central systems. In particular, suppose that it can be influenced by systems that build scenarios about events that have not been directly observed, weighing background and contextual knowledge to estimate the probability of infidelity. Suppose further that the cognitive load manipulation interferes with these scenario-building systems. It could be that different kinds of imagination primes vary in how they recruit cognitive systems involved in simulating imaginary scenarios. The instruction to imagine one's partner committing sexual infidelity might trigger potent and vivid imagery that could serve as input to a jealousy system. The instruction to imagine one's partner in love or forming a deep emotional attachment with another individual might require more recruitment of resource-taxing, deliberative processes—possibly those shared with the system required to hold digit strings in memory. Under this scenario, disrupting deliberative processes might lead to exactly the results observed by DeSteno et al. (2002), whereas allowing simulation and causal reasoning processes to operate as they would under natural conditions leads to the predicted sex difference. Again, this is only one possible scenario, but a plausible one.

We would like to note, in passing, that an empirical test of this potential alternative explanation of DeSteno et al.'s (2002) results could be developed if the evolutionary logic of the information processing features of the jealousy system were fleshed out. If it is the case that jealousy reactions on this task depend on imagining different kinds of scenarios, there might be differences in the kinds of processes involved in imagining sexual infidelity versus emotional infidelity, and corresponding differences in the kinds of manipulations that could influence these processes. For example, sexual infidelity might be easily imagined through purely visual imagery, whereas emotional infidelity might require representation of the mental states of others, using systems that are not imagery based per se (i.e., intentions might matter for emotional infidelity but not sexual infidelity). One prediction would be that tasks that interfere with visual processing might have a greater impact on judgments about sexual infidelity, whereas tasks that interfere with assessment of intentions and other mental states (desire, commitment) might differentially impact emotional infidelity judgments.

Finally, an important factor to consider in any research on evolved mechanisms is that all such mechanisms evolved to operate under particular conditions. These conditions never include the presentation of information in written form, as reading and

writing are historically recent innovations. This is not to say that written information cannot be used as input to evolved mechanisms. Indeed, much evolution-based research, including that of Buss et al. (1992), is predicated on the assumption that written information is converted, via the process of reading, into an internal conceptual format that evolved systems can use. However, this implies that manipulations that influence the cognitive processes involved in reading, interpreting, and mentally representing written information could interfere with processing steps that make information available to evolved mechanisms. This is another way in which cognitive load could interfere with judgments on experimental jealousy tasks in ways that are orthogonal to questions of evolved design.

Future Research on Jealousy

Although we did not set out to write an article on jealousy per se, we make two suggestions for future work. First, we suggest that researchers treat the sexual and emotional jealousy hypotheses separately. Each is based on its own logic (prevention of cuckoldry for men and prevention of resource loss for women), and each should be evaluated on its own merits.[7] Second, we suggest that it is time that the debate move beyond sex differences in self-reports, which may have reached the limit of their utility, and toward investigations of specific design features consistent with the hypothesized functions of jealousy in men and women (see Buss & Haselton, 2005). For example, if jealousy adaptations in men evolved, in part, to prevent cuckoldry, men should express jealousy more intensely when their partners display cues to higher overall levels of fertility, including youth and attractiveness, and to cues indicating that their partners are approaching the high fertility point in the menstrual cycle (for tests of these predictions, see Buss & Shackelford, 1997; Haselton & Gangestad, 2006).

Conclusion

Some might conclude from our argument that evolutionary hypotheses simply are not testable. Although we would argue emphatically that this is not true—and we have offered some brief suggestions for tests in the case of jealousy—this is not an article about how to test hypotheses about jealousy in particular nor about how to test evolutionary hypotheses in general. On that topic, there already exists a large literature (e.g., Simpson & Campbell, 2005; Tooby & Cosmides, 1992). Rather, our aim has been to point out that a particular method, the cognitive load method, does not tell us what DeSteno et al. (2002) claimed that it tells us about evolved psychological mechanisms.

As the use of evolutionary theory in psychology matures, it is particularly important that tests of evolutionary hypotheses be based on sound logic derived from evolutionary theory and from reasonable evolutionary assumptions. They should not import notions external to the hypothesis itself and not directly warranted by it. In particular, a variety of folk or informal theories have not yet been purged from psychology, including the idea that natural selection creates innate reflexes that cause humans to act automatically, like zombies. Many dichotomies, such as innate versus learned, evolved versus cultural, and instinctual versus conscious, are simply not licensed by the logic of evolutionary theory and cannot be the basis of logically sound tests of evolutionary hypotheses.

[7] Note that there is an additional, untested, assumption contained in the emotional infidelity logic—namely, that external emotional involvement leads to resource diversion. Predictions about responses to emotional infidelity are therefore potentially weaker than predictions about responses to sexual infidelity.

References

Barrett, H. C. (2005). Enzymatic computation and cognitive modularity. *Mind and Language, 20,* 259–287.

Barrett, H. C., & Kurzban, R. (in press). Modularity in cognition: Framing the debate. *Psychological Review.*

Bédard, J., & Chi, M. T. H. (1992). Expertise. *Current Directions in Psychological Science, 1,* 135–139.

Buss, D. M. (2000). *The dangerous passion: Why jealousy is as necessary as love and sex*. New York: Free Press.

Buss, D. M., & Haselton, M. G. (2005). The evolution of jealousy: A response to Buller. *Trends in Cognitive Science, 9,* 506–507.

Buss, D. M., & Kenrick, D. T. (1998). Evolutionary social psychology. In D. T. Gilbert, S. T. Fiske, & G. Lindzey (Eds.), *The handbook of social psychology* (4th ed., pp. 982–1026). Boston: McGraw-Hill.

Buss, D. M., Larsen, R. J., Westen, D., & Semmelroth, J. (1992). Sex differences in jealousy: Evolution, physiology, and psychology. *Psychological Science, 3,* 251–255.

Buss, D. M., & Shackelford, T. K. (1997). From vigilance to violence: Mate retention tactics in married couples. *Journal of Personality and Social Psychology, 72,* 346–361.

Buunk, B. P., Angleitner, A., Oubaid, V., & Buss, D. M. (1996). Sex differences in jealousy in evolutionary and cultural perspective: Tests from the Netherlands, Germany, and the United States. *Psychological Science, 7,* 359–363.

Chase, W., & Simon, H. A. (1973). Perception in chess. *Cognitive Psychology, 5,* 55–81.

Cosmides, L., & Tooby, J. (1994). Beyond intuition and instinct blindness: The case for an evolutionarily rigorous cognitive science. *Cognition, 50,* 41–77.

DeSteno, D., Bartlett, M. Y., Braverman, J., & Salovey, P. (2002). Sex differences in jealousy: Evolutionary mechanism or artifact of measurement? *Journal of Personality and Social Psychology, 83,* 1103–1116.

Eberhardt, J. L., Goff, P. A., Purdie, V. J., & Davies, P. G. (2004). Seeing black: Race, crime, and visual processing. *Journal of Personality and Social Psychology, 87,* 876–893.

Fodor, J. A. (1983). *Modularity of mind*. Cambridge, MA: MIT Press.

Fodor, J. A. (2000). *The mind doesn't work that way*. Cambridge, MA: MIT Press.

Harris, C. R. (2000). Psychophysiological responses to imagined infidelity: The specific innate modular view of jealousy reconsidered. *Journal of Personality and Social Psychology, 78,* 1082–1091.

Harris, C. R. (2003). A review of sex differences in sexual jealousy, including self-report data, psychophysiological responses, interpersonal violence, and morbid jealousy. *Personality and Social Psychology Review, 7,* 102–128.

Harris, C. R. (2005). Male and female jealousy, still more similar than different: Reply to Sagarin (2005). *Personality and Social Psychology Review, 9,* 76–86.

Harris, P. L. (2000). *The work of the imagination*. New York: Blackwell.

Haselton, M. G., & Gangestad, S. W. (2006). Conditional expression of women's desires and men's mate guarding across the ovulatory cycle. *Hormones and Behavior, 49,* 509–518.

Hill, K. R., & Hurtado, A. M. (1996). *Aché life history: The ecology and demography of a foraging people*. Hawthorne, NY: Aldine de Gruyter.

Hurtado, A. M., & Hill, K. R. (1992). Paternal effect on offspring survivorship among Ache and Hiwi hunter-gatherers: Implications for mod-

eling pair-bond stability. In B. S. Hewlett (Ed.), *Father–child relations: Cultural and biosocial contexts* (pp. 31–55). Hawthorne, NY: Aldine de Gruyter.

Kurzban, R., Tooby, J., & Cosmides, L. (2001). Can race be erased? Coalitional computation and social categorization. *Proceedings of the National Academy of Sciences, 98,* 15387–15392.

Marlowe, F. (2003). A critical period for provisioning by Hadza men: Implications for pair bonding. *Evolution and Human Behavior, 24,* 217–229.

Payne, B. K., Lambert, A. J., & Jacoby, L. L. (2002). Best laid plans: Effects of goals on accessibility bias and cognitive control in race-based misperceptions of weapons. *Journal of Experimental Social Psychology, 38,* 384–396.

Pinker, S. (1997). *How the mind works*. New York: Norton.

Pinker, S. (2005). So how does the mind work? *Mind and Language, 20,* 1–24.

Sagarin, B. J. (2005). Reconsidering sex differences in jealousy: Comment on Harris (2003). *Personality and Social Psychology Review, 9,* 62–75.

Simpson, J. A., & Campbell, L. (2005). Methods of evolutionary sciences. In D. M. Buss (Ed.), *The handbook of evolutionary psychology* (pp. 119–144). New York: Wiley.

Sperber, D. (1994). The modularity of thought and the epidemiology of representations. In L. A. Hirschfeld & S. A. Gelman (Eds.), *Mapping the mind: Domain specificity in cognition and culture* (pp. 39–67). New York: Cambridge University Press.

Sperber, D. (Ed.). (2000). *Metarepresentations: A multidisciplinary perspective*. New York: Oxford University Press.

Sperber, D. (2005). Modularity and relevance: How can a massively modular mind be flexible and context-sensitive? In P. Carruthers, S. Laurence, & S. Stich (Eds.), *The innate mind: Structure and contents* (pp. 53–68). New York: Oxford University Press.

Symons, D. (1979). *The evolution of human sexuality*. New York: Oxford University Press.

Tooby, J., & Cosmides, L. (1992). The psychological foundations of culture. In J. H. Barkow, L. Cosmides, & J. Tooby (Eds.), *The adapted mind: Evolutionary psychology and the generation of culture* (pp. 19–136). New York: Oxford University Press.

Trivers, R. (1972). Parental investment and sexual selection. In B. Campbell (Ed.), *Sexual selection and the descent of man, 1871–1971* (pp. 136–179). Chicago: Aldine Publishing.

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