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Threats to romantic relationships: How they are perceived and how they are

guarded against in an uncommon mate market

A dissertation submitted in partial satisfaction of the requirements for the degree of

Doctor of Philosophy in Anthropology

by

Katherine N. Sobraske

Committee in charge:

Professor Steven Gaulin, Chair

Professor Michael Gurven

Professor John Tooby

March 2015

The dissertation of Katherine N. Sobraske is approved.

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Steven Gaulin, Committee Chair

March 2015

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Hanson Sobraske, K. N., Boster, J. S., and Gaulin, S. J. C. 2013. Mapping the Conceptual Space of Jealousy. *Ethos*, *41*, 249-270.

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ABSTRACT

Threats to romantic relationships:

How they are perceived and how they are guarded against in an uncommon mate

market

by

Katherine N. Sobraske

The study of jealousy from an adaptationist perspective is dominated by the hypothesis that 1) relationship threats are either sexual or emotional in nature, and 2) there are sex differences in response to these threats. While there is considerable support for sex differences in response to researcher-created stimuli, the notion that people spontaneously conceive of threats as either sexual or emotional threats is untested. Using an unobtrusive, mixed-methods design, I mapped the cognitive space of jealousy. Contrary to conventional supposition, the sexual-emotional distinction is not a primary means of threat organization; instead, threats are organized by 1) their severity, 2) the presence of a specific rival versus a partner's disinterest, and 3) a partner's deceptive actions versus their honesty. A sexual-emotional distinction, if present, is not among the principle means of threat organization. In addition to the analysis of an aggregate population, I also provide analysis of several comparison subpopulations.

Because jealousy is an adaptive response to a (suspected) loss to a romantic rival, a facultative response should account for the traits of rivals in the local mating environment. Using the same unobtrusive, mixed-methods design as the study described above, I evaluated the prediction that jealousy responds facultatively. Specifically, men with many attractive — and, therefore, threatening — rivals are more attentive to their partners' deceptive actions and to their partner's intentions to stay or leave the mateship. Women with many sexually-accessible — and, therefore, threatening — rivals are more attentive to their partners' deceptive actions.

To avoid the costs of a mate's infidelity, "fidelity" is predicted to rank highly among a suite of reproductive success-enhancing traits. Specifically, I predicted that men would highly value "sexual fidelity" and women would highly value "emotional fidelity". I evaluated community and university members' responses to a zero-sum allocation task using various quantitative statistics. My predictions were largely supported: Both community and university men highly valued sexual fidelity in a mate. Additional analysis revealed university men were an adequate proxy for community men vis-à-vis mate preferences. Data from community women supported the prediction by highly valuing emotional fidelity in a mate. Conversely, university women most valued *sexual* fidelity; they least-valued cues of resource acquisition, counter to standard sexual selection logic and multiple previous studies of university women. This suggested the presence of an uncommon mate market affecting university women's preferences.

To describe how an uncommon mate market affected university women's preferences, I conducted long-form, semi-structured interviews, analyzed with framework analysis. The prime mover of university women's mate preferences appears to be the

demography and geography of Isla Vista, affecting women's intrasexual competitive tactics and men's responses to them. In this mate market, women find themselves in the uncommon position of being able to use a man's sexual fidelity — typically a noisy signal — as an honest signal of his devotion to the mateship.

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Chapter I

Introduction

This dissertation centers on jealousy and threats to romantic, potentially reproductive relationships. My central assumption is that, like all emotions, jealousy evolved to mitigate certain recurrent adaptive challenges (Plutchik, 1980, Tooby and Cosmides, 1992). In the case of jealousy, those challenges arise out of the fact the human reproduction is greatly supported by sustained cooperation between those with a common genetic interest in the outcome. Marriage represents a universal human codification of the importance of that sustained cooperation. Hence, as a window on the threats that undermine such cooperation, I begin by considering the reproductive dynamics of marriage.

Universality of Marriage

Humans are a biparental species with expensive, needy young (Flinn et al., 2005; Martin, 1983; Lancaster and Lancaster, 1983; Lovejoy, 1981), necessitating the care and investment of multiple individuals for offspring success (Kaplan and Lancaster, 2003; Kleinman and Malcolm, 1981). Like all biparental species, two members of the opposite sex contribute to the maintenance of the pairbond and their mutual offspring (Andersson, 1994; Emlen, 1995; Geary, 2000; Kaplan et al., 1997; Key and Aiello, 2000; Kokko and Jennions, 2003; Lancaster and Kaplan, 1992; Low; 1998; Noë and Hammerstein, 1994; Soltis and McElreath, 2001; Westneat and Sherman, 1993; cf. Davies et al., 1992). Humans, however, are unique among biparental species in the case that the pairbond may be formalized within the society and thereby recognized as a marriage.

Marriage is found in all described societies (Murdock, 1949). Moreover, marriage in all described societies includes formalized rules regarding the rights and obligations for members of the couple and, often, their kin as well (Betzig, 1989; Ember and Ember, 1983; Marlow, 2000; Murdock, 1949, 1967; Low, 2007; Plotkin, 2007; Walker, Hill, Flinn, and Ellsworth, 2011). More specifically, these rules detail the rights of sexual access and the obligations of resource investment.

The universality of rules suggests two central aspects of marriage: One, the universality component suggests marriage increases the reproductive success (RS) of those involved (Betzig, 1989). Two, the presence of rules suggests that those involved in the marriage may be motivated to behave differently than what is prescribed. More specifically, people may be motivated to grant sexual access and/or resource investment to those outside the marriage.

Rules regarding resource exchange and investment

Resource exchange often starts at or near the time of the marriage ceremony, depending on the duration of the courtship period (Huber, 2011; Murdock and White, 1969; Schlegel and Eloul, 1988). Resources may move vertically downward, given by kin to one or both members of the couple — such as with dowry (Gaulin and Boster, 1990, 1991; Halpern, 1967; Lambrecht, 1935) or indirect dowry (Goody, 1973) — or resources may move vertically upward, given by the bride or groom to future in-laws — such as with groom service (Huber, Danaher, and Breedlove, 2011; Seligman, 1932) or bride service (Bogoras, 1909; Walker et al., 2011). Resources may also be transferred horizontally, exchanged between the bride's and groom's families — such as with bride wealth (Apostolou, 2008;

Walker et al., 2011) or groom wealth (Billing, 1991; Caplan, 1984; Halpern, 1967; Nash, 1978).

Resource exchange between the bride, groom, and their kin typically continues throughout the span of the marriage (Blurton Jones et al., 2000; Geary, 2000; Gowaty, 1996; Hawkes et al., 2001; Lancaster and Lancaster, 1983; Low, 2007; Marlow, 2000, 2005; Smuts, 1992). While the specific rules and norms regarding each party's contribution vary considerably across societies and environmental conditions, a sexual division of labor is generally expected wherein women provide the bulk of the childcare and invest low-variance resources directly into the nuclear family (Gurven and Hill, 2009; Kaplan and Lancaster, 2003). Men, on the other hand, are generally expected to concentrate their efforts on high-variance, high-value resources that are more likely to be shared to those outside the nuclear family (Brown, 1970; Lancaster and Lancaster, 1980; Murdock, 1949). In this fashion, those in the nuclear family can capitalize on the economies of scale regarding production, ensure sufficient quantity and quality of nutrients, and buffer against the irregularities associated with high-variance resources (Fisher, 1989; Gurven and Hill, 2009; Hurtado and Hill, 1992; Lancaster and Lancaster, 1980, Lovejoy, 1981; cf. Hawkes, 1991, 1993; Bleige Bird et al. 2001; Blurton Jones et al. 2000).

Rules regarding sexual access

All societies have marriage rules regarding sexual access (Ember and Ember, 1983; Marlowe, 2000; Murdock, 1967). These include rules about the appropriate ages for those in the union; acceptable number of spouses, either concurrently or serially; and prescriptions about sex outside the marriage (Betzig, 1989; Low, 2007; Plotkin, 2007). In general, rules

regarding sexual access are stricter for women than for men: Chastity is expected of brides (Daly and Wilson, 1983; Weisfeld, 1997), women in most societies are expected to be monogamous (99.2%, Murdock, 1967), and sanctions are stronger for women's adultery than they are for men's adultery (Betzig, 1989; Daly and Wilson, 1992).

Marriage as a means to increase reproductive success

Men's reproductive success and the value of women's sexual fidelity

Marriage rules regarding sexual access are biased towards increasing men's RS. Men are the fast sex; as such, their RS is limited by sexual access to fertile women (Bateman, 1948; Clutton-Brock and Vincent, 1991; Symons, 1979). Unlimited sexual access is vanishingly rare, experienced only by the most despotic men in history (Betzig, 1982). In practice, most men are constrained by the reproductive output of their wives. Because of this constraint, men require paternity certainty to maximize RS. Therefore, widespread rules exist to maximize the sexual fidelity of wives throughout their reproductive careers.

Because knowing a wife's future behavior is impossible, cues of future sexual fidelity are used as proxies. The most common proxy is the bride's virginity at the time of marriage (Apostolou, 2010; Barry, 2007; Broude, 1983; Buss, 1989; Rainwater, 1971). Correspondingly, promotion of chastity begins early: Across societies, young girls are raised to be more sexually-reserved than their male contemporaries (Geary, 2000; Low, 1989). As girls approach puberty, sexual freedom decreases further (Barry and Schlegel, 1984; Barry et al., 1976). While this naturally hampers female mate choice — and thus may hider women's

RS — girls' kin often support this notion because it allows inclusive fitness gains by having greater bargaining power in the mate market and by ensuring that their male kin will marry chaste brides, thus increasing men's RS (Apoostolou, 2007; Dickemann, 1979, 1981; Mace, 2013).

A further means of increasing men's RS via marriage is by wedding a young bride. In most societies, first-time brides are peri-pubertal (Apostolou, 2007; Borgerhoff Mulder, 1988, 1995; Goody, 1959; Low, 2007; Schlegel, 1995). At this stage, a girl is at her highest reproductive value: she has survived to puberty, established that she has a healthy hormonal profile, but — given the delay of fecundity relative to pubertal onset — still has her entire reproductive career ahead of her. It is therefore not surprising that girls this age typically command the highest bride prices (Anderson, 2007, 2014; Dekker and Hoogeveen, 2002; Ingoldsby, 2007; Warner, 2004; cf. Meekers ,1992). Marrying a peri-pubertal bride also helps prevent cuckoldry: if a bride is not yet fecund then her husband cannot be cuckolded. Nonetheless, many societies require virginity tests of brides or have defloration ceremonies (Rozee, 1993). They are most common in societies where bride-price is paid (Daly and Wilson, 1983; Paige, 1983). Virginity tests and defloration ceremonies, at best, cause anxiety and distress for the brides — some are considerably worse than distressful (Olson, 1981; Rozee, 1993; Spencer and Gillen, 1927) — such that it might be expected that the bride's kin would come to her aid. However, the association between these rites and bride price suggests the cost of the bride's distress is outweighed by the inclusive fitness gains her kin receive by establishing her virginity, both directly through greater bride price and indirectly through promotion of chastity norms that will help ensure her male kin's paternity certainty.

While virginity is valued in a bride, sexual fidelity is valued in a wife. Men are motivated to ensure their wives' sexual fidelity to guard against costs to RS associated with cuckoldry. Sanctions — such as physical abuse and/or divorce — against (allegedly) unfaithful wives are permissible and commonly used in all described societies (Apostolou, 2007; Betzig, 1989). These sanctions may even be supported by the *wife's* kin if it promotes a cultural norm of female sexual fidelity that then decreases the likelihood of male kin being cuckolded (Smuts, 1992). Cross-culturally, sexual infidelity is a common reason for divorce; however, there is a sex-bias in allowance of and ease in obtaining it. Generally, a husband and his kin have more rights in divorce proceedings following the wife's adultery than a wife and her kin following the husband's adultery: as Betzig (1989) notes, "In 25 societies, divorce follows from adultery by either partner; in 54 it follows only from adultery on the wife's part and in 2 only from adultery on the husband's" (cf. Daly et al., 1980; Flinn, 1981).

In short, a woman's value as a bride and a wife hinges on her bearing only her husband's children, thereby increasing his RS.

Women's reproductive success and the value of husband's investments

Marriage rules regarding resource investment appear biased towards increasing women's RS. Women are the slow sex (Bateman, 1948; Trivers, 1972) and they have considerable energetic and temporal demands associated with gestation and lactation. As such, their RS is limited by access to investment. Humans' exceptionally altricial offspring (Prentice and Whitehead, 1987) and short interbirth intervals (Alvarez, 2000) result in women typically having several dependent offspring at once. Together, these derived life-

history traits demand a greater investment than a woman is (ancestrally) able to deliver on her own, necessitating the need for assistance (Kaplan, Hill, Lancaster, Hurtado, 2000).

Investment takes many forms — supplying various classes of food, offering protection, teaching skills, etc. — as do those who provide the investment — mother, father, alloparents, other members of the social group (Beise and Voland, 2002; Bjorklund and Jordan, 2013; Emlen, 1995; Gibson and Mace, 2005; Kaplan et al., 2000). Therefore, it is erroneous to assume that women require that necessary resources come from their mates (cf. Hawkes, 1991, 1993; Bleige Bird et al. 2001; Blurton Jones et al. 2000). Nonetheless, several lines of evidence strongly suggest that, cross-culturally, women value resource investment by a partner because it bolsters women's RS.

Cross-culturally, provisioning ability is highly valued in a potential groom (Apostolou, 2007, 2008, 2010; Huber et al., 2011) because paternal resource investment predicts greater offspring health, survivorship, and social competence (Anderson et al., 1999; Flinn and England, 1997; Geary, 2000; Geary and Flinn, 2001; Gurven and Hill, 2009; Gurven et al., 2009; Hill and Hurtado, 1996; Klindworth and Voland, 1995; Reid, 1997; Winking et al., 2011; cf. Sear and Mace, 2008). Therefore, skills promoting resource acquisition are nurtured from an early age. In most societies, boys, more so than girls, are raised to be aggressive, display fortitude, and be self-reliant: all attributes often associated with male-specific provisioning tasks (Low, 1989, 2000; Pellegrini and Bjorklund, 2000; cf., Rohner, 1976). Training for these tasks typically — either formally or indirectly via observation — begins when boys are sufficiently mature (e.g., can keep up on a hunt, can use a plow; Boyette, 2013; Draper, 1976; Weisfeld, 1997). Male-specific provisioning tasks are

often complex and difficult, generally necessitating years of training (Gurven, Kaplan, and Gutierrez, 2006; Kaplan et al., 2000). Typically, it is only when men demonstrate sufficient aptitude at these tasks is demonstrated that they are allowed to marry and/or are chosen as husbands (Ember, 1984; Lancaster and Kaplan, 1992; Witkowski, 1975).

Men's investment capacities affect the type of marriages that they have. Most societies permit polygynous marriages (82%; Murdock, 1967). However, men in these societies are rarely polygynously married because women (or their decision-making kin) will not consent to a such a marriage unless the polygyny threshold has been crossed (Borgerhoff Mulder, 1988; Hartung, 1982; Marlow, 2003; Orians, 1969; Verner and Wilson, 1966; White and Burton, 1988) or men offer alternative benefits to the bride's kin (Flinn and Low, 2014; Ji, Xu, and Mace, 2013). First wives of polygynous men do not typically welcome co-wives because once-monopolized resources must now be shared (Scelza and Bliege Bird, 2008; Strassmann, 1997, 2000; White, 1988; Yanca and Low, 2004; cf. Sellen et al., 2000). Similarly, a first wife's kin often prefer that she be the sole wife because resource monopolization allows for greater offspring health than if the resources were divided (Borgerhoff Mulder, 1990; Gibson and Mace, 2007). Likewise, in societies where monogamy is socially-imposed, a high-investing man is not only a valued resource but one worth competing for. In many of these societies, the bride's kin will pay a dowry with the goal of netting a positive return in the form of increased inclusive fitness (Gaulin and Boster, 1990, 1991, 1993; Srinivasan, 2005; cf. Schlegel and Eloul, 1988).

The importance of men's resource investment into a marriage is also highlighted when its absence predicts divorce. Across most societies, the wife and her kin, relative to the

husband and his kin, are comparatively disadvantaged in the ability to and ease in obtaining a divorce. However, this general trend is reversed when the impetus of the divorce is the lack of the male resource investment: The failure of a husband to provide for his wife and children when cultural rules dictate he do so — either because he is unable or because he is unwilling — is permissible grounds for the wife or her kin to dissolve the marriage (Betzig, 1989; Daly and Wilson, 2000).

In short, a man's value as a groom and as a husband is linked to his ability to invest in his wife and her offspring, thereby increasing her RS.

Conflicting strategies inherent in marriage produce specific reproductive risks

The prevalence of rules associated with marriage suggests that men and women might be motivated to behave differently than what is prescribed — if not, no rules would be necessary.

Women's mixed reproductive strategy and men's cuckoldry risk

Like all mammals, women's RS is limited by access to resources; however, acquiring resources is not the only means by which women may increase their RS. Like all sexually-reproducing species, women require the genes of a partner to be able to pass on her own genes. Therefore selection favors women who acquire mates with the best possible genes. A woman's husband may not — often will not — possess the best available genes, thus creating an incentive for her to seek such genes elsewhere. Acquiring the best resources from one

partner and, simultaneously, the best genes from another is known as women's mixed reproductive strategy (MRS).

Evidence indicates that women are evolved to facultatively pursue MRSs. Women value attractiveness in sex-only partners more than when seeking longer-term romantic relationships (Kenrick, Sadalla, Groth, and Trost, 1990). Similarly, men exhibiting cues of high genetic quality are typically selected as extra-pair copulation (EPC) partners (Gangestad and Thornhill, 1997). Men with these cues report greater inducement of orgasms, promoting greater sperm-retention (Puts, and Dawood, 2006; Puts, Welling, Burriss, Dawood, 2012). Moreover, women are more attracted to cues of men's high genetic quality during ovulation, the time when they are most likely to actually use the genes delivered in an EPC (Gangestad and Thornhill, 1998; Johnston et al., 2001; Penton-Voak et al., 1999); this effect is stronger for women mated to men with cues of low genetic quality (Gangestad, Thornhill, Garver-Apgar, 2005; Pillsworth et al., 2005; Pillsworth and Haselton, 2006; Larson et al., 2012). As expected, women who engage in EPCs have offspring with increased health and survivorship (Lancaster, 1989; Scelza, 2011).

It should be noted that women may also engage in EPCs to gain non-genetic resources — provided either immediately (Scheib, 2001) or over time, as is the case in societies with investments by secondary fathers (e.g., Beckerman et al., 1998; Hill and Hurtado, 1996) — which can also increase offspring health and survivorship. Given these benefits, it is hardly surprising that significant percentages (~20-50%) of women engage in EPCs in industrial, pastoral, horticultural, and foraging societies (Beckerman et al. 1998; Essock-Vitale and McGuire, 1988; Hill and Hurtado, 1996; Kaplan and Hill, 1985; Marlowe,

2000; Shostak, 1981; Winking, Kaplan, Gurven, Rucas, 2007). Rates of non-paternity vary among societies but data suggests women are successfully cuckolding their husbands 1-20% of the time (Bellis and Baker, 1990; Cerda-Flores, Barton, Marty-Gonzalez, Rivas, and Chakraborty, 1999; Flinn, 1988; Gaulin, McBurney, and Brakeman-Wartell, 1997; McBurney, Simon, Gaulin, and Geliebter, 2002; Neel and Weiss, 1975; Potthoff and Whittinghill, 1965; Sasse, Muller, Chakraborty and Ott, 1994; Simmons, Firman, Rhodes, and Peters, 2003; Scelza 2011).

I do not suggest that all women will engage in MRSs. It is a dangerous strategy with (suspected) adultery often leading to beating, abandonment, and/or death (Apostolou, 2007; Betzig, 1989; Stieglitz, et al., 2012). Nonetheless, *some women in some situations* benefit by engaging in an MRS. Therefore, women should facultatively engage in MRSs only when the predicted benefit — adjusted by the likelihood of success — is expected to outweigh the predicted cost — adjusted by the likelihood of failure.

In short, there is an inherent conflict of interest regarding a wife's sexual fidelity: Her husband's RS hinges upon it whereas it may not always serve her reproductive interests.

Men's mixed reproductive strategy and women's risk of resource loss

Men's RS is limited by access to fertile mates; more of which can be acquired through EPCs or through additional wives. Men, therefore, could increase their RS by provisioning the best-available primary partner and her offspring while seeking additional mating opportunities via EPCs (e.g., Davies & Shackelford, 2008; Figueredo & Jacobs, 2000; Gangestad & Simpson, 2000; Gaulin & McBurney, 2001; Shackelford et al., 2004).

Decreased parenting effort will generally result in decreased offspring health and survivorship, negatively affecting men's RS (Anderson et al., 1999; Flinn and England, 1997; Geary, 2000; Geary and Flinn, 2001; Gurven and Hill, 2009; Hill and Hurtado, 1996; Klindworth and Voland, 1995; Reid, 1997; Winking et al., 2011; cf. Sear and Mace, 2008). Therefore selection favors men who apportion resources in a fashion that sufficiently provisions their wife and offspring while also engaging in as many EPCs as possible. This is men's MRS.

Evidence indicates that men are evolved to facultatively pursue an MRS. Men lower their standards when considering the qualities necessary in a short-term sex partner; but keep their standards high for a long-term romantic partner (Kenrick et al. 1990). Likewise, men do not need to know a woman well before consenting to sex (Clark and Hatfield, 1989; Buss and Schmitt, 1993). Together, these conditions relax restrictions on whom a man will have casual sex with, thus allowing for an increased number EPC partners. Moreover, when men have greater bargaining power in the mate market, they provide less paternal effort, thus allowing for greater mating effort. This is the case for men in low sex-ratio mate markets (Kruger, 2009; Marlowe, 1999; Pederson, 1991), and for men who are desirable as EPC partners — and are thus better equipped to employ an MRS (Csathó and Bereczkei, 2003; Waynforth, 1998).

I do not suggest that all men engage in MRSs. Maximizing male RS by optimally balancing parental effort with mating effort is contingent upon a number of factors: sex ratio within the mate market (Geary, Vigil, and Bird-Craven, 2004; Greely, 1994), likelihood of successfully enticing an EPC partner (Gangestad and Thornhill, 1994), loss of a wife's future

fertility through divorce (Winking et al., 2007). Nonetheless, the selective pressures for *some men in some situations* exist; moreover these situations were recurrent over evolutionary time such that facultative adaptations that facilitate men's RS should also exist.

In short, there is an inherent conflict of interest regarding a husband's resource allocation: A wife's RS is affected by her husband's provisioning fidelity whereas he may be motivated to seek use resources for mating effort.

Jealousy as an adaptation designed to defend against a mate's MRS

As evidenced by the ubiquity of marriage, a long-term mate has generally boosted the RS of both males and females. However, even in a strongly biparental species, male and female reproductive interests are not perfectly coincident and tactics that can elevate the reproductive success of one sex can be very costly to the other. Men are vulnerable to costs associated with sexual infidelity; women are vulnerable to costs associated with investment infidelity. Given these considerable costs, both men and women face pressures to 1) identify when the likelihood of these threats has increased before they have actually occurred, and 2) motivate behaviors designed to mitigate or avoid associated costs. The emotion of jealousy is theorized to serve these functions (Buss et al., 1992; Clanton & Smith, 1977; Daly et al., 1982; White & Mullen, 1989).

The nature of jealousy

If sexual infidelity or investment infidelity have such fitness costs, adaptations may have evolved to minimize or avoid them. Following this logic, romantic jealousy has been hypothesized to be either sexual or emotional in nature, responding to threats to sexual exclusivity and threats to emotional exclusivity, respectively (Buss et al., 1992). It has been further hypothesized that differences between men and women in the minimal required parental investment will promote differences in their relative weighting of sexual threats and emotional threats. Because men's required parental investment is small and their reproductive success is limited by sexual access to fertile women, men should be more distressed by sexual infidelity than are women. Conversely, because women's required parental investment is large and their reproductive success is limited by access to resources, women should be more distressed by a loss of a mate's current and future investment. If resource investment is predicted by a deep emotional attachment (cf. Buss, 1988; Mellon, 1981), then a man's emotional infidelity predicts a loss of resources (Buss et al., 1992).

The sex-difference component of this hypothesis is well-supported (see Sagarin et al., 2012 for a recent review and meta-analysis). Psychological experiments of various types have found sex differences in distress using *forced choice methods* (Basset, 2005; Berman and Fraizer, 2005; Brase et al., 2004; Buss et al., 1992, 1999, 2000; Buunk and Fisher, 2009; Buunk et al., 1996; de Souzsa, 2006; Cann et al., 2001; Cramer et al., 2001; Dijkstra et al., 2001; Fernandez et al., 2007; Geary et al., 2001; Guadagno and Sagarin, 2010; Levy and Kelly, 2010; Murphy et al., 2006; Sabini and Silver, 2005; Sagarin and Guadagno, 2004; Sagarin et al., 2003; Schutzwohl, 2007, 2008; Shackelford et al., 2002; Ward and Voracek, 2004; Wiederman and Kendall, 1999), *rating scales* (Bailey et al., 1994; Brase et al., 2004; Brogdon, 2006; Buunk, 1997; Buunk and Dijkstra, 2001; Cann et al., 2001; Edlund and

Sagarin, 2009; Guadagno and Sagarin, 2010; Sagarin and Guadagno, 2004), and *vignettes* (Buunk and Dijkstra, 2004; Park et al., 2008; Sabini and Green, 2004). Similar experimental results were obtained using *physiological measures* of psychological distress (Buss et al., 1992; Geary et al., 2001; Krug et al., 1996; Pietrzak et al., 2002; Takahashi et al., 2006; cf. Harris, 2000). Analyses of *ethnographic* accounts have also supported the sex-difference prediction (Counts et al., 1991; Wilson and Daly, 1982). Most commonly, studies supporting the sex-difference prediction have used heterosexual North American undergraduates; however, results do not differ greatly when considering *non-university North Americans* (Bailey et al., 1994; Edlund et al., 2006; Tagler, 2010; cf. Shackelford, 2004), *homosexuals* (Bailey et al., 1994; Buunk and Dijstra, 2001; de Souza, 2006; Dijkstra et al., 2001; Harris, 2002), *South Americans* (de Souza, 2006; Fernandez et al., 2007), *Europeans* (Brase et al., 2004; Buunk, 1997; Buunk and Fisher, 2009; Buunk et al., 1996; de Souza, 2006; Fernandez et al., 2007; Schutzwohl, 2007, 2008; Wiederman and Kendall, 1999), *Australians* (Ward and Voracek, 2004), or *Asians* (Buss et al., 1999, 2000; Geary et al., 1995). Based on the breadth of this literature, sex differences in romantic jealousy have been upheld as exemplars of successful adaptationist logic in the social sciences (Buss and Haselton, 2005).

What we do not know about jealousy

Given the considerable depth of research on the adaptive function of romantic jealousy, there is a surprising lack of breadth. The overwhelming majority of studies taking an adaptationist approach to jealousy are focused on sex differences in reactions to threats. While this approach has been remarkably fruitful (see above), it also relies on untested suppositions and fails to consider the wider scope and function of jealousy as an adaptation.

In considering Buss and colleagues' original hypothesis, it is apparent that there are two components: 1) Threats are sexual or emotional in nature, and 2) men and women will weigh these threats differently. When researchers distinguish sexual threats from emotional threats — either in the creation of experimental stimuli or in choosing the foci of ethnographic accounts — the first component of the theory is tacitly accepted. While some researchers have noted that the distinction of sexual threats and emotional threats might an artificial one (Berman and Fraizer, 2005; Harris, 2003; Tagler, 2010; cf. Edlund et al., 2006), none have empirically evaluated this potentially serious challenge. This highlights a larger problem related to understanding romantic jealousy as an adaptation: What are the naturally salient aspects of relationship threats — including the place of sexual and emotional threats within the overall jealousy landscape? How does the human mind spontaneously organize relationship threats?

A common methodological issue has also limited the understanding of jealousy's adaptive function. Most researcher-constructed stimuli are direct, unambiguous statements regarding sexual or emotional infidelity; many simply reproduce Buss and colleagues' original stimuli. If jealousy is designed to address a *threat* of infidelity, it should be triggered when infidelity is suggested. Stimuli involving a partner "enjoying passionate sexual intercourse with [an]other person" does not suggest infidelity; it confirms it. This may be why these stimuli also elicit high amounts of anger, hurt, and disgust (Geary et al., 1995, 2001; Shackelford et al., 2000; Becker et al., 2004; cf. Parrott and Smith, 1991, Sabini and Silver, 2005, Sharpstein, 1993). Further, while it is reasonable to reduce the signal-to-noise ratio by using strong stimuli when evaluating a novel prediction (cf. Buss et al., 1992), continued reliance on those same extreme stimuli limits the understanding of the adaptive

function of jealousy (cf. Schutzwohl and Koch, 2004; Schutzwohl, 2005; Shackelford and Buss, 1997; Yarab et al., 1999) — especially when logic dictates weaker, more ambiguous stimuli would be efficacious and, arguably, more ecologically appropriate to evaluate the hypothesized function of jealousy. At present, there is robust support for sex differences in response/distress only for very strong, artificially-distinct sexual and emotional threats to romantic relationships. There are scant data on reactions to weaker threats and, to my knowledge, no data at all on the adaptive function of jealousy independent of such researcher-imposed distinctions. We do not know how people naturally conceive of threats to romantic relationships or how this is affected by sex, age, or other individual differences. In this dissertation I examine how people spontaneously organize threats to romantic relationships, with a particular focus on evaluating the salience of the sexual-emotional distinction. This research is performed with a large aggregate population as well as for subpopulations within it: men, women, younger people, older people, and those with varying real-world infidelity experiences. These analyses are presented in Chapter 3.

Are there facultative shifts in perception of threats to romantic relationships?

As discussed above, all people are vulnerable to costs associated with a romantic partner — cuckoldry, abandonment, violence, defection, etc. However, the type of cost and the likelihood of incurring it can vary in predictable ways. This suggests the presence of facultative responses that alter attention to particular types of threats and motivate counterstrategies appropriate for the threat detected. Thus a person who perceives that the local mating market includes many desirable rivals should be particularly sensitive to cues

his or her partner is implementing an MRS so counterstrategies can be deployed to minimize costs. Sex-specific predictions are outlined below.

Women's MRS involves securing the best available investment from a long-term, primary partner and the best available genes from an EPC partner (e.g., Cashdan, 1996; Geary, 2004; Hodges-Simeon et al., 2010; Little et al., 2001; Scelza, 2011; Symons, 1979). In cases where a woman employs an MRS, the cuckolded primary partner loses time and resource investment in advancing his rival's genes (Buunk et al., 1996; Goetz & Shackelford, 2009; Voracek et al., 2009). A man is particularly vulnerable to these costs when the local mating market contains many rivals of relatively higher genetic quality.

Facultative prediction 1: Based on this logic, men of relatively low genetic quality are at a high risk of a partner's MRS and are therefore predicted to assess threats to romantic relationships differently than lower-risk men. Specifically, higher-risk men should show greater attention to cues that 1) his partner is having an EPC and 2) that she does not intend to leave the primary relationship (i.e., both components of cuckoldry).

Men's MRS involves splitting resources into parenting effort directed at a long-term, primary partner and into mating effort designed to acquire EPCs that could increase the number of his progeny (Davies & Shackelford, 2008; Figueredo & Jacobs, 2000; Gangestad & Simpson, 2000; Gaulin & McBurney, 2001; Shackelford et al., 2004; Trivers, 1972). Such an MRS is potentially costly to his primary partner because she stands to lose some (or all, if he abandons her) of his resources to a rival (Petrie & Hunter, 1993; Scheib, 2001; Trivers, 1972; Westneat et al., 1990). A woman is particularly vulnerable to these costs when there are many sexually-accessible rivals in her local mating market.

Facultative prediction 2: Based on this logic, women with many sexually-accessible rivals are at a high-risk of a partner's MRS and are therefore predicted to assess threats to relationships differently than low-risk women. Specifically, high-risk women should show greater attention to cues that a partner is engaging in an EPC.

To my knowledge, I provide the first evidence that assessment of relationship threats is facultatively dependent on these kinds of mate-market forces. I test these two predictions with data on men and women's perception of and attention to relationship threats in Chapter 4.

Mate preferences as a strategy to avoid future costs to reproductive success

As discussed above, investment capacity is highly valued in a husband (or other long-term partner) and sexual fidelity is highly valued in a wife (or other long-term partner), presumably because these traits bolster the RS of the men and women who manifest such preferences. However, there are many traits that could elevate RS, and these will inevitably vary among potential mates. Vanishingly few individuals will offer maximum doses of all these beneficial traits. Therefore, there should be selection to prioritize those traits that are more strongly correlated with RS. Moreover, because men are limited by the reproductive capacity of their mates in ways that women are not (Bateman, 1948; Clutton-Brock and Vincent, 1991; Symons, 1979), and because both minimum levels of parental investment and primary avenues of parental investment differ by sex (Andersson, 1994; Clutton-Brock, 1991; Trivers, 1972), these strongly valued traits will probably be sex-specific. The core

logic is that when certain traits are more strongly correlated with RS in sex A than in sex B, then these traits should be more strongly preferred in mates by sex B.

Based on existing theory, men should manifest evolved preferences that prioritize a prospective long-term mate's genetic quality (Fink and Penton-Voak, 2002; Perrett, et al., 1998), immunocompetence (Fink, Grammar, and Thornhill, 2010; Pawłowski, Nowak, Borkowska, and Drulis-Kawa, 2014; Zahavi and Zahavi, 1997), and physiological investment capacity (Lassek and Gaulin, 2008; Rilling, Kaufman, Smith, Patel, Worthman, 2009). Moreover, due to paternity uncertainty and the associated costs of cuckoldry, men should have evolved to prioritize a potential mate's sexual fidelity (Hanson Sobraske et al., 2014; Sagarin et al., 2012 and citations therein). Due to the cooperative alliance and social support needed in a biparental, social species such as humans, a long-term mate's kindness should also boost RS (Li, Bailey, Kenrick, Lisenmeier, 2002; Lukaszewski and Roney, 2009). Conversely, traits associated with resource procurement and investment — such as a mate's hard work (Fletcher et al., 2004; Flynn, Geary, and Ward, 2005; Jonason et al., 2012; Low, 1989; cf. Gurven et al., 2013), good social skills (Dunbar and Shultz, 2007; Li, 2007), and ability to have a high status job (Russock, 2001) — are expected to be comparatively less valued by men because these traits predict comparatively smaller increases in RS.

The case for female choice is murkier because — if modern hunter-gatherers/horticulturalists are an acceptable proxy for ancestral humans — women were rarely in full control of their mating destiny. Ergo there is some debate as to whether a selective pressure existed necessary to forge the requisite adaptive preferences (Apostolou, 2007, 2011; Broude and Greene, 1983; Frayser, 1985; Minturn et al. 1969; Whyte, 1978). In

most (87.6%) societies, the bride's kin make marriage arrangements on her behalf; the bride's opinion is formally taken into consideration in 21.5% of these societies (Apostolou, 2007). Given that a bride is often exchanged for resources that are used by her parents to bolster her brothers' or father's RS (Hartung, 1982), there is an inherent conflict of interest in choosing a husband (Borgerhoff Mulder, 1988, 1990; Daly and Wilson, 1983; Flinn, 1988). That said, divorce is permissible in most societies with "incompatibility" being a very common reason for the divorce (Betzig, 1989; Thompson, 1983); this provides the woman with an opportunity to voice her opinion on her next husband. While elopement is uncommon, it exists in many societies (Apostolou, 2007). Moreover, women have mate preferences similar to those of females in other biparental species (e.g., Borgia, 1979; Emlen and Oring, 1977; Orians, 1969;Thornhill and Alcock, 1983). Finally, men appear to employ strategies that take into account women's preferences (e.g., displays kindness, resources, and genetic quality, Buss, 1988; Iredale, Van Vugt, and Dunbar, 2008; Schmitt and Buss, 1996). All together, these patterns strongly suggest that women do indeed have preferences for qualities in a mate increase female RS.

Because women are limited by material resources (Symons, 1979; Trivers, 1972), women are predicted to value cues that a mate is able to acquire resources — such as a mate's hard work (Fletcher et al., 2004; Flynn, Geary, and Ward, 2005; Jonason et al., 2012), intelligence (Fisman, Iyengar, Kamenica, and Simonson, 2006; Geary, 2000; Kaplan, Gurven, and Lancaster, 2007; Low, 2000), ability to have a high status job (Campos, Otta, and siqeria, 2002; Russock, 2011), and good social skills (Irons, 1979, 1983; Townsend and Levy, 1990; Von Rueden, Gurven, and Kaplan, 2011). However, a mate's ability to acquire resources is insufficient in itself to increase women's RS; those resources must also be

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invested. Therefore, women are predicted to value cues of resource investment, like kindness (Lukaszewski and Roney, 2009; cf. Hewlett, 1992) and emotional fidelity (Buss et al., 1992; Sagarin et al., 2012). Cues of a mate's physical quality — such as such as health (Gagnestad, Haselton, and Buss, 2006; Li, 2007), an attractive face (Lie, Rhodes, and Simmons, 2008; Penton-Voak et al., 2004), and a masculine body (Fredrick and Haselton, 2004; cf. Nettle, 2002) — are expected to be comparatively less valued by women when choosing a long-term mate because they predict comparatively smaller increases in RS. Moreover, there is evidence that high genetic quality men are not desirable as long-term mates because they generally do not invest as much in parental effort (Gangestad and Simpson, 2000; Kruger, 2006).

This suite of sex-specific mate preferences is well-supported across societies (e.g., Bereczkei et al., 1997; Buss, 1989; Buunk, Dijkstra, Fetchenhauer, and Kenrick, 2002; Chang, Wang, Shackelford, and Buss, 2011; Gil-Burmann, Peláez, and Sánchez, 2002; Hatfield and Sprecher, 1995; Pearce, Chuikova, Ramsey, and Galyautdinova, 2010; Shackelford, Schmitt, and Buss, 2005; and references above). Despite the considerable breadth of research on both mate preferences and on threats to romantic relationships, to my knowledge, only one study has considered the valuation of sexual fidelity relative to other traits (Mogilski, Wade, and Welling, 2014). However, this study approached intra-trait valuation in an ordinal fashion: informants valued "a history of sexual fidelity" more than "similarity" in a long-term mate but it is unclear how much more. Further, I am unaware of any study that has considered the value of emotional fidelity in a long-term mate, either in isolation or relative to other traits.

As with many findings in the fields of evolved psychology and adaptive behavior, the sex-specific pattern of mate preferences is best documented in Western populations; particularly from undergraduates and, to a lesser extent, university-adjacent community populations (e.g., Buss and Barnes, 1986; Feingold, 1990, 1992; Fletcher, Tither, O'Loughlin, Friesen, and Overall, 2004; Jonason, Li, and Madson, 2011; Kenrick Sadalla, Groth, and Trost, 1990; Stewart, Stinnett, and Rosenfeld, 2000; Waynforth and Dunbar, 1995). Occasionally, the mate preferences of undergraduate and community populations are evaluated in parallel (Buss, et al., 2001; Li et al., 2002; Wiederman and Allgeier, 1992) but, to my knowledge, they have never been quantitatively compared. The lack of comparative data is not trivial given the recurring critique that undergraduates are not representative samples of Western adults (Arnett, 2000, 2008; Harris, 2002; Hooghe, Stolle, Maheo, and Vissers, 2010; Rozin, 2010; Tagler, 2010; Voracek, 2001). Indeed, this critique is often provided as rationale for the use of community populations in research on human mating psychology (e.g., Dijkstra and Buunk, 2002; Green and Sabini, 2006). To evaluate the extent of homogeneity in human mate preferences in Western, American adults, I conducted quantitative within-sex comparisons between community members and undergraduates. These samples were regionally matched to help control for geographical variations in preferences (cf. McGraw, 2002). These data are presented in Chapter 5.

Explaining "Atypical" Mate Preferences

The study presented in Chapter 5 served a two purposes: 1) To evaluate the valuation of sexual fidelity and emotional fidelity relative to other mate qualities, and 2) to evaluate the extent of homogeneity in human mate preferences in Western, American adults, by

conducting quantitative within-sex comparisons between community members and undergraduates. The mate preferences of four populations were evaluated and compared — university/community, men/women. Of these four populations, three displayed mate preferences that were strongly in accord with first-order sexual selection principles: university and community men as well as community women prioritized qualities predictive of sex-specific increases to RS, as outlined above. However, university women did not prioritize qualities predictive of increased RS. In fact, qualities predicted of resource acquisition were among the *least* valued. Also unexpected: As evaluated by university women, *sexual* fidelity was among the most valued traits in a mate. These results were puzzling for a number of reasons. One, the power of my analyses strongly argued against the possibility that these results were driven by a statistical fluke. Two, the mate preference literature is rife with data from Western students whose data is sex-typical, and therefore quite different from the data I collected. Ergo, my data are unlikely to be the result of university women simply having odd preferences. It is certainly possible that a "file drawer problem" exists wherein sex-atypical preferences are more common than would otherwise be believed; however, the nature of a file drawer problem means that its existence is always speculative. Three, community women followed sex-specific patterns of valuation; therefore, university women's mate preferences are unlikely to be part of a larger pattern within the local region. Four, UCSB men followed sex-specific patterns of valuation; therefore, UCSB women's mate preferences are unlikely to be part of a larger pattern influencing the university as a whole. Five, university women showed clear preferences for particular qualities. It was not the case that a few women drove the results in an odd direction, neither was it the case that these women valued all provided qualities equally. Moreover, these

preferences were replicated. Altogether, these reasons suggest the existence of uncommon pressures acting on UCSB women that are not operating on university women in general, nearby community women, or on UCSB men.

Despite a suggestion of novel influences on UCSB women's mate choice preferences, neither the nature nor the mechanism of these influences was provided by quantitative data (cf. Denzin & Lincoln, 2000; Silverman, 2000). A different type of data was required to identify the social or environmental influences on women's mate choice preferences. Semi-structured interviews were chosen over alternative methods of data collection (e.g., focal follows, scan samples) for a number of reasons. Interviews offer emic insight into informants' reasoning and motivations. They also allow access-by-proxy to scenarios where an outsider's presence is suspicious or unwelcome (e.g., sexual encounters). Methodologically, interviews are not associated with a particular theoretical paradigm so they are inherently compatible sexual selection logic. The semi-structured interview format ensures that informants discuss the same overarching topics — thus providing a means of comparison across informants — while still allowing for flexible, idiosyncratic discussion of those topics (Gubrium & Holstein 2002; McCracken, 1988). To my knowledge, this is the first evaluation of atypical mate preferences in an undergraduate population, thus describing and accounting for variation within a decidedly WEIRD population. These data are presented in Chapter 6.

Dissertation Outline

The following is a chapter-by-chapter summary of my dissertation on threats to long-term romantic relationships.

Chapter 1: Introduction

Chapter 2: Methods

Because my participant-driven approach benefited from minimally obtrusive measures — a tack that is rarely taken in adaptationist research on mate preferences — I recruited methods which, though well developed elsewhere, have seldom been used in the realms of evolutionary psychology and human behavioral ecology. These methods are addressed in detail with a particular focus on their strengths in relation to the tasks at hand.

Chapter 3: The nature of the jealousy landscape

Here I map the jealousy landscape by describing the principle means by which people spontaneously organize threats to romantic relationships. This is conducted with an aggregate population and then for six pairs of contrasted subpopulations: men/women, university/community, self sexually faithful/unfaithful, partner sexually faithful/unfaithful, self emotionally faithful/unfaithful, partner emotionally faithful/unfaithful. I consider the prevailing notion that jealousy in naturally cleaved along the dimensions of sexual threats and emotional threats while also offering — and substantiating — alternative means of threat-organization.

Chapter 4: The influence of rivals within the mate market on evaluation of relationship threats

Here I test the hypothesis that the qualities of romantic rivals will facultatively affect informants' evaluation of ambiguous threats to a long-term romantic relationship, thus allowing for better protection against a romantic partner's MRS. This chapter provides explicit tests of the two facultative predictions developed above.

Chapter 5: Mate preferences and the valuation of sexual fidelity and emotional fidelity

Here I present novel data on the valuation of RS-enhancing traits, including both sexual fidelity and emotional fidelity. Further, I evaluate how well students represent Western adults, vis-à-vis mate preferences.

Chapter 6: Long-form interviews of UCSB women regarding the local mate market

Here I describe some novel influences on UCSB women's atypical mate preferences with a particular focus on why sexual fidelity is valued so highly and why cues predicting resource acquisition are valued so little. I also offer a perspective by which these unusual preferences are consistent with adaptive logic.

Chapter 7: Conclusion

Here I provided a summary of these data and their contributions to the fields of jealousy, threat assessment, mate preferences, and adaptive human behavior. I also discuss the advantages of the methods used. I finally propose candidate extensions of the results detailed throughout this dissertation.

Chapter II

Methods

I. METHODS ASSOCIATED WITH CHAPTERS 3 AND 4: SUCCESSIVE PILE SORTS AND ASSOCIATED FOLLOW-UP ANALYSES USED TO IDENTIFY HOW AMBIGUOUS RELATIONSHIP THREATS ARE ORGANIZED

"The studies here have an explicitly cognitive frame of reference. It is assumed that the individual can meaningfully organize any collection of things having psychological referent value; furthermore he will organize the things according to the subjective significance of their relationships." Cliff and Young, 1968

Similarity Judgment Tasks

The vast majority of research on the adaptive function of jealousy has used methods that tacitly accept a sexual-emotional distinction in threats to romantic relationships (e.g., Buss et al., 1992; Buunk and Dijkstra, 2004; De Souza, 2006; Cramer et al., 2001; Easton, 2007; Levy and Kelly, 2011; Thompson, 2007; Sagarin et al., 2012; Sagarin and Guadagno, 2004; Shackelford et al., 2000). When researchers distinguish sexual threats from emotional threats — either in the creation of experimental stimuli or in choosing the foci of ethnographic accounts — they impose characteristics on the jealousy domain that may or may not accurately reflect how threats are spontaneously organized in the minds of informants. Moreover, the most commonly used methods — forced choice, rating scales, and evaluation of ethnographic accounts — are unable to reveal if this distinction is present in the minds of the study subjects.

To understand how threats to romantic relationships are spontaneously organized, I had to break with established methodological traditions in jealousy research. My goal was to

reveal the implicit conceptual structure of jealousy with minimal preconceptions and researcher intrusion. This goal required an alternative method than has previously been used in studying the adaptive function of jealousy.

Graphical representations of similarity data

To expand the scope of hypotheses about jealousy's function I drew on a set of methodological tools previously developed by cognitive scientists in anthropology and psychology. Specifically, I used a similarity-judgment task with a suite of informant-derived jealousy-inducing exemplars and then empirically evaluated graphical representations of the similarity judgments. Graphical representations of similarity judgments allowed me to identify the implicit conceptual structure of the jealousy domain because they are "relatively free of specific theoretical demands, [and] 'uncover' or 'recover' the hidden structure that is in the data" (Bhushan et al., 1997, p.242). For example, a similarity judgment task examining visual perception of textures found informants organize images in terms of three aspects of texture: repeating vs. random, linear vs. circular, and simple vs. complex (Bhushan et al., 1997). Subsequent studies revealed that different V4 neurons were activated for texture images varying along these same three dimensions in both humans and macaques (Arcizet et al., 2008; Puce et al., 1996). This cross-species agreement suggests graphical representations of similarity data can reveal the deep conceptual (and neurological) structures underlying a domain.

Graphical representations of similarity judgments have also been used to study the perceptual domains of *mechanical sound* (Lemaitrie et al., 2007), *the human voice* (Baumann and Belin, 2010; Matsumoto et al., 1973), *odor* (Campo et al., 2008; Coxon et al., 1978; Schiffman et al., 1977; Zarzo, 2011), and *color* (Boster, 1986; Kay and Regier, 2003) and a

variety of conceptual domains such as *ethnicity* (Jones and Ashmore, 1973; Wish et al., 1970), *health and illness* (Trotter and Potter, 1993; Verkes et al., 1989;Weller, 1986), *suites of emotions* (Bimler et al., 1999; Herrmann and Raybeck, 1981; Romney et al., 1997; Russell, 1983), *facial expression of emotions* (Cliff and Young, 1968; Russell, 1980; Russell and Bullock, 1985; Russell and Bullock, 1986), specific emotions such as *anger* (Snell et al., 1991), *loneliness* (Michela et al., 1982), *the distinction between jealousy and envy* (Salovey and Rodin, 1986), *causation* (Wolff and Song, 2003), *animals*, (Boster et al., 1986; Boster and D'Andrade, 1989; Herrmann and Raybeck, 1981; Lopez et al., 1997), and *landmarks* (Aragones and Arredondo, 1985).

Similarity data can be acquired using a variety of methods, such as *pile sorts* (Albert, 1991; Aragones and Arredondo, 1985; Bimler et al., 1999; Bhushan et al., 1997; Boster, 1986; Campo et al., 2008; Jones and Ashmore, 1973; Kay and Regier, 2003; Lemaitrie et al., 2007; Lopez et al., 1997, Reed et al., 2004, Russell, 1983, Russell and Bullock, 1985, Russell and Bullock, 1986; Snell et al., 1991; Trotter and Potter, 1993; Verkes et al., 1989; Weller, 1986; Wolff and Song, 2003), *rating tasks* (Bauman and Belin, 2010; Cliff and Young, 1968; Coxon et al., 1978; Hermann and Raybeck, 1981; Matsumoto et al., 1973; Michela et al., 1982; Picard et al., 2003; Schiffman, 1974; Singh and Luis, 1995; Wish et al., 1970), *pairwise comparisons* (Campo et al., 2008; Schiffman et al., 1974; Yoshioka et al., 2007), *triadic comparisons* (Romney et al., 1997), or *genetic relatedness* (Alvard, 2009). Of these methods, I chose to use pile sorts because they provide fine-grained distinctions between the exemplars of a domain with a relative lack of informant fatigue.

Types of Pile Sorts

Pile sorts require informants to make similarity judgments among a suite of exemplars within a domain of interest by sorting alike exemplars into groups. These similarity judgments are then represented graphically and interpreted by the researcher. There are multiple versions of the general pile sort task, each with advantages and disadvantages.

Free pile sorts: The free pile sort is the most commonly-used version of a pile sort. Here, informants make as many or as few groups as they choose, using whatever criteria they choose. An advantage of the free sort is that informants find it straight-forward and comparatively easy to do. A disadvantage of the free sort lies in comparing responses between informants. Because each informant makes his/her own decisions about the best number of groups, a lumper-splitter problem emerges, resulting in unequal weighing of participants responses in the analyses (Boorman and Arabie, 1972).

Constrained pile sorts: A constrained pile sort circumvents the lumper-splitter problem — thus permitting accurate comparisons between informants — by requiring informants to make a specific number of piles, as determined by the researcher. However, a disadvantage of the constrained sort is that it artificially restricts informants' similarity judgments, making it more difficult for the informants and potentially affecting their decisions.

Successive pile sorts: A successive pile sort (SPS; also called a 'hierarchical sort' or 'h-sort') allows informants the freedom to make as many or as few initial groups as they choose but later components of the task — not present in either the free or constrained sorts

— yield each informant's judged similarity between all exemplars. This eliminates the lumper-splitter problem while providing fine-grained distinctions between all exemplars. A disadvantage of the SPS is that it is difficult to learn how to conduct the task and record the data.

Conducting a pile sort

The following describes the steps typically undertaken when conducting an SPS. Components of my studies are used as examples.

Step 1: Determine attributes of informants

To contrast how members of two different study populations organize a larger concept, members of each population must be identified. Population membership is determined by the question the study means to answer (e.g., Do experts and novices use similar metrics when organizing exemplars?, Boster and Johnson, 1989). The populations being compared will dictate how informants should be recruited to participate in the study.

In my studies, informants were classified as members of several populations based on personal attributes. Some attributes were demographic: men/women, younger/older, university/community. Some attributes involved informants' histories with sexual infidelity or emotional infidelity (2x2 design, self-committed/partner-committed, sexual infidelity/emotional infidelity) (Chapter 3). Some attributes involved informants' perceptions of their local mating rivals to determine whether the informants were at high- or low-risk of a partner's mixed reproductive strategy (Chapter 4).

SPS is often used to make comparisons between populations; therefore, consideration of informants' different attributes is common. However, to my knowledge, my study was the first to use an SPS to address an *a priori* prediction based on informants' attributes (Chapter 4).

Step 2: Acquire a suite of exemplars

To conduct an SPS, informants need exemplars to sort. These exemplars can be researcher- or informant-derived. Researcher-derived exemplars are generally theory-driven (e.g., Alvard, 2009; Lopez et al., 1997; Singh and Luis, 1995) or based on perceived typicality (e.g., Bhushan et al., 1997; Russel and Bullock, 1985; Weller and Romney, 1988). Informant-derived exemplars are generally generated via free list; this was the case for my studies. I considered informant-derived exemplars necessary for use in a study where the central goal is to map the jealousy space in a manner that reduces researcher-imposed constraints or influences as much as possible. Candidate exemplars were nominated via free list by 632 informants using the prompt: "Please think of a romantic relationship that you are in, have had, or would like to have. Briefly describe something your partner could do or say — or fail to do or say — that would make you jealous. This could be a little jealous, very jealous, or something in between." I reviewed all candidate exemplars for uniqueness; overtly-redundant exemplars were removed but, in the interest of reducing researcher-imposed constraints as much as possible, I erred on the side of inclusion. This left 47 potentially unique candidate exemplars.

While an SPS can be executed with 47 exemplars, it takes a considerable amount of time — just shy of an hour on average — and informant fatigue becomes a concern.

Therefore, I sought to reduce the suite of candidate exemplars to a more manageable number in a principled fashion. Seven pre-raters not involved in any other part of the study did a preliminary SPS with the 47 candidate exemplars. Their judgments were collapsed and a preliminary multidimensional plot was produced (see below for specifics on conducting an SPS and its graphical representation). Like most multidimensional plots representing similarity judgments, proximity in space reflects judged similarity. Candidate exemplars were retained in the final suite only if they were conceptually unique or if they maintained the full range of variation (i.e., they were on the edge of the data cloud in the preliminary multidimensional plot). This winnowing left a final suite of 24 relatively unique jealousy-inducing exemplars. There is no methodological reason to use 24 exemplars; it is an outcome of the free list, preliminary pile sort, and their resulting graphical representation. However, this number strikes a good balance between maintaining a wide array of exemplars while reducing the likelihood of informants' cognitive fatigue during the sorting stage.

As noted above, acquiring a free list is not a required component of an SPS, though I considered it necessary given the goal of the study. Because a major limitation of the jealousy-as-an-adaptation literature is the acceptance of a researcher-imposed sexual-emotional dichotomy, a free list was used to collect exemplars rather than creating the exemplars myself or adopting exemplars from the existing literature. Once acquired, there are alternate means to reduce a free list besides conducting a preliminary pile sort, frequency of exemplar nomination being most common. However, since a central research goal was to map the full jealousy domain, it was appropriate to use the widest range of exemplars available — a range which is unlikely to be captured using only frequently nominated exemplars.

Step 3: Conducting the successive pile sort

In conducting the SPS, each informant will create a complete hierarchy of similarity among the exemplars. This is achieved in a three-step procedure.

Step 3.1: Informants make initial groupings among the exemplars, based on perceived similarity. The number of groups is informant-determined, based only on what makes sense to the informant. Therefore, informants typically — although not necessarily — begin their hierarchy someone where in the middle of their hierarchy (Figure 1).

Step 3.2: Work up to a single group by merging initial groups

Step 3.1: Begin in the middle based on number of initial groups

Step 3.3: Work down to individual exemplars by splitting groups

G C A D F B E

G C   A D F B E

G C   A D   F B E

G C   A D   F   B E

G C   A D   F   B   E

G C   A   D   F   B   E

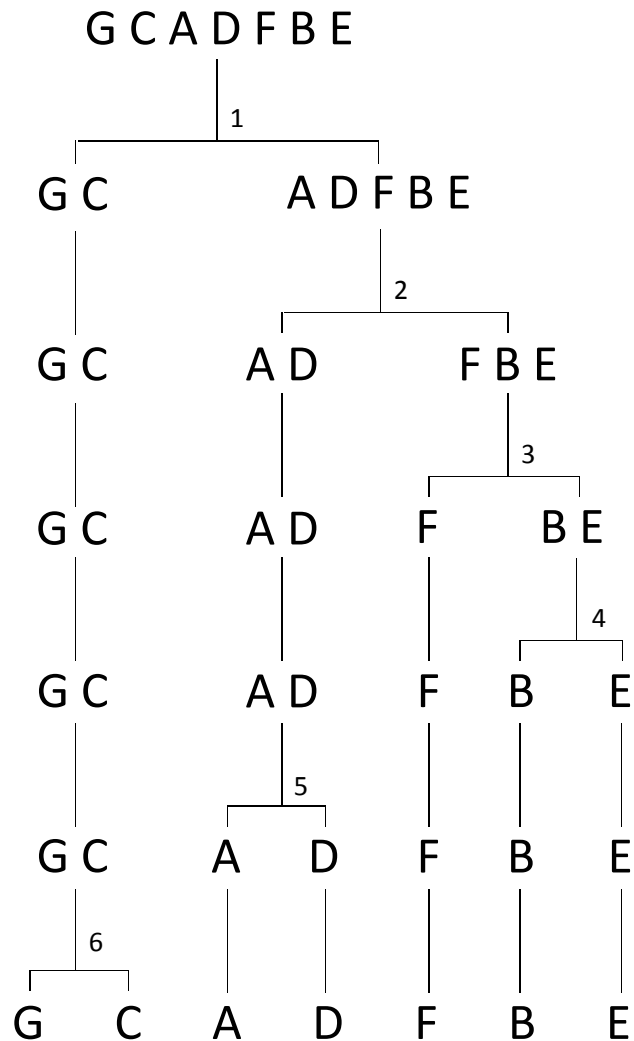G   C   A   D   F   B   E

Figure 1. Visual representation of conducting an SPS.

In my studies, informants were handed a shuffled stack of 24 cards, each with a jealousy-inducing exemplar on it. Informants were then instructed:

> "You'll be asked to group these cards. There are only three rules. One, there has to be at least two groups; more is fine. Two, there has to be some grouping; you can't make it so each card is in a group by itself. Three, there can't be a 'miscellaneous' group. Other than that, sort the cards into as many or as few groups as you like, using whatever criteria makes sense to you."

After sorting the exemplars, informants were asked to give a brief name or label for each of the N initial groups they had created. This labeling is not a required step for conducting an SPS but it was done to provide additional, emic data on informants' reasoning.

Step 3.2: The goal of Step 3.2 is to establish relationships between the exemplars in different initial groups. To do so, informants consider their N initial groups and identify the two *most*-similar groups. These are merged, producing $N-1$ groups. Informants continue merging the most-similar groups until there is only one group, containing all exemplars (Fig. 1).

In my studies, informants performed Step 3.2 as described with one addition: informants provided a label for every newly-merged group.

Step 3.3: The goal of Step 3.3 is to establish relationships among exemplars in the same initial groups. To do so, informants consider their *N* initial groups and identify the group whose members were the *least* similar. Informants then divided this group into two new groups whose members were more similar to each other than the members of the larger group from which they were split. This division step continued — producing *N+1* groups, then *N+2* groups and so on — until all exemplars are in a group by themselves. In this fashion, a full binary tree is elicited for each informant, regardless of how many initial groups were made (Fig. 1).

In my studies, informants performed Step 3.3 as described with one addition: informants provided labels for the new groups created after the first two splits. Therefore, labels were collected for one to *N+2* groups. Because *N* could differ among informants, some informats provided more labels than others.

Step 4: Graphical Representation of SPS Similarity Judgments

An advantage of conducting a similarity judgment task is being able to use graphical representations to identify the organizing features of a domain. As with other similarity judgments tasks, data from an SPS can be represented by dendrograms and by multidimensional plots. Dendrograms are generally more-complete; multidimensional plots are generally more-intuitive. Both types of representations can be produced for an aggregate population or for various sub-populations.

Dendrograms: In most pile sort studies, dendrograms produced are average-link hierarchical clustering trees (Bimler, 2013; Feidelman, Stanton, and Ricardo, 1993; Isenberg,

Neumann, and Carpendale, 2006; Shipman and Boster, 2008; Weller, 1998). These show a consensus of informants' thoughts on the relationship between exemplars. The first split in a dendrogram represents the principle distinction between exemplars whereas later splits are successively less salient distinctions.

In my studies, complete dendrograms were constructed. However, for clarity, the dendrograms displayed in the published studies are "reduced trees", showing only the first five major splits among the 24 jealousy-inducing exemplars. The five-split display was chosen because, for many populations studied here, these splits were more clearly defined (i.e., showed better inter-informant agreement/disagreement) than latter ones. Reducing the trees in this way necessarily produces six major groups.

Multidimensional plots: Multidimensional similarity plots arrange exemplars in thought-space such that physical proximity reflects judged similarity. To produce multidimensional similarity plots, the researcher needs a method to compare the exemplar A-exemplar Z relationship to the exemplar B-exemplar Z relationship. A complete plot requires considering all relationships among all exemplars (in total, Σ N-1 comparisons). Multidimensional scaling is the most common tool used to created plots derived from similarity data.

For my studies, I used correspondence analysis (CA). CA is similar to multidimensional scaling; however, a unique advantage of CA is that, when arranging exemplars in space, it can be used to make comparisons at several levels simultaneously. For example, CA can compare similarity between men's and women's judgments while also

comparing similarity among exemplars, ultimately determining the final position of exemplars.

To use CA, similarity data must be summarized, first as *N* individual similarity matrices then as one average similarity matrix accounting for all informants' similarity judgments. Both similarity matrices are comprised of a row and a column for each exemplar; at each intersection, cells contain a number reflecting the judged similarity between the row-column exemplars. In my studies, the individual and aggregate similarity matrices are 24x24 because I used 24 exemplars.

To begin, each informant has his/her own individual similarity matrix and each cell contains the integer reflecting the judged similarity between the exemplars from the corresponding row and column. For all exemplars separated at the first split, the corresponding integer in the appropriate cell is "1"; for the final pair of exemplars separated at the twenty-third split, the corresponding integer is "23". Thus higher values (e.g., 23) indicate greater similarity because they were separated later. Creating individual similarity matrices is the first step of creating a multidimensional plot. I am unaware of any use that a single individual similarity matrix has on its own.

Then to create the aggregate similarity matrix — and thus the multidimensional plot — the integers within the cells representing the judged similarity are averaged. For example, if half the informants separate exemplar A from exemplar B at split 1 and the other half make the separation at split 4, the corresponding A-B cell of the average similarity matrix will contain the value 2.5. CA factors the rows and columns of the matrix to produce a representation of the judged similarities in low-dimensional space. As with other similarity

plots (e.g., multidimensional scaling), proximity between exemplars reflects perceived similarity. Dimensions of the plot are ordered by eigenvalue and, therefore, by amount of variance explained. In other words, the primary component organizing the domain space is reflected by the x-axis; the secondary component is reflected by the y-axis, etc.

Novel extensions to the SPS method

Below I describe some novel extensions to the SPS method, used to increase rigor in my studies. By my estimation, these extensions have produced the most methodologically thorough studies using pile sorts of any type, including SPS. Therefore, the following is not meant to be read as what *must* be done when conducting an SPS but rather as what *can* be done to maximize inferential rigor. These steps include 5) conduct quantitative interpretation of multidimensional plots based on informant perceptions, 6) conduct quantitative comparisons between populations, 7) develop qualitative interpretation of dendrograms, and 8) perform qualitative comparison between populations.

Step 5: Quantitative Interpretation of Multidimensional Plots

Interpretation of the domain space typically begins and ends with the researcher inspecting the plot and guessing at the underlying variable that might be reflected along each of the principle dimensions (Albert, 1991; Askell-Williams and Lawson, 2001; Bhushan et al., 1997; Bimler and Kirkland et al., 1997; Campo et al., 2008; Coxon et al., 1978; Cliff and Young, 1968; Hermann and Raybeck, 1981; Johnson, 1997; Lemaitrie et al., 2007; Lopez et al., 1997; Michela et al., 1982; Picard et al., 2003; Reed et al., 2004; Romney et al., 1997; Romney et al., 1979; Russel and Bullock, 1985; Salovey and Rodin, 1986; Schiffman et al.,

1977; Snell et al., 1991; Trotter and Potter, 1993; Wish et al., 1970; Wolff and Song, 2003; Yoshioka et al., 2007). Unfortunately, even the most sophisticated guess is, at best, an unsupported hypothesis. Like all hypotheses, it can and should be evaluated before it is admitted as scientific evidence. Further, I believe that the typical "intuitive" approach is particularly problematic when the goal is to understand informants' — rather than the researcher's — thoughts about a domain.

I sought to move beyond intuition and to validate interpretations of the domain space of jealousy. After evaluating the multidimensional plot produced in Step 4, I produced candidate descriptors of the major axes based both on inspection of the exemplars in space as well as on the labels informants provided in the sorting stage (Step 3). Then, using Likert scales, a completely different set of informants evaluated how well the descriptors applied to each jealousy-inducing exemplar. These ratings were then correlated with the exemplars' x-, y-, and z-coordinates in the jealousy-space. If one of these axes of the multidimensional plot was indeed accounted for by a candidate descriptor, the Likert ratings of the exemplars should significantly correlate with their coordinate values along that axis. To my knowledge, I conducted the first studies in which interpretation of similarity judgments were quantitatively evaluated by informants.

Selection of descriptors: Because I was interested in both an emically-derived description of the jealousy space while also evaluating prevailing theories, six descriptors were considered. Since the adaptive literature on jealousy is dominated by the notion that some events are cues to sexual (as opposed to emotional) infidelity, I selected three, theory-based candidate descriptors for the jealousy space's principle axes to test whether these are

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dimensions along which informants spontaneously organize their conceptions of jealousy: 1) how well the exemplar indicated certain sexual infidelity versus none, 2) how well the exemplar indicated certain emotional infidelity versus none, and 3) how well the exemplar indicated sexual infidelity versus emotional infidelity. Inspection of the multidimensional plots indicated three additional candidate descriptors: severity of threat, the presence or absence of a specific rival, the deceptive versus honest nature of the exemplar (see Chapters 3 and 4 for stimuli).

Step 6: Quantitative Comparisons Between Populations:

Comparisons between populations' similarity judgments are often performed only by visual inspection of graphical representations (e.g., Albert, 1991; Hermann and Raybeck, 1981; Romney et al., 1997; Russel and Bullock, 1985, 1986; Weller, 1986; cf. Boster and Johnson, 1989; Shipman and Boster, 2008). However, it is possible to make quantitative comparisons.

In my studies, comparison populations (e.g., men and women) were tested for both similarities and differences in the structure of their jealousy spaces. To do so I 1) summarized each informant's pile sort judgments with individual similarity matrices, 2) collapsed the individual similarity matrices into aggregate matrices, 3) compared matrices using the Quadratic Assignment Program (QAP; Hubert and Schultz, 1976), and, independently, 4) compared dendrograms using the Fowlkes-Mallows index (Fowlkes and Mallows, 1983).

As discussed above, similarity judgments were first summarized by individual similarity matrices. Then these individual matrices were treated differently, depending on

whether I was assessing similarity between two comparison populations or if I was assessing differences.

To assess *similarity* between comparison populations (e.g., men and women), the individual similarity matrices of those in the same population (e.g. all women) were averaged, creating a single 24-by-24 aggregate matrix. This, incidentally, is exactly the same procedure for creating women's — rather than the entire population's — multidimensional plot. The comparison populations' aggregate matrices are then compared using QAP (further discussion below). In this context, the QAP statistic tests whether two comparison populations generally agree on the pattern of similarity among these jealousy-inducing exemplars (i.e., do both comparison populations split the exemplars in roughly the same way?).

Then, to assess *differences* between populations, individual similarity matrices are again collapsed; however, they are collapsed in a different manner. Here, they are collapsed into a single informant-by-informant correlation matrix with one row and one column per informant, creating an *N*-by-*N* matrix. Each cell represents the correlation between the individual similarity matrices of two informants from the corresponding row and column. To get this correlation, the cells of Informant A's individual similarity matrix (e.g., the split level between two exemplars from the similarity judgment task) are compared to the corresponding cells of Informant B's individual similarity matrix. For my studies, this means 576 (=24•24) comparisons were made per correlation. With such correlations performed for every possible informant pair, the resultant correlation matrix summarizes inter-informant similarity, rather than inter-exemplar similarity.

Again using QAP, the informant-by-informant correlation matrix is compared to an *N*-by-*N* model matrix. A model matrix identifies whether the two informants belong to the same population or not: If so (e.g., two women), the corresponding cell contains a "1"; if not (e.g., a man and a woman), the corresponding cell contains a "0". In this context the QAP statistic tests whether differences between members of two comparison populations are greater than the differences among members within a single comparison population.

QAP: As suggested above, the QAP tool can evaluate both similarities and differences and subsequent results are interpreted in the same fashion because the inputs being compared are equivalent in structure (i.e., two matrices). In my studies, QAP comparisons were evaluated with a *z*-statistic and, more directly, with Monte Carlo simulations. QAP *z*-scores reflect the agreement between the compared matrices and are evaluated similarly to traditional *z*-scores. Monte Carlo simulations count the percent of times a random permutation of the compared matrices results in greater similarity than is seen between the observed matrices. For a 5% tolerance of a Type I error, the observed matrices must be more alike than the permuted matrices 950,000 times out of 1,000,000 simulations. When considering *similarities*, a random permutation of a matrix may alter the judged similarity between exemplars. Therefore — using men and women as an example — a significant result means that randomly permuting the men's aggregate matrix increases its similarity to the women's aggregate matrix only 5% or fewer times. In tests of *differences*, a random permutation of a matrix may alter whether a pair of informants is accurately classed as being from the same population. Again using men and women as an example, a significant result means randomly permuting the model matrix results in two mixed-sex groups being more different than the all-men group is from the all-women group 5% or fewer times.

Fowlkes-Mallows index: QAP evaluates similarities and differences across the entire data set; however, it does not specify what these similarities and differences are. These are better identified through graphical representations; more often through dendrograms as they provide more fine-grained detail than CA plots. When considering dendrograms, specific points of difference can be hypothesized via examination and then formally evaluated using the Fowlkes-Mallows index (Fowlkes and Mallows, 1983). For example, visual inspection of both younger and older informants' reduced trees shows exemplars are generally grouped very similarly but that the relationship between the groups (i.e., the branching pattern of the reduced trees) is dissimilar. The Fowlkes-Mallows index can be used to evaluate if the difference in branching constitutes a statistically significant deviation from the null hypothesis of a similar grouping of exemplars.

The Fowlkes — Mallows index evaluates the similarity between two dendrograms by testing the null hypothesis that the two are unrelated (Fowlkes and Mallows, 1983; Nemec and Brinkhurst, 1988). The index is determined by accounting for the number of within-group exemplar pairs in found in both dendrograms. The number of pairs in common is contrasted with the number of pairs that are not in common. For example, if exemplars A and B are both in the same group in younger and older informants' dendrograms, this counts as a match in calculating the Fowlkes-Mallows index. Two identical dendrograms will have an index of 1.00; two completely dissimilar dendrograms will approach 0.00. To my knowledge, my studies are the first to use an inferential tool of any kind when comparing two populations' pile-sort-produced dendrograms. Moreover, to my knowledge, my studies are the first to use the Fowlkes-Mallows index in any capacity within the social sciences.

Step 7: Qualitative Interpretation of Dendrograms

As noted above, interpretations of dendrograms are typically qualitative (cf. Baumann and Belin, 2010; Coxon et al., 1978; Kay and Reieger, 2003 and citations therein). However, the means of interpretation — both in the philosophical approach and in the nuts-and-bolt methods — are generally unspecified in the manuscript (e.g., Aragones and Arredondo, 1985; Askell-Williams and Lawson, 2001;Lopez, 1997; Reed et al., 2004). This makes it difficult — if not impossible — to evaluate the merits of the conclusions and/or conduct a replication. To avoid this obliqueness, I created and then explicitly detailed methodological guidelines for interpretation of the dendrograms. These guidelines are transparent and allow for replication. I believe this is a considerable improvement over the typical reporting of gestalt impressions. My guidelines take a four-step approach to qualitative interpretation of dendrograms.

Step 7.1: I identified the six major groups in the dendrograms as defined by the reduced trees. Tautologically, these groups were comprised of exemplars with high inter-informant agreement on similarity. Exemplars within these groups are united based on criteria that 1) link particular exemplars and, 2) distinguish them from others. In this fashion, all subsequent interpretations are emically grounded.

Step 7.2: I returned to the raw data, found groups whose exemplars matched the major groups as closely as possible, and collected the associated informant-provided label. Some groups had 'hard' boundaries wherein many informants identified a consistent set of member exemplars — with no additions or deletions. For hard groups, acquiring a sufficient number of labels for analysis was relatively easy. Other groups had 'fuzzy' boundaries

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wherein few individual informants formed precisely the same group as the aggregate population did. To acquire more data on fuzzy groups, I relaxed the inclusion standard by one exemplar: if an individual informant made a group that had one fewer or one more exemplar than the aggregate group, I collected that label.

Step 7.3: I conducted thematic analysis of group labels (Lacey and Luff, 2007; Ryan and Bernard, 2003). Here the collected labels are reviewed for overarching consistencies in topic, tone, intensity, etc. Most frequently, group labels referenced how informants felt about the situations described in the exemplar groups (e.g., "suspicious", "anxious", "hurt", "angry"). When referenced feelings were similar in concept but varied in intensity across informants, the median state was assigned as the group's major theme.

Step 7.4: The major groups' labels were matched back to the aggregate dendrogram. When considering the labels along with the dendrogram's branching patterns, an overall logic emerges. This method cannot remove researcher bias because thematic analysis is subjective; however, it has the advantages of being transparent and rooted in the emically-derived structure of the dendrograms.

The collection and analysis of informant-provided labels is not uncommon (Campo et al., 2008; Lopez, 1997); however, it is rare to find description about how the analysis was conducted. It may be the case that thematic analysis is a standard methodology but there is no way to establish this. More often, researchers mention trends in the data but fail to connect it to the branching pattern of the dendrogram or to an axis of a multidimensional plot. This makes it difficult to know how important or consistent these trends are. My method of label

extraction is labor-intensive and susceptible to researcher bias but provides specific insight into informants' perceptions, is systematic, and is replicable.

Step 8: Qualitative Comparisons Between Populations

When considering two comparison populations' dendrograms, both the major groups and the hierarchical structure may differ. The Fowlkes-Mallows index can identify if different populations used different decision criteria when making similarity judgments — thus producing different dendrograms — however, like any inferential statistic, it cannot identify what those different decision criteria are. Thematic analysis was used to do this. The process was largely the same as described above except that the aggregate labels were contrasted between the comparison populations. When an exemplar group was present in only one of the populations, a label was assigned with no further evaluation. When exemplar groups were similar between the two comparison populations, major group labels were contrasted on qualities suggested by the labels themselves. Often this involved the particular emotions elicited, the strength of emotion elicited, or the labels' foci (e.g., the problem is because of a rival versus the problem is internal to the relationship).

As discussed above, the means of analysis are rarely made clear in studies that evaluate group labels and the importance of any differences is unclear to someone without access to the raw data. My methods involve transparency — and possibly rigor — not present in similar studies.

Relation to dissertation

The methods described here are used in the studies presented in Chapters 3 and 4. The goal of the study presented in Chapter 3 was to evaluate the long-standing — though untested — assumption that threats to romantic relationships are primarily organized and responded to as those of a sexual nature and those of an emotional nature (Buss et al., 1989; Sagarin et al., 2012 and references therein). To do so, I mapped the jealousy space, described it generally and also specifically for particular populations (e.g., men and women). Then, using the quantitative and qualitative methods described above, I evaluated whether my informant's similarity judgments revealed a strong categorization paralleling the sexual-emotional distinction.

The goal of the study presented in Chapter 4 was to test the novel hypothesis that the qualities of romantic rivals will facultatively affect informants' evaluation of ambiguous threats to a long-term romantic relationship, thus allowing for strategic deployment of counterstrategies and therefore better protection against a romantic partner's MRS.

II. METHODS ASSOCIATED WITH CHAPTER 5: ZERO-SUM ALLOCATION TASKS USED TO IDENTIFY MATE PREFERENCES

Sex-specific valuation of traits in a long-term mate

The traits that are most valued in a long-term mate are predicted to be those associated with the greatest increases in reproductive success (RS). There are many traits that could elevate RS, and potential long-term mates who manifest high levels of these traits should be

targeted by evolved preference modules. However, vanishingly few individuals will offer

maximum doses of all beneficial traits. Therefore, there should be selection to value traits

that are more strongly correlated with increased RS over traits with weaker correlations.

Because men and women are differ in potential reproductive capacity and in primary avenues

of parental investment (Bateman, 1948; Symons, 1979; Trivers, 1972), there are likely to be

sex difference in the traits most strongly valued.

Based on existing theory, men should manifest evolved preferences that prioritize a

prospective long-term mate's genetic quality and physiological-investment capacity (Fink,

Grammar, and Thornhill, 2010; Fink and Penton-Voak, 2002; Lassek and Gaulin, 2008;

Pawłowski, Nowak, Borkowska, and Drulis-Kawa, 2014; Perrett, et al., 1998; Rilling,

Kaufman, Smith, Patel, Worthman, 2009; Zahavi and Zahavi, 1997). Due to paternity

uncertainty and the associated costs of cuckoldry, men should have evolved to prioritize a

potential mate's *sexual fidelity* (Hanson Sobraske et al. 2014; Sagarin et al., 2012 and

citations therein). Moreover, due to the cooperative alliance and social support needed in a

biparental, social species such as humans, a long-term mate's *kindness* are expected to be

comparatively less valued because these traits predict comparatively smaller increases in RS

(Dunbar and Shultz, 2007; Li, 2007; Low, 1989; Russock, 2001; cf. Gurven et al., 2009).

Because women are limited by material resources, women are expected to value a

mate's ability to procure and retain resources (Buss, 2003; Campos, Otta, and siqueria, 2002;

Fisman, Iyengar, Kamenica, and Simonson, 2006; Kaplan, Gurven, and Lancaster, 2007;

Russock, 2011; Townsend and Levy, 1990; von Rueden, Gurven, and Kaplan, 2011).

However, a mate's ability to procure resources is insufficient in itself to increase women's

RS; those resources must also be invested. Therefore, women are predicted to value cues of resource investment (Buss et al., 1989; Lukaszewski and Roney, 2009; Sagarin et al., 2012). Cues of a mate's physical quality — (Fredrick and Haselton, 2004; Gagnestad, Haselton, and Buss, 2006; Li 2007; Lie, Rhodes, and Simmons, 2008; Penton-Voak et al., 2004; cf. Nettle, 2002) — are expected to be comparatively less valued in a long-term mate because they predict comparatively smaller increases in RS.

Sex-specific mate preferences are well-supported: the valuation of a variety of traits have been considered across a variety of cultures (e.g., Bereczkei et al., 1997; Buss, 1989; Buunk, Dijkstra, Fetchenhauer, and Kenrick, 2002; Chang, Wang, Shackelford, and Buss, 2011; Gil-Burmann, Peláez, and Sánchez, 2002; Hatfield and Sprecher, 1995; Minervini and McAndrwews, 2006; Pearce, Chuikova, Ramsey, and Galyautdinova, 2010; Shackelford, Schmitt, and Buss, 2005; and references above). To my knowledge, only one study has considered the valuation of sexual fidelity relative to other traits (Mogilski, Wade, and Welling, 2014). However, this study approached intra-trait valuation in an ordinal fashion: informants valued "a history of sexual fidelity" more than "similarity" in a long-term mate but it is unclear how much more. Further, I am unaware of any study that has considered the value of emotional fidelity in a long-term mate, either in isolation or relative to other traits. To address this empirical gap, I conducted a within-sex study of mate preferences between several RS-enhancing traits, including both sexual fidelity and emotional fidelity.

As with virtually all findings on adaptive mate preferences, sex-specific patterns are best documented in Western populations; particularly from undergraduates and, to a lesser extent, university-adjacent community populations (e.g., Buss and Barnes, 1986; Feingold, 1990,

1992; Fletcher, Tither, O'Loughlin, Friesen, and Overall, 2004; Jonason, Li, and Madson,

2011; Kenrick Sadalla, Groth, and Trost, 1990; Stewart, Stinnett, and Rosenfeld, 2000;

Waynforth and Dunbar, 1995). Occasionally, the mate preferences of undergraduate and

community populations are evaluated in parallel (Buss, et al., 2001; Li et al., 2002;

Wiederman and Allgeier, 1992) but, to my knowledge, they have never been quantitatively

compared. The lack of comparative data is not trivial given the recurring critique that

undergraduates are not representative samples of Western adults (Arnett, 2000, 2008; Harris,

2002; Hooghe, Stolle, Maheo, and Vissers, 2010; Rozin, 2010; Tagler, 2010; Voracek, 2001).

Indeed, this critique is often provided as rationale for the use of community populations in

research on human mating psychology (e.g., Dijkstra and Buunk, 2002; Green and Sabini,

2006). To evaluate the extent of homogeneity in human mate preferences in Western,

American adults, I conducted quantitative within-sex comparisons between community

members and undergraduates. These samples were regionally matched to help control for

geographical variations in preferences (cf. McGraw, 2002). Presumably, any within-sex

differences in mate preferences between adjacent university and community populations

would be due largely to differences between community and undergraduate subcultures.

Traits evaluated

The twelve descriptive traits were selected based on previous research and on the

adaptive logic outlined above.

"*Commits time and energy to the relationship*", "*good sense of humor*", and "*kind to me*" were used as cues of a willingness to engage in a cooperative relationship and to share resources (Dunbar and Dunbar, 1980; Moore, Cassidy, Law Smith, and Perrett, 2006; Weisfeld, Nowak, et al., 2011; Lukaszewski and Roney, 2009).

"*Ability to have a high-status job*", "*good social skills*", and "*hard working*" were used as cues of a mate's ability to procure and retain resources (Fletcher et al., 2004; Flynn, Geary, and Ward, 2005; Jonason et al., 2012).

"*Attractive face*", "*healthy and has plenty of energy*", and "*curvaceous, feminine body*" or "*muscular, masculine body*" were used as cues of a mate's genetic quality, immunocompetence, and sex-specific hormone profile, respectively (Gangestad and Scheyd, 2005; Wedekind and Folstad, 1994; Jasieńska, Ziomkiewicz, Ellison, Lipson, and Thune, 2004; Fredrick and Haselton, 2004).

"*Intelligence*" was used as a cue of both genetic quality and ability to procure resources (Alexander, 1971; Prokosch, Yeo, and Miller, 2005).

"*Has romantic feelings only for me*" was used as a cue of emotional fidelity, theorized to predict a relative monopoly on a mate's resource investment.

Finally, "*sexually faithful to me*" was used as a strong cue of paternity certainty and a weaker cue of investment fidelity (Buss et al., 1989; Sagarin et al., 2012).

Zero-sum allocation tasks

Participants used two zero-sum allocations tasks to describe their preferred long-term mate. To do so, participants allocated 0 to 10 "mate dollars" to each of the 12 RS-enhancing traits described above. The greater the allocation, the more the mate exemplified the trait. This method appeared to be intuitive; no participant reported confusion and clarification questions were rare.

The two allocation tasks differed only in mate dollar budget. The smaller, constrained budget was 20 mate dollars; it was used to reveal traits that participants considered "necessities" in a mate (cf. Li et al. 2002). Pretesting of this budget revealed that people thought this task to be conceptually simple but difficult in practice. Likewise, study participants often spontaneously mentioned that 20 mate dollars was far too few and that it was hard to choose where to best allocate them. The larger, moderate budget was 60 mate dollars; it was used to reveal traits that participants considered "luxuries". Sixty mate dollars was selected because it was half of what would be necessary to buy a "perfect 10" mate.

Theoretically, these zero-sum allocation tasks mirrored actual mating decisions; specifically, that a mate who rates a "perfect 10" on all desirable attributes is rarely available — or attainable — requiring trade-offs between traits. Methodologically, providing moderately-constrained and highly-constrained budgets — rather than a generous budget or, alternatively, providing Likert scales for rating traits — prevented ceiling effects and allowed for variance across responses. However, I recognize that providing all participants equal budgets does not reflect realistic differences in mate value and likely concomitant differences in "purchasing power" in the mating market.

Statistical analyses

To evaluate the valuation of sexual fidelity and emotional fidelity relative to other RS-enhancing traits and to assess the homogeneity of mate preferences in Western adults, I made five types of comparisons.

One, student t-tests were used to identify significant differences among the highest- and lowest-valued traits within a budget. For example, in the constrained budget, community women spent the greatest quantity of mate dollars on "Kind", "Romantic Feelings", and "Commits Time"; these were not significantly different from each other (all $t < 0.856$, all $p > 0.393$). This test addressed the questions "Are the highest-ranked traits definitely more valued than those ranked less? Are the lowest-ranked traits definitively less valued than those ranked more?"

Two, Spearman's rank correlations were used to identify significant covariations in trait rankings, within-population and between-budget. For example, university women's rank order of traits in the constrained budget was compared to the rank order of traits in the moderate budget. This test addressed the question "Does the order of importance among traits differ when someone is considering what is necessary in a mate versus when someone is considering what is luxurious?"

Three, paired-sample t-tests were used to identify differences in trait valuations between-budgets within a single population. For example, comparing the mate dollars that university men spent on "Healthy" in the constrained budget versus in the moderate budget.

Percents of budget — rather than absolute mate dollars — were used to permit comparisons among the $20 and $60 budgets. This test addressed the questions "Is a trait considered a necessity or luxury? Does this trait have a low or a moderately-high satisficing threshold?"

Four, Spearman's rank correlations were used to identify significant covariations in trait rankings, between-population and within-budget. For example, comparing the rank orders of university women's and community women's constrained budgets. This test addressed the questions "Do university members value this suite of traits in a similar fashion to community members? Do they do so when considering what is necessary in a mate as well as when considering what is luxurious?"

Five, student t-tests were also used to identify significant differences in trait valuations between-population and within-budget. For example, when comparing university men's spending to community men's spending on "Healthy" within the constrained budget. This test addressed the question "Do university members value a particular trait in a similar fashion as community members?"

Relation to dissertation

The methods described here are used in the study presented in Chapter 5. The goal of the study was twofold. One, to describe — within-sex — the valuation of both sexual fidelity and emotional fidelity in a long-term mate, relative to additional traits associated with increases in reproductive success. Two, to evaluate how well students can serve as representatives of Western adults, vis-à-vis mate preferences.

III. Methods associated with Chapter 6: Semi-structured interviews and framework analysis.

Why qualitative data were necessary

Humans — a highly social, biparental species with sex-specific limiting resources — should be selected to prefer long-term mates with traits that best predict high RS (see previous section for an expanded argument and associated references). Women are expected to highly value traits predicting resource acquisition and a willingness to invest; sexual fidelity and cues of genetic quality are expected to be relatively less-valued in a long-term mate. When evaluating this notion (described above and in Chapter 5), the mate preferences of community women followed the predicted pattern, similar to previous community populations (e.g., Asendorpf et al. 2011, Fisman et al. 2006, Schwartz and Hassebrauck 2012, Simpson and Oriña 2003, Sprecher et al., 1994, Wierderman and Allgeier, 1992; cf. Kurzban and Weeden 2005). However, this was not the case for UCSB women. These women consistently valued sexual fidelity very highly and did not value cues of resource acquisition ability, such as "hard working", "ability to have a high status job", and "intelligent" (see Chapters 5 and 6 for statistics). UCSB men followed theory-based predictions, similar to other university populations (e.g., Buss and Barnes, 1986, Geary et al. 2004, Kenrick et al., 1993, Li et al. 2002, Regan, 1998, Schmitt and Buss, 1996, Stewart et al. 2000). In other words, UCSB women had unexpected mate preferences but their closest comparison groups did not. This suggests the existence of uncommon pressures acting on

UCSB women that are not operating on university women in general, nearby community women, or on UCSB men.

The mate preferences of UCSB women — high valuation of sexual fidelity and low valuation of cues of resource investment — are not predicted by first-order principles of sexual selection logic. Nonetheless, that logic may still produce reasonable hypotheses addressing UCSB women's mate choice preferences if additional factors are considered. Reasoning further, I hypothesized that UCSB women could be getting cues that most UCSB men were wealthy and, therefore, valuation of cues to resource acquisition was unnecessary because wealth came by default in this pool of candidate mates. If this hypothesis were accurate, it would only clearly address why cues of resource acquisition were low-valued; it would not address why sexual fidelity was prioritized. Moreover, it would not necessarily predict a difference between UCSB women's valuations and community women's valuations: UCSB is an expensive public university but Santa Barbara is an even more expensive town where cues of wealth are likely present to a greater degree. The wealth-by-default hypothesis is, at best, incomplete. Alternatively, I hypothesized that because UCSB is a top-tier university, perhaps UCSB women are not valuing cues of resource acquisition because intelligence came by default in this pool of candidate mates. Again, this hypothesis might explain the valuation of cues to resource acquisition but it would not explain the valuation of sexual fidelity. Further, this valuation ought to be present in women from other top-tier universities but that does not appear to be the case, based on published literature (e.g., Buss et al. 2001, Pillsworth 2008, Townsend, 1993). The intelligence-by-default hypothesis is, at best, incomplete. Finally, I was unable to construct a hypothesis that could simultaneously account for UCSB women's high valuation of sexual fidelity as well as

account for why this did not occur in other university women. Likewise, I am unaware of other studies with applicable hypotheses about women's high valuation of sexual fidelity.

The uniqueness of UCSB women in their mate choice preferences suggests the presence of additional environmental or social influences on mating strategies that are not operating in other colleges. Moreover, these influences appear to be principally affecting UCSB women because members of comparison groups — UCSB men and local community women — had preferences that followed patterns established by both sexual selection theory and prior literature. Despite a suggested presence of influences on UCSB women's mate choice preferences, neither the nature nor the mechanism of these influences was provided by quantitative data (cf. Denzin and Lincoln, 2000; Silverman, 2000). A different type of data was required to identify the social or environmental influences on women's mate choice preferences. Interviews were used to "help define the cultural context of other data gathered" (Page et al., 1990; cf. Peterson and Muehlenhard 2007).

Interviews

Types of Interviews

Informal interviews are typically spontaneous conversations between the researcher and the informant. Questions are derived from immediate surroundings with no preparation by the researcher. Informants dictate the topics of conversation; researchers are permitted to ask follow-up questions as necessary. Therefore, informal interviews are the most emic of all interview types but the least systematic (Firmin 2008, Patton, 1990). Control of the interview

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is almost-exclusively in the informants' hands (Bernard, 1994, Dohrenwend and Richardson, 1965).

Unstructured interviews consist of the researcher asking informants about a small number of topics. Questions are typically very open ended with no predetermined wording. Informants mentally meander through the topic and researchers are permitted to ask follow-up questions as necessary. Unstructured interviews are highly flexible and can be adapted to fit context, previous statements, and the styles of both the researcher and the informant (Firmin 2008). Control of the interview is mostly in the informants' hands (Bernard, 1994, Dohrenwend and Richardson, 1965).

Semi-Structured interviews consist of the researcher asking all informants the same suite of predetermined questions. These questions are typically open-ended and informants are encouraged to provide expansive, emic responses. Researchers are permitted to ask follow-up questions as necessary (Firmin 2008). Control of the interview is approximately shared between the researcher and the informants (Bernard, 1994, Dohrenwend and Richardson, 1965).

Structured interviews consist of the researcher asking all informants the same suite of questions in the same order. There is no probing for greater explanation and no follow-up questions are permitted. Often, the range of allowable responses is limited, either by the structure of the question (e.g., yes/no questions) or by prompting the informant with a list of predetermined responses (e.g., good, fair, poor) (Firmin 2008; Nichols, 1991). Control of the interview is mostly in the researcher's hands (Bernard, 1994, Dohrenwend and Richardson, 1965).

Advantages of Interviews

To learn about a person's motives, logic, and rationale, interviews are often a more appropriate tool than either surveys or observations (Bell 2010). Surveys certainly have the advantages of being direct, streamlined, and easily comparable across informants. However, they are not the ideal tool for acquiring people's motives, logic, or rationale (Firmin 2008). Surveys, by definition, are creations of the researcher, made before there has been any interaction with informants. Therefore, the quality of the data procured is entirely dependent on how well the researcher can predict informants' motives *a priori* (Bell 2010). Even with a survey that allows accurate and complete descriptions of informants' motives, survey data are inherently shallow because they lack thick exposition (Bernard, 1994, 1995). Conversely, interviews allow for idiosyncratic, nuanced variation between people's responses as well as insights relevant to the study population that are unanticipated by the researcher (Johnson 2002). Interviews also facilitate communication between the researcher and informant, allowing for clarification when confusion or misunderstanding arises. Clarification is especially valuable in situations where the researcher and the participants differ in the meanings of words and phrases (Aiken et al. 2013, Catania et al., 1990, Zeleya et al. 2012).

Unlike surveys, observations allow data to be collected in real-time, thus eliminating the need of a researcher to anticipate informants' responses. However, this does not make observation a preferable means of evaluating motives. Observation tautologically requires that the researcher witness the action of interest. This strategy is fallible as actions can easily go unwitnessed by the researcher if they are too subtle or if the researcher is not in the right spot at the right time (Mirriam, 1998). Moreover, if an action is witnessed, it may be

attributed to an incorrect motive, either due to an honest mistake or to etically-derived biases (DeWalt et al., 1998; Schensul et al., 1999). In short, even under the best conditions, inferring motivation to a person's actions requires guesswork and is subject to biases and susceptible to errors. Interviews avoid the problems inherent in attributing motivations to people's actions because the researcher can simply ask what an informant is thinking. Further, any confusion can be directly addressed at the time of interview, again reducing errors and the introduction of biases (Bernard, 1994, Johnson 2002).

It should further be noted that interviews are an excellent means of acquiring data about unobservable behavior (Sharp 2009, Cohen et al. 2007, VanderStoep and Johnson 2009). Behavior may be unobservable because it happened in the past. For example, Krishnan and colleagues (2007) used interviews to study the motives for lifetime changes in informants' sexual behavior, pre- and post-HIV diagnosis. The use of interviews here was appropriate because they granted researchers thick descriptions of past events, allowed for contrasts with informants' current state, and provided informants' motives for changes in behavior. In this case, both the longitudinal and mental components make interview use a practical necessity. Interviews are also appropriate for studying scenarios wherein observation drastically affects the outcome. For example, McKeganey and Barnard's (1996) research on female prostitutes was conducted principally by interviews because, in part, observation negatively affected the rate and which johns were picked up, presumably due to the johns' self-selection. By using interviews, the researchers acquired accounts of regular, unaffected encounters. Similarly, when Page and colleagues (1990) studied hard drug use, they relied on interviews for data because informants anticipated safety and legal troubles if researchers were present when the drugs were purchased (cf. Rocha 2004). Interviews are

also an appropriate tool for acquiring data about scenarios where observation without intervention is unethical. For this reason, interviews are a principle means of gathering data on sexual abuse and rape (e.g., Bletzer and Koss 2004, Gavey 2005, Krahe et al. 2007, Rhodes et al., 1996, Testa et al. 2011, Testa et al. 2003, Turchik et al. 2009, White et al. 2000).

I chose to use interviews to study influences on women's mate choice preferences. As discussed above, interviews are an excellent tool to acquire rich, thick data on informants' motivating feelings, logic, and rationale. Unlike surveys, interviews allow for emically-derived data that may reveal factors unanticipated by the researcher and preserve idiosyncratic variation in informants' responses. Unlike observation, interviews allow for data on informants' thoughts without considerable interpretation by the researcher. There were additional components of this project that made observation a poor methodology choice. The homogenous nature of IV (85.1% of the population is between 15 and 24 years old, US Census 2010) would make my presence as an observer obvious. Given the number of IV inhabitants, it would be practically impossible to explain the purpose of any non-participant observation to everyone. Therefore, most people would consider me "a creeper" (an odd person who does not belong in nor engages with a particular social environment). The presence of me as a non-participant observer would likely influence people's behaviors around me, thus affecting my results. Moreover, the degree of sexual assault present in IV would make non-participant observation wildly unethical. Participant observation was not a viable option either, especially at parties. Conforming to the degree and expectation of drinking, drug use, and sexual behaviors is both against UCSB's Faculty Code of Conduct (2003) and personally repellant. Using semi-structured interviews, I was able to learn about

informants' thoughts, feelings, and opinions; get an on-the-ground description of their experiences without any influences from a "creeper" researcher; and do so in an ethical manner.

Advantages Particular to Semi-Structured Interviews

The principle advantage of a semi-structured interview is that it is both systematic and flexible (Bernard, 1994, 1995; Firmin 2008). In a semi-structured interview, all informants are asked the same suite of predetermined questions in the same order. This systemization allows for comparison across informants. The same degree of comparison is unlikely using informal or unstructured interviews because informants would have to independently broach the same topics. The systemization of a semi-structured interview exists only in the researcher's prepared questions: informants responses are not structured in any predetermined manner. They are free to respond in any fashion, providing etic responses in their own words (Johnson 2002, Warren and Karner 2005). Moreover, researchers have the flexibility of pursuing intriguing statements with follow-up questions (Sharp 2009). This flexibility — both in informant response and in researcher follow-up — is not permissible in structured interviews or surveys. Presumably, the combination of systemization and flexibility present in semi-structured interviews is particularly attractive to researchers who know a bit about their topic of study — enough to structure the suite of predetermined questions — but still require informants to fill in the blanks.

I could be described as such a researcher: Data from surveys indicated the presence of an influence on UCSB women's mate choice preferences but they did not indicate what the influence was. Therefore, I needed specific topics discussed but for informants to mentally meander through these topics, thereby suggesting what the influence could be. The means by which the influence asserted itself was also unknown. Different women could have different exposures and therefore be influenced to different degrees. This was suggested by variance in UCSB women's mate choice preferences (Chapter 5). To address this possibility, uniformity in discussion topics across women was required to compare informants' thoughts and experiences. In short, I used semi-structured interviews so informants could talk freely about specific topics.

Disadvantages of Interviews

Interviews are efficacious tools for eliciting deep, thick explanations from informants, particularly so for studies on their thoughts. However, interviews are not without disadvantages. Most experts cite length of time — both in data collection and data analysis — as a disadvantage of interviews, especially for unstructured or semi-structured interviews (Bernard, 1994, 1995; Johnson 2002, Miles and Huberman, 1994, Warren and Karner 2005). Researchers using interviews seem to view this time component as the "price of admission" for deep, emic data: a considerable amount of data is acquired but it takes time to organize and analyze it all.

Interviews are susceptible to skew in the data corpus due to presentation biases. Susceptibility comes from the immediate, directed feedback a researcher can give informants. Informants are able to assess the researcher's tone of voice in reaction to their responses; in face-to-face interviews, informants can also use the expression on the researcher's face (Testa et al. 2011). An informant who interprets a tone or expression as judgment may curtail his or her responses. An informant who perceives positive reinforcement may provide more of the same type of information (and contrariwise for negative reinforcement), thereby skewing the content of data provided. An informant could lie, believing that this is what researchers "want to hear". Researchers, therefore, are likely to collect more complete and accurate data when they present a calm, respectful, and rather blank countenance (Bernard, 1994, Sharp 2009, Testa et al. 2011).

It is also possible that the data corpus could be skewed, not due to presentation bias but due to informants' desire to mislead the researcher. Perhaps the most notorious example of this was the inaccurate data acquired by Mead (1928) in her research on adolescent girls' sexual experiences in Samoa. Not only did informants mislead Mead, they did so in a coordinated fashion, thereby eliminating her ability to identify inaccurate responses by contrasting them against truthful responses (Freeman, 1983, Orans, 1983). The extent of the skew may have been exacerbated by Mead's desire to support a determinist view (Shankman 2009). Interviews are susceptible to informant lies, particularly if the researcher is studying things that cannot be independently verified, such as informants' thoughts or past behavior. Therefore, researchers should be active listeners when interviewing and constantly asses their informants and their informants' statements (Bernard, 1995, Johnson 2002): Do informants

have motives to misrepresent themselves? Does this response jibe with previous response made by this informant? Does this response jibe with responses made by other informants?

The data corpus can also be skewed by the type of questions researchers ask. Given that interviews are used to allow to informants express their thoughts in their own words, researchers must be very careful not to ask leading questions to help insure informants' thoughts are their own (Bernard, 1994, 1995; Firmin 2008; Johnson 2002). This care must be taken both when crafting the predetermined suite of questions as well as when asking any follow-up questions. Because skew can be introduced with follow-up questions, semi-structured and unstructured interviews may skew only some informants' responses. This preserves a greater amount of informants' unaffected responses but it reduces comparability across informants. Researchers using interviews should be attentive when asking questions — both predetermined and follow-up — and remember that the goal of interview research is to hear what the informant has to say, not to try to get them to say what is preferable or convenient (Johnson 2002, Warren and Karner 2005).

Conducting a Semi-Structured Interview

The success of a semi-structured interview depends on the both the honesty of responses and depth of information provided by informants (Bernard, 1995, Breakwell, 1995). Both are facilitated by transparency of the researcher: interviews should begin by telling informants what to expect from the interview and what the interviewer expects of them. The motive for the interviews and the general scope of the questions should be made apparent (e.g., "I'm interested in how the environment — social and otherwise — affects what women want in their romantic partners. This could be due to a number of different

things but I'll be focusing my questions on you, the people around you, and about romantic

relationships in general."). Informants should also be told why they were chosen as

informants. While the match between informant and topic of investigation might seem

obvious to the researcher — for example, survivors of strokes are appropriate informants for

a study on coping with the after-effects of a stroke (Jenkins et al. 2012) — informants should

understand the why they were included in the study (Johnson 2002, McCracken, 1998).

Finally, informants should be assured that their thoughts are valid and valuable: that there are

no wrong answers and you just want to know what they think. A strength of semi-structured

interviewing is the freedom informants have to explain in their own words. Therefore,

informants should be encouraged to mentally meander, provided it is relevant to the research

topic (Bernard, 1994, Wimmer and Dominick, 1997).

The approach of semi-structured interview is "to steer the interviews around the issue

of interest and to let informants teach [you] what [you] need to know" (Bernard, 1995).

Indeed, if the researcher felt he/she knew what the informants knew, interviews would not be

required. To allow the informants to teach what they know, open-ended questions are

preferred. This allows for expansive responses that may speak to interviewers' *a priori*

hypotheses, expand upon concepts broached by other informants, or illuminate previously-

unconsidered issues. In situations where informants' responses are terse or unclear, the semi-

structured format allows for probing to elicit more information (Wimmer and Dominick,

1997). Probes can be as simple as "Tell me more about …" or "Can you define that for me,

so I know what that concept means to you?" These probes may become less necessary as the

informant becomes familiar with the level of detail desired in responses. Other probes are

more tactical and can be considered slightly exploitative of informants' natural tendencies.

After a terse response, the researcher could deliberately summarize the informant's thoughts incorrectly, relying on informants' tendencies to correct inaccurate summaries with greater specificity. Otherwise, after a terse response, the researcher could deliberately not speak so as to create an awkward silence that the informant feels compelled to fill with exposition. Both of these tactics have the potential to irritate informants and should be used sparingly lest the entire interview be jeopardized (Agar, 1980, Bernard, 1994, Dohrenwend and Richardson, 1965, Warwick and Lininger, 1975).

The order of questions asked is important; order can affect the informants' comfort, the clarity of response, and the purity of response. It is advisable to begin the interview with non-threatening, chit-chat questions to establish the routine of the interview and — especially for informant-researcher pairs with little established report — to break the ice (Bernard, 1994, DiCicco-Bloom and Crabtree 2006, Miles and Huberman, 1994). Likewise, the more personal, intense questions should be asked towards the end of the interview when (hopefully) a comfortable, confidential environment has been established and maintained (DiCicco-Bloom and Crabtree 2006). Through the middle of the interview, the question set should adhere to a logical order to promote clarity of response and avoid informant confusion: General questions should precede specific questions; if a topic has a temporal component, the questions about the beginning should precede questions about the end. Additionally, the order of questions should be structured to avoid leading or influencing the informants' responses. For example, "Can women trust the men here?" should follow "Tell me about the men here" to avoid planting notions about trust in informants' minds (Johnson 2002, Warren and Karner 2005).

Semi-structured interviews are typically used by researchers with an intermediate understanding of a topic: enough is known to create a suite of prepared questions but enough is unknown such that more information from informants is necessary. The suite of prepared questions should be considered preliminary for the first few informants interviewed. If these informants consistently broach an issue for which the prepared questions are insufficient, inappropriate, or otherwise lacking, the researcher should amend the suite of prepared questions (Becker, 1971, Miles and Huberman, 1994). What constitutes "first few" is subjective and the appropriate number of preliminary interviews is up to the researcher's judgment. Leaving an important issue under-explored is a poor strategy for tautological reasons; however, constant refining of the suite of prepared questions diminishes the comparability of informant responses. The researcher must split the difference between the two, crafting an appropriate suite of questions with the input of informant responses and then commit to those questions.

Semi-structured interviews are not conversations: both the researcher and the informant are aware they are performing a task so there is no reason to pretend otherwise (Bernard, 1995). Nonetheless, interviews should be conversant and researchers should generally be "unthreatening, self-controlled, supportive, polite, and cordial" (Lofland, 1976). This tone is facilitated by open-ended questions, which — by their nature — are typically value-free. For example, "Do you think the US should continue to aid the Egyptian government even though the army overthrew the democratically-elected leader, thus breaking the agreement for receiving US aid?" is both value-laden and closed-ended, whereas "What do you think the US's role in Egypt should be?" is neither.

It is preferable to audio- or video-record interviews to ensure complete collection of both the words said as well as the tones in which they were said (Bernard, 1994, Johnson 2002, Miles and Huberman, 1994). Recordings also facilitate a more conversant atmosphere than would be achieved if the researcher was attempting to transcribe *in situ*. This is not to say notes shouldn't be taken at all; on the contrary, recordings should be supported by notes the researcher takes about the physical interview setting, the perceived mood of the informant, and actions the informant makes (if only obtaining audio recordings), or any other details the researcher deems valuable. For ethical reasons, informants need to be made aware of any recordings taking place — video, audio, or written notes — and of their rights to edit footage (Firmin 2008). For sensitive subjects — sex, war crimes, power disputes, health status, etc. — audio recordings may be preferable to video recordings because they offer greater anonymity (Bernard, 1995, Levrakus 2008).

Framework Analysis

Framework Analysis Theory

The goal of framework analysis is to describe and interpret experiences of those affected by a particular setting or experience (Richie and Spencer, 1994; see Leydon et al., 2000, for an example on cancer patients' information needs). It is an atheoretic method that can be used to support or reject *a priori* hypotheses as well as identify emergent themes. Framework analysis is typically done with semi-structured interview data; alternative types of text are rarely subjected to this analysis. The data inputs are what informants say and — to

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a lesser extent — do during the interview (e.g., hand gestures). There is no attempt to ascribe

non-specified meaning to informants' statements, making it a more emic method than latent

styles of analysis (e.g., narrative analysis, discourse analysis). To conduct a framework

analysis on interview data, the researcher 1) familiarizes himself/herself with the full data set,

2) begins thematic analysis by identifying candidate themes within and across informants'

data, 3) applies the candidate themes across the full data corpus in a constant comparison

fashion, 4) organizes the themes into charts to assists in interpretation of themes, and 5)

presents interpretation of the data in a full text report and as visual representations that

collapse the data into succinct summaries, usually tables or figures.

Framework analysis was designed to work in matters of public policy where decision-

makers need to be apprised of concerns or situations affecting the study population (Richie

and Spencer, 1994, Lacy and Luff 2007; see Burton et al., 2003, for an excellent example of

bicycles as a means of transportation rather than recreation). The reporting structure allows

for different levels of engagement with the data. Decision makers could use only the visual

representations if time is short or there is little desire to interact with the full report.

Conversely, those wanting to evaluate the analysis and interpretation could use both the

visual representations and the full report. The flexibility of framework analysis has made it

attractive for use outside the public policy sphere, particularly so in the medical research

community (e.g., Jenkins et al. 2012, Luff and Thomas, 1999)

I chose to use framework analysis to evaluate factors influencing women's mate

choice preferences for several reasons. One, framework analysis allows for support or

rejection hypothesized themes while also allowing for identification of emergent themes.

This dual capacity was critical because, as discussed above, I had hypotheses for why UCSB women were undervaluing cues of resource acquisition in a potential mate but no legitimate hypotheses for why they were highly valuing sexual fidelity. The former needed evaluation and the latter needed explanation. Two, framework analysis can be used to support interpretation consistent with an adaptationist paradigm without requiring the imposition of additional — and, potentially, unrelated or incompatible — paradigms (such as discourse analysis or grounded theory; see Appendix 1 for a brief discussion of alternative means of interview analysis). Given that the outstanding questions surrounding UCSB women's mate choice preferences were rooted in adaptationist logic, it was important that interview analysis was compatible with this reasoning, thus making the entire suite of analyses logically consistent. Three, framework analysis does not require that similarly-coded responses be uniform (more discussion below). Instead, a consensus scope can be described while still noting dissenting opinions. This allowed for both greater specification of trends and also transparency when reporting summaries. Given the sexual — and, thus, sensitive — nature of the study, providing a consensus allowed for the greatest clarity possible while also protecting individual informants' identities. Four, framework analysis is systematic with clear stages of analysis and overt summaries of interpretation. These allow for replication and validation of results, respectively, and thereby closely approximate quantitative methods of analysis.

Specifics of Conducting Framework Analysis

Stage 1, familiarization: The goal of the familiarization stage is tautological: to "gain an overview of the collected data" (Srivastava and Thomson 2009). Familiarization begins

during the interviews themselves as a natural outcome of attending to informants' responses. Later, transcribing audio recordings, reviewing notes taken during the interview, and re-listening to recordings all offer unique advantages to the familiarization process. Transcribing audio recordings is a laborious but thorough means of further familiarizing oneself with data (Bernard, 1994, Miles and Huberman, 1994). Reviewing notes taken during the interview — especially notes on behavior — can also offer insight into informant perceptions. For example, hand gestures indicating separation of two places can reinforce oral descriptions of distinctness. Audio recordings provide information beyond what was said. Attending to informants' tone and volume can provide shades and nuances to informants' statements that are inaccessible when only using transcriptions. Reviewing transcriptions, notes, and audio can and should be done several times initially and later on an as-needed basis.

Stage 2, identifying a thematic framework: The goal of identifying a thematic framework is to isolate major themes present within and across interviews and to report any connections between the themes, if present. There are several ways to indentify themes in interview data. One, terms or phrases particular to the study population can indicate themes. This supposes that concepts requiring slang or shorthand are important (Agar, 1983, Becker, 1993, Ryan and Bernard 2003). These themes are sometimes called "*in vivo* codes" (Straus, 1987) or "local typologies" (Patton, 1990). Two, the underlying schema of metaphors and analogies can indicate themes (e.g., "Rock of Gibraltar" and "nailed in cement" indicate a theme of strength and lastingness; Lakoff and Johnson, 1980). Three, transitions between topics can indicate themes. Transitions signal an underlying link that unites two seemingly disparate topics (Agar, 1983, Silverman, 2006). Four, linguistic connections can indicate

themes. Words such as "because", "therefore", and "as a result" suggest causal themes; words such as "if", "rather than", and "instead of" suggest conditional themes (Casagrade and Hale, 1967, Lindsay and Norman, 1972, Ryan and Bernard 2003). Five, what is not said can indicate themes. Omissions can signal informant discomfort (Bogdan and Taylor, 1975), power relationships (Gal, 1991), resistance and protest (Greenhalgh, 1994) or cultural assumptions about what "everyone knows" (Price, 1987, Spradley, 1979). Six, repetition of "topics that occur and recur" (Bogdan and Taylor, 1975) can be used to identify themes. Repetition is a major component of the constant comparison method wherein the entire data corpus is combed for similarities and differences across informants and across topics (D'Andrade, 1991, Glaser and Strauss, 1967, Guba, 1978).

My approach to identifying themes relied heavily on constant comparison (Glaser and Strauss, 1967). I attempted to find kernels or common denominators influencing behaviors and motivators that were present across informants and across topics. This approach has also been described as isolating a "patterned response" (Braun and Clark 2006) or "key issues" (Clarke and Kitzinger 2004). Because I was interested in understanding influences of women's mate choice preferences, I was particularly attentive to common denominators affecting a wide suite of behaviors. For example, the topic of IV geography was mentioned in discussions about qualities of people who live in IV, strategies for academic success, women's motivations to increase their attractiveness, the ubiquity of parties, and men's tactics to avoid a monogamous relationship.

Stage 3, indexing: The goal of indexing — referred to as "coding" in general thematic analysis and "constant comparison" in grounded theory (Braun and Clark 2006) — is to

assign themes to components of the data set. This process is iterative, requiring refinement between preliminary indexing and the final product. Ultimately, the researcher reviews the raw data, refines candidate themes, and re-indexes as needed. In other words, Stages 1-3 are neither isolated nor steadfastly linear (Brogdan and Taylor, 1975, Ritchie and Spencer, 1994). To begin, during Stage 1 familiarization candidate themes often suggest themselves. These should be noted but set aside until familiarization is complete (c.f., D'Andrade, 1991, Guba, 1978); the same should be done for any *a priori* hypothesized themes. Following familiarization, deliberate thought about the full data set may suggest additional candidate themes. Using the first-pass list of candidate themes, individual components of the data set are indexed where appropriate. For example, if "wealth" is a candidate theme, all informant responses addressing wealth are indexed as such. Indexing continues until all interviews have been completely evaluated and indexed with all candidate themes. Then all data indexed similarly are reviewed together for focus, scope, produced affect, etc. The review should consider both the data comprising the candidate theme and the candidate theme itself. When considering the data, the researcher should judge whether all similarly-indexed responses are indeed similar: whether they "go together". If necessary, oddball, erroneously-indexed data should be reassigned to a more-appropriate candidate theme. When considering the candidate theme itself, the researcher should evaluate its cohesion. Those that lack cohesion should be 1) split into new candidate themes if obvious factions exist, 2) merged into a single new candidate theme if two candidate themes are more similar than initially supposed, or 3) rejected entirely if they do not accurately represent a common denominator present in the data set. The indexing process will promote greater familiarization with the data set and new candidate themes may suggest themselves. These should be considered along with any

newly-split or newly-merged candidate themes in a second round of indexing. The review-and-refine process of indexing should be repeated until the researcher is satisfied that there are no value-added refinements to be made.

A few additional fine points of framework analysis need to be mentioned.

If a researcher desires (as I did), subthemes can also be isolated using the same review-and-refine indexing process described above (e.g., McGuigan and Golden 2012, Read et al. 2004). Establishing subthemes is not a mandatory part of thematic analysis but it can be useful for researchers who are distilling information for a third party who will not access the raw data or when additional specification of a complicated data set is helpful for comprehension.

When indexing data, grouping responses by focus is likely to result in a consensus but with some dissenting opinions. Using framework analysis, it is acceptable to create opposing subthemes to account for opposing opinions. This is appropriate when informants differ in binary terms: yes versus no, black versus white. It is also acceptable to lump varying opinions together into a broader theme. This is appropriate when informants differ along a gradient or in multi-dimensional thought-space.

Because framework analysis typically takes semi-structured interview as data, informant responses are not predetermined. As such, it is possible that a single response reflects multiple themes. In framework analysis, it is acceptable to index a single response with multiple themes (Pope et al. 2000, Ritchie and Spencer, 1994).

Stage 4, charting: The goal of charting is to create an organized, complete table of all instances of a theme. This allows the entire data set to be scanned relatively easily and quickly. Charting is a tool for researchers to organize large data sets or to allow validation by third parties who will not access the raw data (e.g., public-policy makers, Rabiee 2004; Lacey and Luff 2007, Ritchie and Spencer, 1994).

Charts are two-dimensional tables that contain every piece of data relevant to the study. Data within the charts are organized either by theme or by informant. A chart organized by informant is more appropriate if the researcher is interested in contrasting particular informants (e.g., people with illness versus their caretakers); a chart organized by theme is more appropriate if the researcher is interested in cross-population similarities. Organizing by theme is more common so the "how to chart" description below will reflect that layout (switching the words "theme" and "informant" will describe the process for organizing by informant).

Chart creation occurs after indexing is completed; it is not part of the fluid, iterative process between familiarization, identifying a framework, and indexing. The researcher begins by creating a table with a column for each theme. Within each theme-column, the researcher enters data on every response indexed as that particular theme. These data include the informant who said it, the timing (for audio recording) and/or page number (for transcription). If the response is very brief, a verbatim transcription is also included; however, it is more likely that a distilled summery of the response is used instead (Pope et al. 2000). After all responses are charted, data from across the entire suite of interviews will be organized into the appropriate theme-column that can then be easily perused. This

organization provides a focused, concentrated view of the themes. By using a chart to consider only the data relevant to a particular theme, the researcher is better able to gain a thick understanding of a theme. This may include matters that influence — or are influenced by — a particular theme, the scope of the theme, informants' valuations of the theme, and consensus and dissenting opinions regarding the theme. Generally speaking, the larger the data set, the more useful charting stage.

Stage 5, mapping and interpretation: The goal of the mapping and interpretation stage is to collapse data into visual representations of themes and, if necessary, displaying themes' inter-connectivity. Maps should be "an organized, compressed assembly of information that permits conclusion-drawing" (Miles and Huberman, 1994). The type of map used should be dictated by interpretation of the data. For example, Luff and Thomas (1999) found that general practitioners differed from complementary practitioners in their attitudes on therapy, particularly as it related to efficacy and cost-effectiveness. To represent this, informants were marked as general practitioners or complementary practitioners and then plotted along a continuum representing their valuation of efficacy versus cost-effectiveness. When Jenkins and colleagues (2012) studied the lives of people after suffering a stroke, they found the themes "re-ablement and social inclusion" and "career support" were both types of long-term support. To represent this, a figure showing all themes was presented; the icon for "long-term support" subsumed the icons of "re-ablement and social inclusion" and "career support". If emphasizing the inter-connectivity of themes is not a reporting priority or if themes appear to be isolated, a bullet-pointed table of major findings is an acceptable map (see Brunton et al. 2006 for an example).

Maps are not meant to be a report in and of themselves; the necessary collapsing of data loses specificity and omits outliers. Rather, maps are supplements to full write-ups discussing the breadth of each theme and its relation to other themes. Their requirement as part of the framework analysis methodology is, in part, an artifact of their origin. Framework analysis was created for studying matters of public policy (Ritchie and Spencer, 1994). As such, terse summaries of the data were presumed efficient means of communicating information to those who would not otherwise engage with the full report, such as members of the public who are interested only in the general findings or members of the legislature who do not read entire bills before voting on them.

Because they are efficacious summaries of data, visual representations are not uncommon in qualitative analyses of interview data. However, their requirement as an established step of analysis is unique to framework analysis.

Relation to dissertation

The methods described here are used in the study presented in Chapter 6. The goal of the interviews was to understand why heterosexual UCSB women value sexual fidelity in a mate so highly and why they place so little value on cues predicting resource acquisition ability.

Appendix1: Additional Interview Analysis Methods

Below are outlines of methods that can be used to analyze interview data but — for varying reasons described below — were deemed inappropriate for evaluating the interviews with UCSB women. Inclusion in this list is principally based on frequency of use in published literature and is not intended to be inclusive. See Denzin and Lincoln (2003), Minichiello and colleagues (1995), and Silverman (2006) for comprehensive treatments of interview analysis options.

Content Analysis

The goal of content analysis is to identify and describe the focus of a group of informants by reporting the frequency of words or concepts of interest present in a text (Holsti, 1968, Weber, 1990). Content analysis is based on the tenet that the more frequently a concept is mentioned, the more important it is to the informant.

To conduct a content analysis, the researcher 1) defines concepts in a way that they are "mutually exclusive and exhaustive" (GAO, 1996), 2) he/she goes through texts, accounting for frequencies, and 3) establishes either intra- or inter-rater reliability by having the entire data set recoded, either by the same or different researcher, respectively. Replication requires that concepts of interest are explicitly defined so another person could reasonably arrive at the same frequencies of occurrence.

 The rigorous standardization and potential for replication inherent in content analysis were appealing for use on the UCSB interviews. However, content analysis was deemed an inappropriate tool to evaluate interviews about women's mating environment on both

methodological and philosophical grounds. It is extremely problematic for a researcher to conduct semi-structured or structured interviews with the intent of later using content analysis because it is too easy to (inadvertently) steer the conversation and, thus, alter frequencies. Philosophically, I do not subscribe to the notion that important, focal concepts will be those that are mentioned the most often. For example, "air" is extremely important to me yet I generally only mention it when I burn dinner and ask someone nearby to open a window. Moreover, this line of reasoning is not compatible with adaptive logic: people do not need to be consciously aware of and conversant about their motives to behave adaptively. Therefore, it is unlikely that frequencies could be effectively used to answer the question of why UCSB women (under)value particular features in a potential mate.

Discourse Analysis

The goal of discourse analysis is to identify hidden motivations behind communication that influence the interpretation of the message (Jaworski and Coupland, 1999). Conducting a discourse analysis requires accepting the tenet that communication both affects and reflects reality (Jorgenson and Phillips 2002); the methodology involved leans heavily on this tenet. Discourse analysis can be performed on any type of text designed to communicate information from the sender to the receiver: a dialogue need not exist; indeed, the communication need not be verbal at all (e.g., news articles).

To conduct a discourse analysis, the researcher 1) locates instances of sender-receiver interactions of interest, 2) identifies underlying images, implications, assumptions, argumentative positions, power relationships, etc. that affect the totality of the communicated information, and 3) reports consistencies across several sender-receiver interactions. There

are several forms of discourse analysis, differing mainly in focus (e.g. critical discourse analysis focuses mainly on politics and power relationships).

Discourse analysis relies on the researcher's ability to understand the communicated event and also the social values underpinning it. To this end, the sender-receiver interactions are emically-derived but the interpretation of them may not be. Because discourse analysis is influenced by idiosyncrasies in approach, focus, and biases of the researcher involved, practitioners often describe results as *an* interpretation, rather than *the* interpretation.

While discourse analysis is a common means to evaluate interview data and a powerful technique in certain regards, it was wholly inappropriate for my research goals. First, the philosophical approach is not obviously compatible with adaptive logic. Second, my research goals were to use informants to identify factors in the social environment that influence women's mate choice preferences. I could not identify an obvious reason — or even an outlandish reason — why this would be uncovered by evaluating the motivation of communication with an outsider. In short, an answer was more likely to be found in *what* was described rather than *how* or *why* something was described.

Narrative Analysis

The goal of narrative analysis (also called "narrative inquiry") is to interpret experience through stories (Allport 1962, Riessman, 1993). In doing so, the focus is not what happened but rather on the meaning the storyteller derived from what happened: Why it was told? What did the storyteller intend to covey (Franzosi, 1998)? The units of analysis can be the entire story as a whole or its components, provided a plot exists that can unite different

parts into a meaningful whole (Czarniawska, 1998). Therefore, longer texts — either written or oral — are required.

To conduct a narrative inquiry, 1) texts are collected, either from previously-derived sources or from prompting (e.g., conducting an interview or requesting a story be written), 2) texts are broken down into components, 3) components are evaluated for meaning ascribed to that component, 4) if the entire story is being analyzed, combine the component meanings into a larger story meaning, 5) confirm with the storyteller that any attributed meanings are accurate. There is no inherent theory creation nor are there inherent objectives for *a priori* hypothesis evaluation with narrative analysis.

Like discourse analysis, narrative analysis requires empathy of the researcher to interpret experience through stories. Any inherent murkiness in the act of interpretation is compounded in narrative analysis because the researcher is reading between the lines of what the storyteller has said. The researcher may have the luxury of relying on known norms or proclivities when attributing meaning to a story but this is not a certainty. Also like discourse analysis, the stories being analyzed are emically-derived but the interpretation may not be. These two conditions make narrative analysis particularly sensitive to (unintentional) researcher biases.

Narrative analysis is commonly used on interviews, however, it is unsuitable for to determine factors influencing women's mate choice preferences. It is extremely subjective, sensitive to biases, and not concerned with postulating an answer to a question (e.g., why UCSB women might be (under)valuing particular features in a potential mate). Moreover, all analysis is confined to an individual informant's stories; the method does not cleanly map

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onto identification of inter-informant patterns (nonetheless, other researchers have done so, e.g., Hunter 2010). Likewise, a single informant is an inappropriate study population for evaluating factors influencing wom*e*n's mate choice preferences.

Interpretive Phenomenological Analysis

The goal of interpretive phenomenological analysis is to "identify the universal nature of a shared experience" (Smith and Osborn 2007) by evaluating informants' stated logic, motivations, and the meaning derived from their experiences. Factual information about what occurred is treated as a means to gain context and otherwise understand informants' representation of experiences; factual information itself is not analyzed. Interpretive phenomenological analysis is a descriptive process with no attempt to test *a priori* hypotheses. Likewise, descriptions are limited to the particular group of informants being studied; there is no extrapolation to a larger population. Interpretive phenomenological analysis is typically conducted on in-depth, semi-structured interview data although diary data (Dunne and Quayle 2001) and focus-group data (Smith and Osborn 2007) may also be used.

To perform interpretive phenomenological analysis, 1) the researcher conducts a semi-structured interview; 2) interview transcripts are evaluated for themes related to informants' logic, motivations, and derived meanings; 3) themes are refined using constant comparison; and 4) using these themes, an overall description of the informants' experiences is provided, often with typifying quotes used to support the researcher's interpretation.

Like discourse analysis and narrative analysis, phenomenological analysis focuses on the meanings informants derive from experiences. However, phenomenological analysis differs because its focus is on *stated* meanings, rather than *attributed* meanings. Because of this, phenomenological analysis is more grounded and therefore is less susceptible to researcher bias.

The emically-derived, grounded nature of phenomenological analysis is well-fit to a study investigating the UCSB mating environment. However, because phenomenological analysis does not consider information outside of the meanings informants derive from experiences, a considerable swath of information is dismissed. Given that interviews were, in part, being conducted to get data on informants' experiences in IV, dismissal of factual data was unacceptable. Further, phenomenological analysis's lack of hypothesis testing was problematic considering some candidate *a priori* hypotheses existed about women's mate choice preferences. In short, the benefits of IPA were insufficient to outweigh its costs.

Grounded Theory

The goal of grounded theory analysis (Glaser and Strauss, 1967) is to produce a theory that describes the main concerns of participants on a topic of interest. Grounded theory analysis is usually performed on semi-structured interview data, although any data on the topic of interest is permissible (Glaser 2001).

To conduct grounded theory analysis, the researcher 1) gathers data by asking an open-ended question (ex. "Tell me about how you choose your clothing"; Frith and Gleeson 2004), 2) identifies categories — a collection of similar concepts — within and across data

from different sources, and 3) identifies relationships between the categories. The categories and relationships between them define the grounded theory. Grounded theory analysis has been widely used and is considered the most common method to evaluate interview data (Lacy and Luff 2007; Braun and Clark 2006; Silverman 2006).

The grounded theory methodology is highly emic: both the categories and the relationships between them are derived from the data set (Glaser and Strauss, 1967). The theory generated from the data — rather than from *a priori* logic or previous research — "grounds" it. Therefore, a researcher conducting a grounded theory analysis does not give any special affordance to pre-existing theories about what categories may exist and the relationships between them. For every grounded theory analysis, the theory generated is custom-made for the data from which it was derived (Silverman 2006; Strauss and Corbin, 1994). Later, a grounded theory can be used to explain a similar data set without undergoing the analysis (for example, see Nathaniel and Andrews 2010 for a review of applications of Glaser and Strauss' s grounded theories on death and dying).

A hallmark of grounded theory analysis is the constant comparison method (Strauss and Corbin, 1994). In this, the researcher familiarizes himself/herself with the data, creates both candidate categories and candidate relationships between them, and evaluates the fit of each by applying them to new data within the same data corpus. It is a highly iterative process where refinements to or rejection of the candidate theory are made if it does not fit new data well. Constant comparison ceases when the researcher judges no further substantive refinements can be made. The reliance on data "grounds" the theory created. It is important to note that many analytical approaches use the constant comparison method (e.g. content

analysis, framework analysis) and are thereby grounded analyses. However, a grounded *theory* analysis requires theory creation based on relationships between categories.

Several components of grounded theory analysis were appropriate for identifying influences on UCSB women's mate choice preferences but I ultimately decided against using it. The emically-derived nature of the methods was attractive because — as noted above — UCSB women appear to be influenced by something in their social environment that is not obviously identified by standard sexual selection theory. Additionally, I appreciated the rigor of the constant comparison method and the familiarity with the data it ultimately afforded. However, the fundamental questions — why do these women value sexual fidelity as much as they do and indicators of resource acquisition as little as they do — are quite specific for grounded theory. To my knowledge, no hard-and-fast rules exist about allowable specificity of research topics; however, there was a disconcerting gulf between my research questions and the questions typically addressed by grounded theory (e.g., What difference does knowledge about dying make for the terminally ill?, Glaser and Strauss, 1965; How do crack-addicted women negotiate their substance use with motherhood?, Kearney et al., 1995; How do social workers understand and deal with ethical issues in their professional practice?, Holland and Kilpatrick, 1991). More problematic was that candidate hypotheses existed about why UCSB women (under)valued particular qualities in a mate. A proper grounded theory analysis could not be conducted while also pursuing these hypotheses. For these reasons, I did not use grounded theory analysis.

Chapter III

Mapping the Conceptual Space of Jealousy

Abstract: Evolutionary approaches to the study of romantic jealousy have principally been guided by the idea that there are two types of threats to romantic relationships — sexual and emotional — and that these two affect men and women's fitness differently. While this approach has garnered considerable empirical support, it has not investigated the full conceptual domain of jealousy. To do so, we employ techniques developed by cognitive anthropologists and psychologists. Correspondence analysis of similarity judgments among jealousy-inducing exemplars reveals that threats to romantic relationships are spontaneously categorized along three plausibly adaptive dimensions: how severe they are, whether they suggest the presence of a specific rival, and whether they imply deception by the romantic partner. This pattern of results is consistent across men and women, younger and older adults, and those with differing infidelity experience. The full conceptual landscape of jealousy highlights considerations that have been previously overlooked by researchers relying exclusively on sexual selection theory.

[Key terms: cognition, emotion, psychological anthropology, sex]

"If we truly believe that emotions are the result of the way people construe and evaluate what is happening, then the most useful theory will be based on those construals and evaluations, inasmuch as they are what, psychologically speaking, causes the emotions." -- Richard Lazarus

The study of emotions and the events eliciting them has a long history (Ellsworth and Scherer 2003). Modern approaches — particularly appraisal theory and evolutionary psychology — have explicitly outlined the pathways between the elicitor and the emotive response (Arnold 1960; Lazarus 1966; Mesquita and Frijda 1993; Pinker 1997; Plutchik 1980; Tooby and Cosmides 1992). Both appraisal and evolutionary approaches agree that the elicitors of emotion have affective valence and that the resulting emotions motivate behavior aimed at reaping benefits or mitigating harm (Ellsworth and Scherer 2003; Lazarus 1991; Gaulin and McBurney 2001; Osgood 1964). Appraisal theory focuses on the evaluative processes that assign valence (Dohle et al. 2012; Gutierrez and Giner-Sorolla 2007; Kuppens et al. 2003; Scherer 1997; Tracy and Robins 2006), whereas evolutionary psychology emphasizes the adaptive function (sensu Darwin 1859) of particular valence/context pairings (Buss et al. 1992; Sell et al. 2009; Sznycer et al. 2012). Thus, the two theoretical approaches agree that emotions involve appraisals of contexts by their possible effects on the individual and motivate adaptive responses to those contexts but focus on different aspects and causes of the emotional appraisal.

In the evolutionary psychology literature, romantic jealousy is one of the most intensively studied emotions. There it is considered a negative emotion that motivates both attention to and mitigation of threats to romantic relationships (Buss et al. 1992). Current

theory assumes that romantic threats signal one of two distinguishable losses — loss of sexual exclusivity and loss of emotional exclusivity — and, further, that men and women will evaluate (sensu Lazarus 1991) these losses differently. Specifically, men will be more distressed than women by loss of sexual exclusivity, and women will be more distressed than men by loss of emotional exclusivity (Buss et al. 1992). The overwhelming majority of evolutionary research on jealousy has considered only this predicted sex difference (see Sagarin et al. 2012 for a recent review and meta-analysis).

While the sex-difference component of the hypothesis has received considerable support, it is not without critique. For example, the forced-choice methods typically used — requiring participants to decide which is worse: a partner's sexual infidelity or a partner's emotional infidelity — reliably produce the sex difference, whereas alternative response modes may not (see DeSteno et al. 2002; Harris 2005). Moreover, there are questions about whether these two infidelities are ordinarily disassociated in real-world situations (Berman and Fraizer 2005; Harris 2003; Tagler 2010; cf. Edlund et al. 2006). Here we offer an additional critique, one central to an evolutionary view of jealousy: no evidence has yet been offered that the human mind, left to its own devices, carves relationship threats into distinct sexual and emotional components. While few evolutionary researchers have explicitly claimed that the sexual-emotional distinction is the sole or primary distinction organizing romantic threat perceptions, the literature is dominated by studies designed to look for sex differences along this dimension, using stimuli that assume its reality and salience (e.g., Buunk and Dijkstra 2004; De Souza et al. 2006; Cramer et al. 2001; Easton et al. 2007; Levy and Kelly 2010; Thompson et al. 2007; Sagarin et al. 2012; Sagarin and Guadagno 2004; Shackelford et al. 2000).

We suggest that identifying the primary components of jealousy will clarify several outstanding questions about the adaptive design and function of jealousy. Are "sexual" and "emotional" principal components of jealousy, or do humans spontaneously parse jealousy in some other way? If so, what are its components, and how might they track particular fitness risks? How stable are the components of jealousy across individuals who differ by sex, age, or relationship experience? The study reported here attempts to describe the conceptual space of jealousy by answering these various questions.

To do so, we exploit graphical representations of similarity-judgment data, a methodological approach that is well established in many domains of anthropology and psychology (Albert 1991; Alvard 2009; Boster 1986, 1987; Bhushan et al. 1997; Campo et al. 2008; Cliff and Young 1968; Hermann and Raybeck 1981; Parrott and Smith 1993; Romney et al 1997; Tronvoll 2011; Weller 1986) but that has been little used by evolutionary psychologists (see Singh and Suwardi 1995 for an exception). This methodology is ideally suited to describe the conceptual space of jealousy because it reveals the components of this emotion as it is instantiated in the minds of the informants, with minimal researcher-imposed constraints or prior hypotheses canalizing informants' responses (Jaworska and Chupetlovska-Anastasova 2009; Romney et al. 1997; Ryan and Bernard 2003; Torgerson 1965; and citations listed above). For example, graphical representations of similarity judgments of surface texture have revealed a consistent set of (implicit) organizing components, regardless of the sensory modality in which the texture stimuli are presented (Bhushan et al. 1997; Picard et al. 2003; Yoshioka et al. 2007). Moreover, each of these components correlates with the activation of particular populations of neurons in both humans (Puce et al. 1996) and macaques (Arcizet et al. 2008). Such results suggest that

graphical representations of similarity judgments can accurately reflect distinctions implicit

in the minds, and perhaps brains, of informants. In other words, we chose to use graphical

representation of similarity judgments because, while remaining "relatively free of specific

theoretical demands, [this technique] 'uncovers' or 'recovers' the hidden structure that is in the

data" (Bhushan et al. 1997:242).

Methods

Overview

The present study was undertaken in five phases: (1) exemplars of events inducing

jealousy were nominated, and 24 were selected to cover the greatest possible conceptual

range with a manageable number of stimuli; (2) informants judged the similarity of the

exemplars; (3) the judged similarity of exemplars by different subpopulations of participants

and by all the participants as a whole was graphically represented both as hierarchical trees

and as multidimensional plots; (4) the three principal dimensions of these plots were

evaluated with subsequent rating tasks, in part, to determine whether they represented sexual

and emotional threats; and (5) the jealousy spaces of different subpopulations were

compared.

Participants

Phase 1: Nomination of jealousy-inducing exemplars. 226 men (mean age = 20.12 ±

6.24, range = 18 — 41) and 406 women (mean age = 20.86 ± 5.93, range = 18 — 47) were

given extra credit in an undergraduate anthropology course for nominating a romantic-jealousy-inducing situation. Sexual orientation of the nominators was not assessed.

Phase 2: Similarity judgment. 200 heterosexual participants judged the similarities among the jealousy-inducing exemplars via the successive pile sort, described below. The sample is grouped by sex and age; 45 younger men (mean age = 19.92 ± 0.74, range = 18 — 21), 72 younger women (mean age = 20.25 + 0.75, range = 18 — 21); 41 older men (mean age = 25.65 ± 4.97, range = 22 — 42), and 42 older women (mean age = 25.93 ± 5.07, range = 22 — 41). All younger participants are university undergraduates; all older participants are nonundergraduate residents of the same city as the undergraduates. Twenty-nine participants reported having been sexually unfaithful to a partner (11 men, 18 women); 34 participants reported having been emotionally unfaithful (16 men, 18 women); 36 participants suspected that a past or current partner had been sexually unfaithful to them (18 men, 18 women); and 35 participants suspected that a past or current partner had been emotionally unfaithful (22 men, 13 women). Undergraduate participants received course credit for participation; older community participants were not compensated.

Phase 3 was analytical only.

Phase 4: Characterizing the dimensions of the jealousy space. 448 participants (mean age = 23.35 ± 2.032; 217 men, 231 women) performed these rating tasks. Participants were undergraduates or community members who did not participate in phases 1 or 2. Undergraduates received extra credit for participation; community members were not compensated. Sexual orientation of the raters was not assessed.

Phase 5 was analytical only.

Protocol

Phase 1: Nomination of jealousy-inducing exemplars. To construct an instrument that was both appropriate for this study population and relatively free of researcher-imposed bias, stimuli were created by the participants. Participants in this phase were asked: "Please think of a romantic relationship that you are in, have had, or would like to have. Briefly describe something your partner could do or say — or fail to do or say — that would make you jealous. This could be a little jealous, very jealous, or something in between." Most of the 632 nominated exemplars might induce jealousy. However, six were more consistent with envy (i.e., no potential romantic loss was mentioned; for example, "My partner saw someone famous on the street"). Because romantic jealousy is the sole focus of this study, these six exemplars were removed.

In the exemplar-nomination phase, neither the presence nor absence of sex differences speaks to the goal of our study. In latter phases (see below), these exemplars are structured by participants to reveal the conceptual space of jealousy; only then can we identify the components spontaneously used to organize threats to romantic relationships and note any sex differences. In other words, we use free listing as a *tool* to explore the primary components of jealousy; the free list is the flashlight, not the space revealed by its light. Nonetheless, we note some sex differences in exemplar nomination. Among the

remaining 626 exemplars, the *content* of nominated exemplars did not obviously differ by sex or age. Of note, a partner's sexual infidelity and a partner's emotional infidelity were each nominated multiple times by both men and women, as well as by younger and older participants. However, post hoc analysis revealed that the frequency of nominating *severe* sexual threats was greater for men than for women (see Results section for specification of "severe" threats; 39 nominations by men, 25 nominations by women, $\chi^2 = 19.65$, $p < 0.001$). The frequency of nominating *severe* emotional threats did not differ between men and women (six nominations by men, 13 nominations by women, $\chi^2 = 0.15$, $p > 0.05$).

After eliminating many redundant exemplars, 47 of the original 626 were determined to be sufficiently distinct.[1] To further reduce the number of exemplars in a principled way, seven preraters who did not participate in any other phases of the study completed a successive pile sort (see below) with these 47 candidate exemplars. Correspondence analysis (CA; see below) of these preliminary similarity judgments produced a plot of the 47 candidate exemplars in a preliminary "jealousy space." Using this plot, we reduced the number of exemplars to 24 by selecting the smallest subset of exemplars that maximally spanned the space (i.e., exemplars that either occupied a unique region or were on the edge of the data cloud). Since the goal of this study is to identify the components of jealousy rather than to confirm a hypothesis, we strove to retain the full diversity of nominated exemplars.

[1] For example, the candidate exemplars — "I caught my boyfriend kissing another girl" and "My boyfriend made out with someone else at a party" — were considered redundant. Conversely, the candidate exemplars — "My boyfriend mentioned an ex-girlfriend and that they had a strong connection" and "My boyfriend compares me to his ex" — were considered distinct threats and were further evaluated. We erred on the side of caution and subjected all nominated exemplars that seemed unique to further analysis.

Thus, the range of jealousy-inducing exemplars was spanned with minimal redundancy[2] and cognitive burden on Phase 2 participants. See Appendix for the 24 final jealousy exemplars.

Phase 2: Similarity judgments. The successive pile-sort method (Boster 1986, 1987, 1994) was used to elicit participant's judgments of similarity among the exemplars. We used a successive pile sort, rather than a free pile sort or triad task, because it elicits an equal number of fine-grained contrasts from all participants. In this task, each jealousy exemplar is printed on its own index card, and all 24 cards are presented to a participant in random order. The participant is then asked to sort the exemplars into as many groups as desired, using whatever similarity criteria he or she chooses after being told "there are no right answers; we just want to know what you think." The participant is also asked to provide, for each group, "a brief name or label that describes the group." Following that, the participant is asked to merge the two most similar groups and provide a new name for the merged group. This combine-and-name step repeats until all exemplars are in a single group. Each participant is then presented with his or her original groups and asked to split the group containing the most dissimilar exemplars into two groups. Splitting of groups continues until each exemplar constitutes its own group.

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[2] The candidate exemplars listed below occupied a similar space in the preliminary CA. The first two exemplars were retained because they were most distant within the cluster; the last four were omitted from subsequent analyses. Other exemplars were retained or omitted in a similar fashion.
"You find out from a friend that your partner had dinner with an ex-girlfriend.", "Your partner mentions an ex-girlfriend and that they had a strong connection.", "Your partner compares you to an ex.", "Your partner calls you by her ex-boyfriend's name.", "Your partner discusses past relationships with unnecessary detail.", "Your partner tells you she considered marrying her last boyfriend."

Phase 3: Graphical representations of the jealousy space. The successive pile sort elicits a complete binary tree from each participant in which the number of splits from the root of the tree needed to separate a pair of exemplars is the measure of their similarity. The resulting similarity matrices are represented both by average-link hierarchical clustering trees (Fig. 1, Electronic Supplement Fig. 1) and by CA) plots (Fig. 2, Electronic Supplement Fig. 2). For clarity, the trees shown here are reduced, with only the first five major splits displayed; for the various subpopulations studied here, these splits were more clearly defined than later ones. Reducing the trees in this way necessarily leaves six major groups.

CA performs a simultaneous factoring of the rows and columns of a matrix so that both can be represented in the same low-dimensional space (Greenacre 1983). A CA of a symmetrical matrix produces a solution similar to principal components analysis, because the row scores and the column scores are the same. Also, as in principal components analysis, CA dimensions are ordered by the amount of variance they explain. Thus, in this study, the primary component dictating how threats are perceived is reflected by the x-axis; the secondary component is reflected by the y-axis, etc. As in most plots that assign Cartesian coordinates to cases, proximity indicates similarity.

Phase 4: Interpreting the dimensions of the jealousy space. Axes of multidimensional scaling or CA plots are often interpreted intuitively by the researchers, based solely on inspection of the spatial array of exemplars, with no attempt to empirically validate these interpretations. We decided an additional step was necessary for two reasons. First, because researchers might not classify threats to romantic relationships in the same fashion as nonacademics (Haslam and Bornstein 1996; Parrott and Smith 1993), we preferred a more emic approach. Second, because the purpose of this study is to evaluate the presence of

sexual and emotional components in the absence of researcher-imposed biases, we deemed it both appropriate and fair to rely on our participants' judgments, rather than our own. Therefore, the meanings of the CA dimensions were objectively assessed by evaluating the degree to which the exemplars' coordinates on each dimension correlate with independent ratings of the exemplars on six particular qualities. Three of these qualities were chosen to match prior theorizing about jealousy by evolutionary psychologists, and three were chosen in the normal way, by inspecting the CA plot.

Thus, Phase 4 participants rated the degree to which each of the 24 jealousy exemplars indicated: (A) sexual infidelity, (B) emotional infidelity, (C) position on a sexual infidelity-emotional infidelity continuum, (D) severity of threat, (E) rival specificity, and (F) deception by the romantic partner. Scales A — C were inspired by our desire to evaluate the salience of the sexual-emotional distinction that has been emphasized in prior evolutionary research on jealousy (e.g., Sagarin et al. 2012). Thus, to allow confirmation of a sexual-emotional distinction, participants rated sexual threat and emotional threat independently (on the possibility that these jealousy components are orthogonal) and also rated sexual versus emotional threat along a continuum (on the possibility that these components are related but distinct at the extremes). Scales D — F were suggested by an inspection of the CA plot. Participants then rated the extent to which each of the 24 exemplars fit each of these six qualities, using six-point Likert scales. Wording for the scales was as follows:

A) Sexual infidelity: "If your partner did this, would it indicate that your partner is having a sexual relationship with someone else?" (anchored with "Definitely no" and "Definitely yes").

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B) Emotional infidelity: "If your partner did this, would it indicate that your partner has a strong emotional bond with someone else?" (anchored with "Definitely no" and "Definitely yes").

C) Sexual infidelity-emotional infidelity continuum: "If your partner did this, would it indicate that your partner has an exclusively sexual relationship with someone else, an exclusively emotional relationship with someone else, or a relationship with someone else that has both sexual and emotional elements?" (anchored with "Exclusively sexual" and "Exclusively emotional").

D) Threat severity: "If your partner did this, how serious a problem would it be for your relationship?" (anchored with "Not a problem" and "Very big problem")

E) Rival specificity: "If your partner did this, would you think (s)he is generally uncommitted to you or interested in another particular individual?" (anchored with "Generally uncommitted" and "Interested in particular individual").

F) Deception: "If your partner did this, would you think (s)he was being sneaky or open?" (anchored at "Open and honest" and "Sneaky and dishonest").

Phase 5: Comparing the jealousy spaces of subpopulations. Several contrasts between participant subpopulations were evaluated: men compared to women; younger compared to older; participants who had been sexually (or emotionally) faithful compared to unfaithful participants; and participants whose partners had been sexually (or emotionally) faithful compared to those with unfaithful partners. Men were compared to women because previous theory and research has devoted the greatest attention to the prospect of sex differences, as discussed above. There were two reasons to contrast the responses of young undergraduates with those of somewhat older community members. The first is to address the critique that

psychological research depends too heavily on university undergraduates who do not respond as more mature adults would (cf., Tagler 2010). The second reason to contrast the responses of younger and older individuals is that they are in different phases of their reproductive careers. This supposition was supported: younger participants were in less-committed relationships as compared to older participants (single or casually dating versus seriously dating, engaged, or married; $F = 35.349$, $p < 0.001$). Finally, we evaluated claims that infidelity experience affects the perception of jealousy-inducing events (Buss and Shackelford 1997; Sagarin et al. 2003). As in earlier studies, we distinguish between participants whose partners were or were not sexually or emotionally unfaithful (Edlund et al. 2006; Guadagno and Sangarin 2010; Sagarin et al. 2003; Tagler 2010). However, we also distinguish between participants who themselves had and had not been sexually or emotionally unfaithful (cf. Schutzwohl 2008).

Assessments of *both* similarities and differences between subpopulations rely on (1) summarizing each participant's pile-sort judgments with an individual 24-by-24 exemplar similarity matrix, (2) collapsing these matrices into aggregate subpopulation matrices, and (3) comparing the matrices using the Quadratic Assignment Program (QAP) (Hubert and Schultz 1976). Each cell in the individual similarity matrix contains the integer reflecting the judged similarity between two exemplars (e.g., the split level separating the two exemplars).

To assess *similarity* between comparison subpopulations, the individual similarity matrices of those in the same subpopulation (e.g., all women) were averaged, creating a single 24-by-24 aggregate matrix. The resulting aggregate matrices of any two subpopulations (e.g., men versus women) are then compared using QAP. In this fashion we

address the question: Do these two subpopulations generally agree on the pattern of similarity among these threats to romantic relationships?"

To assess *differences* between subpopulations, we again begin with individual similarity matrices; however, they are collapsed in a different manner. Here, they are used to create a participant-by-participant correlation matrix where each cell represents the correlation between the individual similarity matrices of the two participants. For this study, the correlation matrix is 200-by-200, and each participant's judgments are compared to all other participants' judgments. Again using QAP, we compared the correlation matrix to a model matrix with 1s corresponding to participants in the same population (e.g., two women) and 0s corresponding to participants in different populations (e.g., a man and a woman). By comparing the correlation matrix to the model matrix, we address the question: "Are the differences between members of two comparison populations greater than the differences among members within a single comparison population?"

For tests of both significant similarities and significant differences, QAP comparisons were evaluated with a *z*-statistic and, more directly, with Monte Carlo simulations. QAP-*z* scores reflect the agreement between the compared matrices and are evaluated similarly to traditional *z*-scores. Monte Carlo simulations count the percent of times a random permutation in the compared matrices results in greater similarity between the two. Because the matrices being compared are not the same in tests of similarities and tests of differences, QAP can be used for both. In tests of *similarities*, a random permutation of a matrix may alter the perceived similarity between threat exemplars; in tests of *differences*, a random permutation of a matrix may alter whether a pair of participants is accurately classified as being from the same subpopulation. For a 5% tolerance of a Type I error, the observed data

must be more similar to random permutations 95% of the time. One million permutations were used in each comparison.

We also made comparisons between the reduced trees of comparison subpopulations. Differences in the configuration of the trees were made using the Fowlkes-Mallows index (Fowlkes and Mallows 1983; see Nemec and Brinkhurst 1988 on the use and interpretation of inferential tests comparing dendrograms). Additionally, thematic analysis of the group names provided by participants during the sorting task was used to indentify salient qualities of relationship threats (Lacey and Luff 2007; Ryan and Bernard 2003).

Results

Description of the Exemplar Groups and the Overall Jealousy Space

We used a CA plot, a reduced tree, and the names participants provided for their pile-sort groups to identify jealousy components for all participants considered together. The overall reduced tree (Electronic Supplement Fig. 1) identified the major groups as DIP, CEFJKW, LMNVX, BOQRS, AGH, and TU. These groups range in severity from mild threat (group DIP) to severe threat (groups AGH and TU). The severe exemplars are similar to those used as stimuli in other evolutionary psychology studies (severe emotional exemplars: AHG; severe sexual exemplars: TU). The major exemplar groups are also observable by their clustering in the CA plot (Electronic Supplement Fig. 2). The range in severity is evident as a gradation across the x-axis, as discussed below.

*Is jealousy best characterized by its sexual and emotional components?*

If jealousy were best characterized by its sexual and emotional components, the sexual and emotional ratings (scales A and B from Phase 4) would each correlate highly with one or the other of the first two dimensions from the overall CA plot (previous theory is agnostic regarding which would be the primary dimension); but this is not the case. The first dimension correlates positively with *both* the sexual ($r = 0.869$, $p < 0.001$) and emotional ratings ($r = 0.694$, $p < 0.001$), and the second dimension correlates with neither sexual ($r = 0.311$, *ns*) nor emotional ($r = 0.096$, *ns*) ratings (Electronic Supplement Table 1).

Another possible interpretation of previous theorizing about jealousy is that sexual and emotional threats do not constitute independent dimensions but instead represent a single continuum, with exclusively sexual threats at one end and exclusively emotional threats at the other. Scale C (from Phase 4) was designed to assess this possibility. Ratings of exemplars on this scale fail to correlate significantly with the first dimension ($r = 0.394$, *ns*). However, the sexual-emotional continuum ratings are significantly correlated with second dimension scores ($r = 0.497$, $p < 0.05$), as discussed below.

What is the best description of the first dimension of the CA plot?

In Phase 4, we also collected three additional ratings, scales D — F (severity, rival specificity, and deception by the partner) that were suggested by our inspection of the overall jealousy space. As detailed below, these three ratings provide a better characterization of its main dimensions.

The first dimension of the CA plot explains 17.6% of the variance; it is most highly correlated with Scale C's severity ratings ($r = 0.948$, $p < 0.001$; Electronic Supplement Table 1) and not correlated with the specificity ratings (scale E, $r = -0.026$, *ns*) or with deception
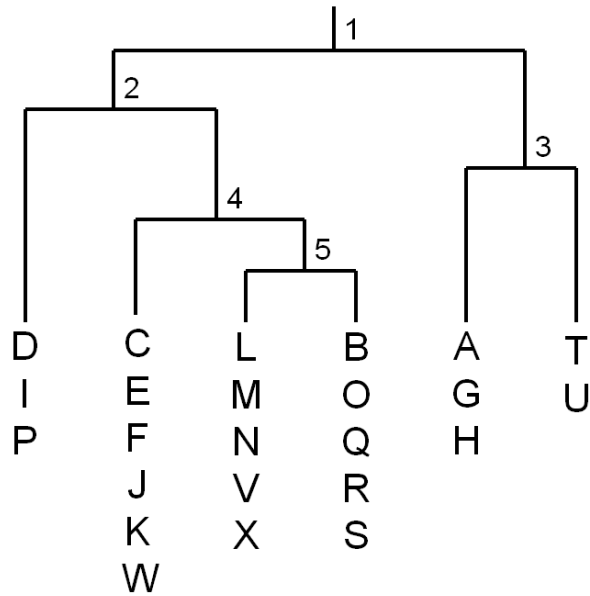
Electronic Supplement Figure 1. Overall reduced tree representing all participants' similarity judgments. Letters represent threat exemplars and numbers represent the sequence of splits between them.
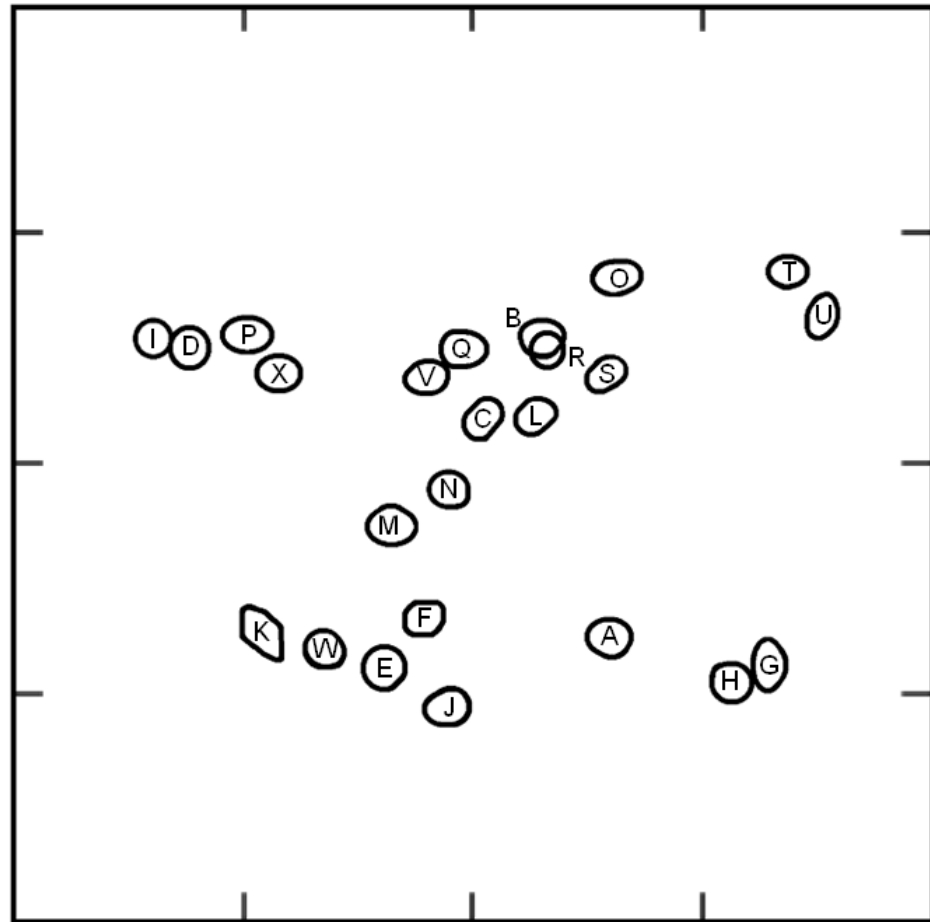
Electronic Supplement Figure 2. Overall jealousy space from all participants' similarity judgments. Each exemplar is represented by a unique letter and is surrounded by 95% confidence ellipses. Severe exemplars are AGHTU.

ratings (scale F, $r = 0.204$, *ns*). As mentioned above, this first dimension is also highly correlated with both sexual and emotional ratings. However, the severity ratings are more highly correlated with exemplar position on the x-axis (0.948 vs. 0.869 and 0.694) and fully mediate the first dimension's relationship with both the sexual ($b = 0.055$, *ns*) and emotional ratings ($b = -0.049$, *ns*), suggesting that severity provides the best description of this first dimension of the jealousy space. In other words, when participants consider a threat to romantic relationships, they attend to its degree of severity rather than its sexual or emotional nature.

What is the best description of the second dimension of the CA plot?

The second dimension of the CA plot explains 9.3% of the variance; it is correlated with Scale D's specificity ratings ($r = 0.661$, $p < 0.001$; Electronic Supplement Table 1), Scale E's sexual-emotional continuum ratings ($r = 0.497$, $p < 0.05$), and Scale F's deception ratings ($r = 0.572$, $p < 0.01$). None of these correlations are significantly different from each other. Of these three rating scales, only deception ratings and sexual-emotional continuum ratings are significantly correlated with each other ($r = 0.481$, $p < 0.05$), and deception ratings fully mediate the relationship between the second dimension and sexual-emotional continuum ratings ($b = 0.288$, *ns*). This suggests rival specificity and deception are better descriptors of the second dimension of the jealousy space than are any of the three sexual/emotional scales (A-C).

What is the best description of the third dimension of the CA plot?

The third dimension explains 8.7% of the variance; it is correlated only with deception ratings ($r = -0.629$, $p = 0.001$; Electronic Supplement Table 1).

Is one's view of jealousy-inducing threats affected by one's sex?

Yes. Participants agree significantly more with members of their own sex than with the opposite sex (QAP $z = 2.93$, Monte Carlo = 0.99; Electronic Supplement Table 2). This sex difference is most clearly reflected in the different shapes of the reduced trees (Figs. 1a and 1b), suggesting women attend more to the specificity of a rival than do men, and men attend more to the severity of the threat than do women. At the same time, men's and women's overall views of jealousy are very similar (QAP $z = 14.92$, Monte Carlo = 1.000). This is demonstrated by the similar positions of exemplars in the CA plot comparing the jealousy spaces of men and women (Fig. 2). CA can be used to make multiple comparisons at once; in this case, we compared similarity in judgments between men and women while simultaneously comparing similarity among exemplars. If differences were mostly due to sex and very little to do with the qualities of the exemplars, men's judgments would be to one side of the CA plot and women's would be to the other. This segregation is not present, indicating sex is not the main organizer of exemplars. Instead, exemplar position is mostly due to the differing features of the exemplars themselves.

Like the overall jealousy space, men's jealousy space and women's jealousy space were best described by severity, specificity, and deception. There are no significant sex differences in strength of correlation between exemplar coordinates and their ratings for the first three dimensions (all ps > 0.400).

Elec.Supp.Table 1. Correlations between exemplar ratings and the first three dimensions of the jealousy space of all participants.

	First dimension	Second dimension	Third dimension	Sexual	Emotional	Sex-Emot. Continuum	Severity	Specificity
Second dimension								
r	0.009							
p	ns							
Third dimension								
r	0.022	0.012						
p	ns	ns						
Sexual								
r	0.869	0.311	-0.118					
p	< 0.001	ns	ns					
Emotional								
r	0.694	0.096	-0.107	0.704				
p	< 0.001	ns	ns	< 0.001				
S-E continuum								
r	0.394	0.497	-0.195	0.663	0.053			
p	ns	< 0.05	ns	< 0.001	ns			
Severity								
r	0.948	0.009	-0.176	0.906	0.755	0.442		
p	< 0.001	ns	ns	< 0.001	< 0.001	< 0.05		
Specificity								
r	-0.026	0.661	0.057	0.249	0.475	0.018	0.022	
p	ns	< 0.001	ns	ns	< 0.05	ns	ns	
Deception								
r	0.204	0.572	-0.629	0.397	0.149	0.481	0.308	0.218
P	ns	< 0.01	< 0.001	ns	ns	< 0.05	ns	ns

Electronic Supplement Table 2.

| | | Monte |
Differences	QAP z	Carlo
Men-Women	2.93	0.99
Younger-Older	2.22	0.98
Participant's sexual infidelity	1.86	0.96
Partner's sexual infidelity	1.05	0.85
Participant's emotional infidelity	0.93	0.82
Partner's emotional infidelity	-0.52	0.31
Similarities		
Men-Women	14.92	1.00
Younger-Older	14.36	1.00
Participant's sexual infidelity	13.72	1.00
Partner's sexual infidelity	14.13	1.00
Participant's emotional infidelity	14.32	1.00
Partner's emotional infidelity	14.40	1.00

Correlations, statistical differences, and statistical similarities between the jealousy spaces of

different subpopulations.

Is one's view of jealousy-inducing threats affected by one's age?

Yes. Participants agree significantly more with members of their own age class than

with the other age class (QAP z = 2.22, Monte Carlo = 0.980; Electronic Supplement Table

2). This age difference is reflected in the differing shapes of the trees in Figures 1c and 1d. In

particular, younger participants make a significantly stronger distinction between severe

sexual threats and severe emotional threats than do older participants (Fowlkes-Mallows

index = 0.00; Fowlkes and Mallows 1983). However, the overall view of jealousy by younger and older participants is very similar (QAP Z = 14.36, Monte Carlo = 1.000).

Is one's view of jealousy affected by one's prior sexual infidelity?

Yes. Participants agree significantly more with participants who share their history of sexual fidelity (QAP *z* = 1.86, Monte Carlo = 0.960; Electronic Supplement Table 2). This difference between the sexually faithful and unfaithful participants is reflected in the different shapes of the trees in Figures 1e and 1f. However, again, the overall view of jealousy by the sexually faithful and unfaithful are very similar (QAP *z* = 13.72, Monte Carlo = 1.000).

Is one's view of jealousy affected by other aspects of one's infidelity history?

No. Participants did not agree significantly more with others who shared their experience of partner's sexual or emotional infidelity or with others who shared their own history of emotional infidelity (all QAP *z* ≤ 1.05, Monte Carlo ≤ 0.85; Electronic Supplement Table 2). The views of jealousy by all three pairs of these subpopulations are very similar (QAP *z* ≥ 14.13, Monte Carlo = 1.000).

The Nature of Romantic Jealousy

Evolutionary approaches to the study of romantic jealousy have been guided by the idea that there are two distinct types of threats to a romantic relationship — sexual and emotional. Thus, most prior researchers have created stimuli explicitly designed to be either sexual or emotional in content. While this approach has succeeded in uncovering predicted
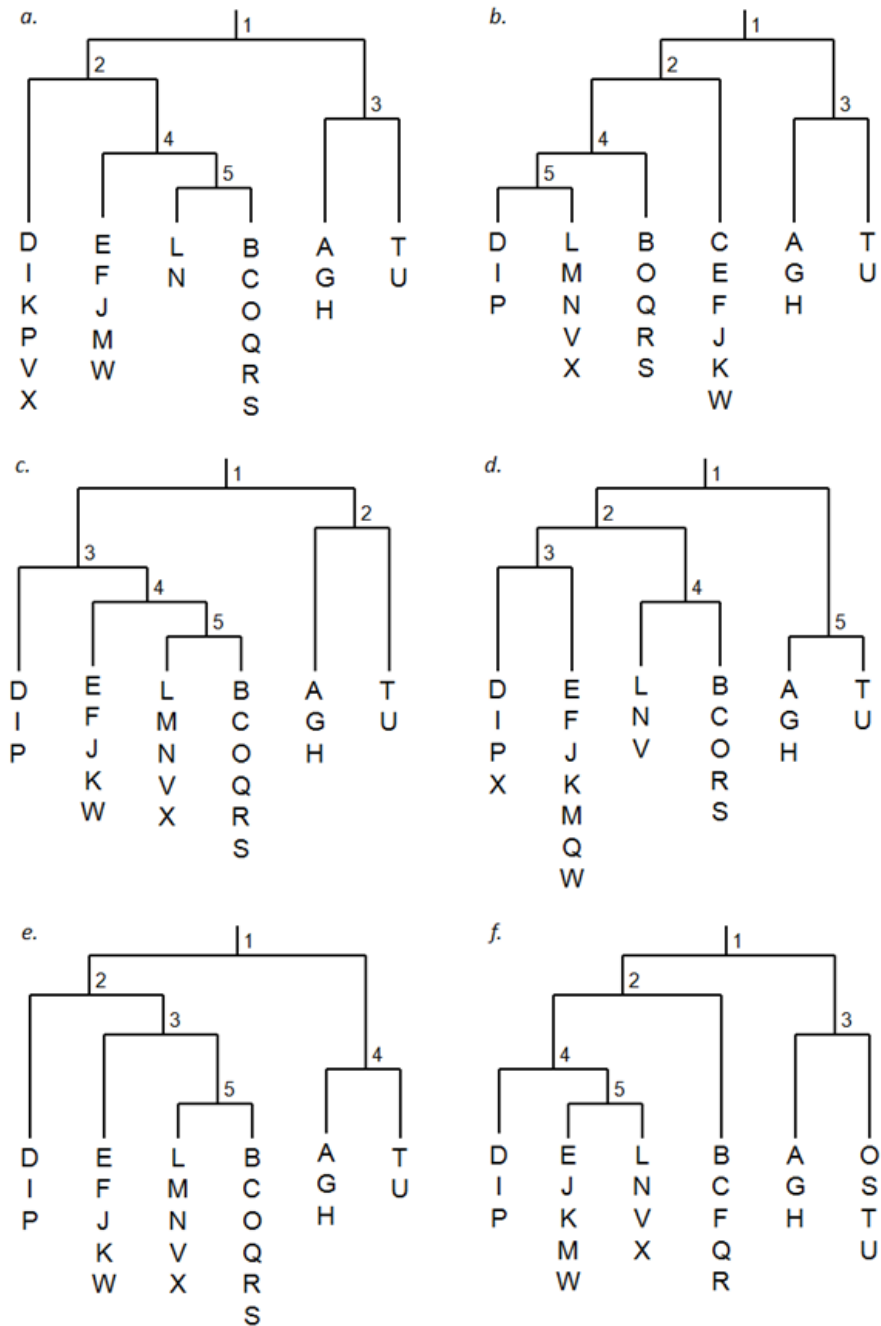
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Figure 1. Reduced trees for men (a) and women (b), younger (c) and older (d), sexually faithful (e) and sexually unfaithful (f). Letters represent threat exemplars and numbers represent the sequence of splits between them.
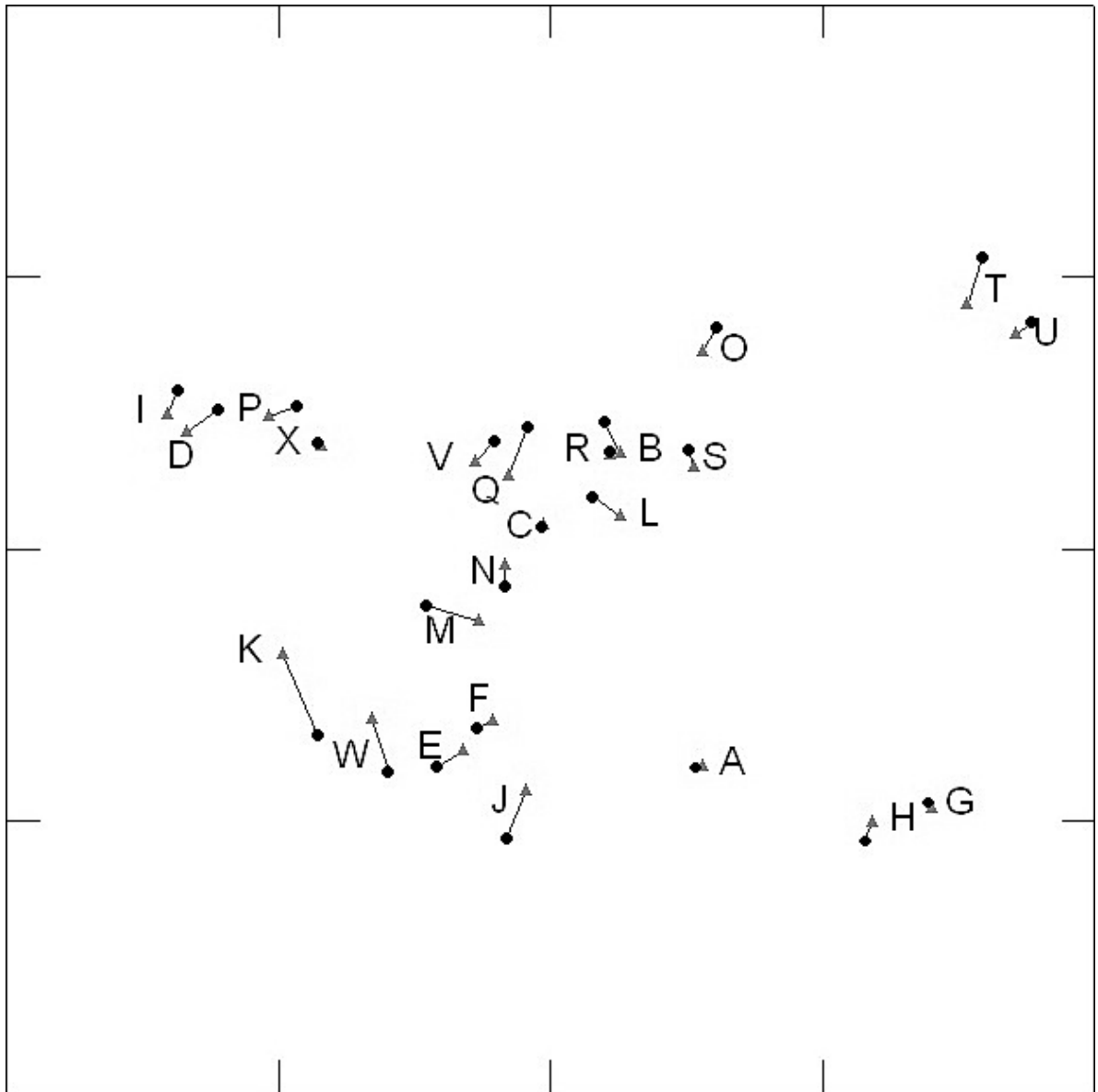
Figure 2. Composite correspondence analysis plot comparing men's and women's judgements. Triangles indicate men's judgements of exemplars; circles indicate women's judgements of exemplars. For each exemplar, a line connects average male and female judgments. Line lenghts indicate degree of agreement between men's and women's perception of a particular exemplar; thus a short line indicates that men and women view an exemplar similarly.

sex differences, it has necessarily neglected questions about the wider conceptual landscape of jealousy and the relative salience of the sexual/emotional components vis-à-vis other elements of that landscape. Here we show that, when participants are presented with a more open-ended task — similarity judgments of exemplars nominated by others like themselves — the components of jealousy are threat severity, rival specificity, and deception by the partner.

Based on the strength of the correlations and patterns of mediation among the ratings (Phase 4), the primary component of jealousy is best characterized as threat severity. In bivariate terms, this dimension is also significantly *positively* correlated with *both* the sexual infidelity and the emotional infidelity ratings. This pattern is highly inconsistent with previous theorizing, which postulates that sexual and emotional threats vary independently and pose distinct challenges. Our data suggest that, if subjects are not presented with stimuli that spotlight this distinction, they do not spontaneously recognize a sexual-emotion dichotomy but instead see these threats as varying in parallel. Moreover, the first dimension is most strongly correlated with severity, and severity completely mediates the relationship between the first dimension and *both* the sexual and emotional ratings. In other words, participants attend to the severity of the threat, not its sexual or emotional nature.

Similarly, the overall reduced tree (Electronic Supplement Fig. 1) and the reduced trees of all subpopulations (Fig. 1) show participants first distinguish severe from nonsevere exemplars and only much later distinguish severe-sexual from severe-emotional exemplars. These patterns do not overturn previous jealousy research, but they do suggest that a distinction between sexual and emotional threats is not a primary component of people's spontaneous assessment of romantic threats. These patterns further imply that sex differences

in response to romantic threats have been overstated in the existing evolutionary psychology literature.

The primacy of severity in similarity judgments is not only quantitatively reflected in the reduced tree and in the CA plot but also qualitatively in participants' names for their exemplar groups. The low-threat group (exemplars DIP) caused little concern for most participants (e.g., "Probably nothing"; "Shouldn't get mad"). Conversely, participants considered severe-threat groups (exemplars AGH and TU) quite serious, and the names of these groups reflected intense concern (e.g., "Unforgivable"; "The relationship is over"). Severity is a novel consideration in jealousy research, but it is consistent with the emotion's hypothesized adaptive function. Threats to a romantic relationship require appropriately calibrated behavioral responses. Severe threats merit urgency and strong countermeasures. Less severe threats must be attended to commensurately to avoid undue stress on the relationship (e.g., aggressive confrontation, incessant mate guarding).

Again based on the strength and pattern of the bivariate correlations and mediations, the second dimension of the jealousy space is most strongly correlated with rival specificity. Names for the exemplars were consistent with this interpretation. When considering low-specificity groups, participants were more likely to focus on interpersonal problems (exemplars CEFJKW: "Complete lack of interest in me"; "Lack of respect"); when considering high-specificity groups, participants were more likely to suspect a particular rival's presence (exemplars DIP, LMNVX, and BCOQRS: "There is another woman"; "Aware of another woman"; and "Interested in another man"). The presence or absence of a specific rival is also a novel consideration in jealousy research, and it too is plausibly adaptively salient. While the first dimension signals the magnitude of the necessary response,

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this second dimension directs the behavioral response: should it monitor the partner because he/she is loosely bonded, or should it be aimed at a specific rival who might be repelled or undermined with targeted strategies (cf. Buss et al. 2000; Buunk and Dijikstra 2004; Buunk et al. 2011; Dijikstra and Buunk 1998, 2002)? Given this proposed function, this component may be especially salient in cultures where mate switching or sexual infidelity is comparatively easy.

Both the second and third dimensions of the jealousy space were correlated with deception ratings. Names for the exemplar groups were consistent with this interpretation. For both dimensions, exemplars AGH comprised the low-deception group; these exemplars were considered upsetting but honest ("Explicit statements of disinterest"; "Honest"). Exemplars comprising the high-deception group were different for the second and third dimensions of the jealousy space. In the second dimension, the high-deception group comprised exemplars TU. Independent ratings confirm these exemplars are both deceptive and indicate the presence of a specific rival; however, when considering this group, participants overwhelmingly focused on their partner's involvement with a rival ("Definitely wants to be with another man"; "Cheating"). In other words, participants were less concerned that the actions were deceptive and more concerned about whom the actions involved. Interpretation of the third dimension was more straightforward: this dimension was only correlated with deception ratings, and names for the high-deception group clearly reflected participants' attention to dishonesty (group BOQRS: "Untrustworthy"; "Things I would pay special attention to"; "Very suspicious"). Like severity and specificity of rival, deception by a partner suggests an adaptive basis. Implications of infidelity — occurring before any confirmation of its occurrence — should motivate increased attention to the partner's

behavior, whereabouts, and associates. As succinctly put by a participant, deceptive acts require special attention.

Between-Subpopulation Variation

There is considerable overall agreement between participant subpopulations in their similarity judgments of jealousy exemplars, as indicated by the QAP-z and Monte Carlo values. Men's judgments are quite similar to women's; younger participants' judgments are quite similar to older participants'; judgments of those with a history of infidelity are quite similar to those without. Agreement between subpopulations is also shown in the pairs of reduced hierarchical trees (Fig. 1) where many of the exemplar groups are recognized by all subpopulations. (For example, exemplars DIP form a high-specificity, low-severity group in all of the hierarchical clustering trees.) This overall similarity is notable considering the fact that most evolutionary research has focused on differences rather than similarities between subpopulations (e.g., sex differences). Nonetheless, there were many nuanced, yet significant, differences between subpopulations' constructions of the jealousy space.

Men Compared to Women

Some sex differences in judgment of the jealousy-inducing exemplars are apparent in men's and women's reduced trees (Fig. 1a and 1b). Men were more attentive than women to subtle differences in the severity of the 19 nonsevere exemplars, dividing them into a low-threat group (exemplars DIKPVX) and two moderate-threat groups (EFJMW and BCLNOQRS). Women were more attentive than men to indications of a specific rival, dividing nonsevere exemplars into a low-specificity group (CEFJKW) and high-specificity

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groups (DIP, LMNVX, and BOQRS). There were no apparent sex differences in attention to deception indicated by the reduced trees.

Sex differences were also present in exemplar groups' names. Those given to the low-threat group suggested men were more upset by these exemplars than were women (men: "Probably nothing" and "mysterious behavior"; women: "Female friend" and "Doesn't mean anything"). Considering moderate threat groups, names did not indicate sex differences in distress; however, there were sex differences in foci. Men focused on how the threats would make them feel ("Uncomfortable feelings"; Trying to make me jealous") whereas women were more likely than men to relate the threats to faults in the relationship ("Commitment not good"; "Neglecting me"). Nonsevere threats to romantic relationships such as these are rarely studied by evolutionary psychologists (cf. Schutzwöhl 2005), and therefore qualitative data presented here are especially informative.

Sex differences in judgments of five severe threats (AHG and TU) were expected based on evolutionary theory and prior research (cf. Buss et al. 1992; Daly and Wilson 1982). Names given to severe sexual and severe emotional-threat groups supported this notion: Men seemed more upset by severe sexual threats than did women, and women seemed more upset by severe emotional threats than men did. However, comparing men's and women's jealousy spaces (Fig. 2) highlights that differences between sexes are quite small compared to differences between exemplars.

Younger Compared to Older Participants

When considering moderate-threat groups (EFJKW and LNV), younger participants provided names indicating more anxiety and distress than older participants did (younger:

"Suspicious of something physical"; "I don't want you to see him"; older: "Slightly annoying"; "Maybe bad"). There were no apparent age differences in distress when considering either low-threat or severe-threat groups. However, the distinction between severe sexual (TU) and severe emotional (AGH) groups was significantly more salient for younger participants than it was for older participants. This is evident in the different shapes of the younger and older participants' reduced trees (Fig. 1c and 1d). Likewise, this distinction is apparent in the names given to the severe sexual threats: older participants were much more likely to consider sex as a component of a romantic relationship than were younger participants (younger: "Cheating"; "I hate you"; older: "Most serious offences to the relationship"; "Relationship definitely over"). This pattern suggests that the distinction between sexual and emotional threats may have been overestimated in the literature on the adaptive basis of jealousy because younger participants have predominated in earlier research.

Comparison between Sexually Faithful and Sexually Unfaithful Participants

Considering all subpopulations studied, the jealousy space of sexually unfaithful participants was the most divergent from the overall jealousy space. The shape of sexually unfaithful participants' reduced trees suggests most exemplars are not very threatening (i.e., more closely related to exemplars DIP than BOQRS in Fig. 1f). Similarly, sexually unfaithful participants' names for all groups of exemplars were relatively emotionally detached or blasé compared to names given by sexually faithful participants (unfaithful: "You bug me" and "I kind of care"; faithful: "Definite red flags" and "Purposefully hurting me").

Strengths, Limitations, and Conclusions

This study was designed to describe the conceptual space of jealousy in a manner that allowed for identification of distinct sexual and emotional components but did not presuppose them. Given our participant-driven methods, the data provide a more complete description of the conceptual space of romantic jealousy than has prior research, which has either been narrowly focused on the possibility of sex differences or, conversely, explored the broader conceptual space comprising both jealousy (romantic and otherwise) plus envy (Haslam and Bornstein 1996; Parrott and Smith 1993; Salovey and Rodin 1986). In addition, our results suggest a possible adaptive basis for the components identified: attend to the magnitude of the threat, and implement appropriate counterstrategies targeted at the rival or the romantic partner. This provides a blueprint for replication and extension in other populations.

We believe this study also illustrates how a narrow reliance on an etic, exclusively theoretical, approach can produce a limited understanding of a topic. This is particularly true when the topic is human cognition (cf. Romney and Moore 1998). By constructing an instrument based on participants' nominations, our study revealed components never before suggested by evolutionary psychologists.

Of course, this study has limitations. Relying on participants to generate exemplars requires them to recall or predict circumstances that could elicit jealousy in a romantic relationship. However, we believe that we were able to mitigate these limitations by collecting candidate exemplars from more than 600 people, aged 18 to 47.

In selecting the final set of exemplars, we gathered a wide range of participant-nominated, jealousy-inducing exemplars while reducing redundancy among them. The resulting 24-exemplar set has led to the identification of three jealousy components that, at minimum, reflect the views of our youthful North American participants. These three components — severity , specificity of rival, and deception by partner — are consistent with the view that jealousy functions to avoid harm to romantic relationships, a view shared by appraisal theory and evolutionary psychology. Further research with culturally appropriate stimuli are needed to evaluate how well these components apply to other populations. Replications in cultures that have little mate switching or divorce, infrequent mixed-sex social interactions, or allow polygyny would be particularly valuable.

Because this study was designed to evaluate a hypothesis that anchors a large literature in evolutionary psychology, we were especially concerned to minimize our own researcher bias. This led us to take precautions — such as acquiring ratings for the jealousy space dimensions — that are typically neglected. It is possible that some unintended bias affected the thematic analysis of the group names. Egregious distortions are unlikely because the quantitatively derived reduced trees firmly constrain thematic interpretations. It is also possible that the initial elicitation and selection of exemplars was biased in some fashion, but given that the reduction of candidate exemplars to the final suite of 24 was based on their position in the preliminary jealousy space — not on exemplar content — any bias should have been minimized.

Since our principal goal was to describe the jealousy space — particularly to explore the extent to which it is organized by a distinction between sexual and emotional threats — we chose to work with the population most heavily used by evolutionary psychologists in

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documenting this sex difference: young North Americans. Cultural variation in courtship norms, sexual autonomy, acceptance of divorce, and permissible interaction between men and women all might affect perception of threats to romantic relationships. We consider this project only the first step in identifying the adaptive components of jealousy and recognize the need for further studies in other cultures. To that end, we have begun replication in South America.

We acknowledge that our community participants were significantly, but not considerably, older than our university participants. However, members of these subpopulations were in different phases of their reproductive careers. The significant differences between older and younger subpopulations — particularly in the distinction of sexual threats from emotional threats — are consistent with the difference in reproductive-career phase. As with other aspects of this study, further research can evaluate how similar the jealousy space of our older subpopulation is to the jealousy spaces of other adult populations.

Finally, a reviewer accurately noted that the difference between those who have and have not been sexually faithful may be due to individual differences in sociosexuality (Simpson and Gangestad 1991). Our data do not allow us to test this hypothesis, but we encourage others to incorporate the Sociosexuality Inventory (Simpson and Gangestad 1991) into any replication studies.

There are many further questions posed by our results: What additional dimensions of jealousy space might there be? Do similarities in perception of threat result in similarities in associated behavioral responses? Why do women focus more on specificity of a romantic

rival than do men? Why do men focus more on severity of threats than women? Why does one's own sexual infidelity — but not other kinds of infidelity experience — affect one's perception of the jealousy space? What other demographic differences affect one's view of jealousy? What features of a threat lead it to be regarded as severe? How does the sociocultural milieu affect perception of threats to romantic relationships? Do severity, specificity, and deception reflect a human universal parsing of the jealousy space, or are they particular to certain populations?

In sum, this study shows that the conceptual space of jealousy is best defined by the severity of threat, specificity of rival, and deception by the partner, in that order of importance. Moreover, the differences between subpopulations are slight in comparison to their broad agreement on the nature and structure of the jealousy space. Prior research across a wide range of conceptual, cognitive, and perceptual domains suggests that the method used here can provide insights into the organization of diverse concepts. If its application in this realm is similarly informative, it may help scientists to appreciate the full functional scope of relationship jealousy.

Appendix

A   You say "I love you" and your partner does not respond

B   Your partner cancels a date with you to spend time with another man

C   You find out from a friend that your partner had dinner with an ex-boyfriend

D   Your partner starts loaning her favorite books and music to another man

E   Your partner talks about casual flings she has had with men she didn't know

F   Your partner remembers ex-boyfriends' birthdays but always forgets yours

G   Your partner says she would rather be in a relationship with someone else

H   Your partner has told you she's not certain if she will stay with you or find another partner

I   Your partner helped care for another man when he was ill

J   Your partner talks about how much she values certain traits in other men; traits she knows that you don't have

K   Your partner talks about other men she knows that make her laugh

L   Your partner flirts with other men when she thinks you aren't looking

M   Your partner obviously enjoyed when another man pursued a relationship with her

N   Your partner does not make physical contact with you when there are other men around

O   Your partner spends the night at another man's house

P   Your partner begins working late nights with a male co-worker

Q   Your partner gives another man a very expensive gift for no reason

R   Your partner has a very close relationship with another man but won't let you spend time with the two of them

S   Your partner gets drunk at a party, leaves for a while and refuses to tell you where she was

T   You catch your partner kissing another man

U   Your partner tells you she has been having sex with another man

V   Your partner initiates physical contact with another man while talking with him

W   Your partner mentions an ex-boyfriend and that they had a strong connection

X   Your partner dances with another man

Chapter IV

Functional Variation in Sensitivity to Cues that a Partner is Cheating with a Rival

As published in *Archives of Sexual Behavior, 43*, 1267-1279.

ABSTRACT

The costs imposed by a romantic partner's mixed reproductive strategy (MRS) generate selection pressures for anticipatory responses to mitigate or avoid those costs. People will differ in their vulnerability to those costs, based in part on the qualities of their romantic rivals. Thus, we predicted that individuals at high risk of a partner's mixed reproductive strategy — women with many sexually accessible rivals and men with many rivals more physically attractive than themselves — would be more attentive to cues that an MRS was being employed than those at lower risk. Based on similarity judgments derived from a successive-pile-sort method, this prediction was supported in a study involving over 1,300 students and community members. These results complement a growing body of research on selection pressures generated by romantic rivals.

Keywords: jealousy, mixed reproductive strategy, rivals, romantic threats

INTRODUCTION

Romantic relationships have the potential to enhance or harm reproductive success. In this domain, harmful events can elicit a constellation of plausibly adaptive negative emotions, such as anxiety (Philips, 2010), anger (Buunk & Dijkstra, 2004), disgust (Becker, Sagarin, Guadagno, Millevoi, & Nicastle, 2004), envy (Parrott & Smith, 1993), fear (Sharpsteen, 1991), sadness (Buunk & Dijkstra, 2004), and jealousy (Buss, Larsen, & Semmelroth, 1992). Each of these emotions has a discrete function (cf. Pinker, 1997; Plutchik, 1980; Tooby & Cosmides, 1992): jealousy functions to signal an actual or potential loss to a rival (Clanton & Smith, 1977; Daly, Wilson, & Weghorst, 1982; White & Mullen, 1989). When triggered, jealousy motivates both attention to romantic threats and efforts to mitigate their associated fitness costs (Buss et al., 1992; for a brief review, see Buss & Haselton, 2005). Building on this premise, sex differences in response to relationship threats have become a major focus of research in evolutionary psychology (Buss et al., 1992; Sagarin, Martin, Coutinho, Edlund, Patel, Skowronski, & Zengel, 2012 and references therein). A variety of between-sex differences are predicted because men and women are differentially vulnerable to particular partner-inflicted fitness costs (e.g., diversion of resources, abandonment, cuckoldry). A substantial literature has explored these predictions (Sagarin et al., 2012; for a between-sex comparison of threats to romantic relationships using the same methods employed here, see Hanson Sobraske et al., 2013).

Despite the rich literature on between-sex differences in jealousy and their plausible basis in sex-specific threats to romantic relationships, comparatively little research has examined parallel within-sex differences (cf. Buss et al., 1992; Murphy, Vallacher,

Shackelford, Bjorklund, & Yunger, 2006; Tagler, 2010). Just as differential vulnerability to partner-inflicted fitness costs predicts between-sex differences, it similarly predicts within-sex differences. One important determinant of within-sex vulnerability is variation in the composition of the local mating market: Vulnerability to partner-inflicted fitness costs is higher for individuals surrounded by numerous, desirable romantic rivals (Traes & Giesen 2000; Zhang, Parish, Huang, & Pan, 2012).

Rivals are desirable if they offer traits sought in a partner — either a long-term partner or a short-term, extra-pair copulation (EPC) partner (cf. Dijkstra & Buunk, 1998). When employed as part of a mixed reproductive strategy (MRS), EPCs can elevate reproductive success relative to what is achievable with only a sole, primary partner. For men, monogamy can hamper reproductive success if mating opportunities are neglected during their partners' infertile periods of gestation and lactation (Clutton-Brock & Vincent, 1991). We do not claim that men are never monogamous or that monogamy cannot lead to considerable reproductive success — nor do we suggest that other evolutionary-minded researchers generally make such claims. However, the biological requirements for reproduction dictate that the average man's reproductive success, like that of other male mammals, is ultimately limited by his sexual access to women (for a thorough discussion, see Andersson, 1994). Therefore, men's MRS entails provisioning the best-available primary partner and her offspring while seeking additional mating opportunities via EPCs (e.g., Davies & Shackelford, 2008; Figueredo & Jacobs, 2000; Gangestad & Simpson, 2000; Gaulin & McBurney, 2001; Shackelford, Voracek, Schmitt, Buss, Weekes-Shackelford, & Michalski, 2004). Such an MRS is potentially costly to his primary partner because she stands to lose some (or all, if he abandons her) of his resources to a rival (Petrie & Hunter,

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1993; Scheib, 2001; Trivers, 1972; Westneat, Sherman, & Morton, 1990). A woman is more vulnerable to these costs when there are many sexually-accessible rivals in her local mating market. A sexual accessible rival is tautologically required for an EPC to occur and therefore accessibility is functionally desirable by men seeking an EPC partner (Dijkstra & Buunk, 2002; Schmitt & Buss, 2001; Schmitt et al., 2004; Stillman & Maner, 2009).

Women are burdened with greater minimal parental investment (Trivers, 1972) and thus cannot achieve the same reproductive rate as men. Therefore, a woman's MRS differs from a man's MRS. For women, an MRS entails harvesting both high-quality paternal investment and high-quality genes — but from different males. An individual man is unlikely to provide both the best genes and the best parental investment. Thus, the female MRS typically involves securing the best available investment from a long-term, primary partner and the best available genes from an EPC partner (e.g., Cashdan, 1996; Geary, Vigil, Byrd-Craven, 2004; Hodges-Simeon, Gaulin, & Puts, 2010; Little, Jones, Penton-Voak, Burt, & Perrett, 2001; Scelza, 2011). A woman's MRS is costly to her cuckolded partner because he expends his resources to advance a rival's genes (Buunk, Angleitner, Oubaid, & Buss, 1996; Goetz & Shackelford, 2009; Voracek, Fisher, & Shackelford, 2009). A man is particularly vulnerable to these costs when the local mating market contains many rivals of relatively higher genetic quality. This is because women's strategy of engaging in an EPC to acquire the best available genes is only adaptive if the EPC partner does, in fact, have better-quality genes than those of her primary partner (e.g., Bellis & Baker, 1990; Buss & Schmitt, 1993; Gangestad & Simpson, 2000; Geary et al., 2004; Little et al., 2001; Pillsworth & Haselton, 2006; Puts, Dawood, & Welling, 2012a; Scheib, 2001).

As outlined above, both men and women can reap fitness benefits by implementing an MRS, but they may also experience fitness costs arising from their primary partner's counterstrategies. Hence, for both sexes, the motivation to engage in an MRS should be calibrated to these costs and benefits and thus is likely to depend on the qualities of potential EPC partners. Thus, a person who perceives the local mating market to include many desirable rivals should be particularly sensitive to cues his or her partner is implementing an MRS so counterstrategies can be deployed to minimize harm. This perspective yields two predictions — one for each sex — about within-sex differences in response to relationship threats:

1. Men who perceive they have many rivals of relatively higher genetic quality will be more sensitive to cues that their partner: (1) is having sex with another man, *and* (2) intends to remain in the primary relationship. We specify *relatively* higher genetic quality because — irrespective of absolute levels — an EPC will only be strategic if the genes acquired are better than those offered by the primary partner.

2. Women who perceive they have many sexually-accessible rivals will be more sensitive to cues their partner is engaging in EPCs. Contrary to men, *absolute* — not relative — degree of rival sexual-accessibility is of concern because men's reproductive success is limited by the number of female sex partners, a factor independent of his primary partner's sexual accessibility.

Testing these predictions requires a method that can unobtrusively track sensitivity to relationship threats and extract beliefs about what these threats signify. Neither the forced-choice methodology (e.g., Buss et al., 1992) nor the rating scales often used in evolutionary

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research on jealousy (e.g., Cann & Baucom, 2004; Edlund & Sagarin, 2009; Guadagno & Sagarin, 2010) can provide these types of data. Additionally, typical stimuli (e.g., "Imagine your partner enjoying passionate sexual intercourse with that other person") are inappropriate for addressing these predictions as they describe strong, clear threats to fitness and therefore produce little variance in response, regardless of the composition of the local mating market (cf. Schützwohl, 2005; Schützwohl & Koch, 2004). More to the point, a "partner enjoying passionate sexual intercourse with [an]other person" is not a *cue* of an EPC; it is a verification. In short, typical jealousy methods and stimuli are inappropriate for measuring cue sensitivity.

To monitor MRS cue sensitivity, we used a similarity-judgment task and a suite of two dozen relationship threat exemplars. Similarity judgments can be used to reveal the implicit conceptual structure of relationship threats by tracking sensitivity to particular threat exemplars and extracting participants' beliefs about what these exemplars signal in the context of romantic relationships. Comparisons of conceptual structures can then be made within-sex, based on participants' assessments of the composition of the local mating market.

While relatively unexploited in evolutionary research (for an exception, see Singh & Luis, 1995), similarity data have been used to identify the implicit conceptual structure of many different domains. Multidimensional scaling or correspondence analysis (CA) (Greenacre, 1984; Hirschfeld, 1935) are applied to these similarity data to produce graphical representations of the relevant domain's conceptual structure as it is represented in informants' minds (Brewer, 1995; Jaworska & Chupetlovska-Anastasova, 2009; Romney, Moore, & Rusch, 1997; Ryan & Bernard 2003; Torgerson, 1965). Graphical representations

of similarity data have been used to study conceptual structures (Boster, Berlin, O'Neill, 1986; Cliff & Young, 1968; Russell, 1983; Salovey & Rodin, 1986; Weller, 1986) and a variety of perceptual domains (Baumann & Belin, 2010; Boster, 1986; Kay & Regier, 2003; Picard, Dacremont, Valentin, & Giboreau, 2003; Zarzo, 2011). Representations generated by multidimensional scaling or CA "can be used to explore and discover the defining characteristics of unknown social and psychological structures, but also to confirm *a priori* hypotheses about these structures" (Giguère, 2006, p. 105). These methods are especially well-suited to our present study because they reveal the participants' implicit conceptual structure of threats to romantic relationships in a quantitative way. This quantification then allows statistical comparisons between classes of participants who differ in MRS vulnerability.

METHOD

The present study was undertaken in six phases: (1) exemplars of events inducing jealousy were nominated and edited with 24 ultimately selected; (2) informants judged the similarity of the exemplars with the successive pile sort (Boster, 1986, 1994); (3) these same informants also reported their assessments of the mating rivals, used to determine MRS risk; (4) similarity of exemplars was graphically represented both as hierarchical trees and as 3D plots; (5) the three principal dimensions of these plots were ascertained by evaluating with third-party ratings of the exemplars; and 6) the similarity judgments of high- and low-risk subpopulations were compared. This multi-phased approach is typical of studies comparing

similarity judgments between two populations (Bimler et al., 1999; Boster et al., 1986; Cliff & Young, 1968; Weller, 1986)

Participants

Phase 1 involved nomination of jealousy-inducing exemplars from 632 participants (226 men; age $M = 20.60$ years, $SD = 6.07$, range = 18-47). They were enrolled in an introductory anthropology course and each nominated one jealousy-inducing threat exemplar. These participants were not involved in the rating task or the similarity-judgment task. Phases 2 and 3 involved similarity judgment task participation and risk assessment from 131 men (age $M = 22.48$ years, $SD = 4.66$, range 18-42) and 129 women (age $M = 22.27$ years, $SD = 4.59$, range = 18-43). They were either university students who self-enrolled for course credit via an online scheduling system, or near-by community members recruited in person by research assistants; community participants were not compensated. The online scheduling system did not display this study as a participation option for university participants who described themselves as homosexual; when recruiting potential community participants, research assistants described the study as being for "heterosexual non-students between 22 and 45 years of age". Nonetheless, data from eight people describing themselves as mostly- or completely homosexual were acquired. Because we were testing hypotheses about adaptive (evolved, reproductively motivated) mating tactics, which should be most unambiguously expressed in heterosexuals, data from these eight participants were removed prior to analysis. This created a participant pool of 68 university men, 63 community men, 66 university women, and 63 community women, all reporting an exclusively- or primarily

heterosexual orientation. These 260 participants judged the similarity of jealousy-inducing exemplars and provided information about their local mating rivals used to determine MRS risk class. There were no significant differences in current involvement in an invested, committed relationship between high MRS-risk participants and low MRS-risk participants, either for men ($\chi^2 < 1.00$) or for women ($\chi^2 < 1.00$).

Phase 4 was analytic only and did not require participants. Phase 5 involved ratings of exemplar qualities from 486 people (232 men). Participants rated the jealousy-inducing exemplars on one or two (of six) qualities (see "Dimension description" below). These participants were not involved in the nomination task or similarity judgment task. Phase 6 was analytic only and did not require participants.

Protocol

Phase 1 was determining the suite of jealousy-inducing exemplars, the first step of which was generating a free list. Participants were prompted with: "Please think of a romantic relationship that you are in, have had, or would like to have. Briefly describe something your partner could do or say — or fail to do or say — that would make you jealous. This could be a little jealous, very jealous, or something in between." Of the 632 nominated jealousy-inducing exemplars, six were exemplars of envy rather than exemplars of jealousy (i.e., no potential romantic loss was mentioned; for example, "My partner saw someone famous on the street"). Because the focus of the study was on jealousy, rather than a wider expanse of relationship problems, these six exemplars were removed. Of the remaining

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626 nominations, redundant exemplars were removed (by KNHS), leaving 47 potentially unique candidate exemplars.[1] To further reduce this exemplar set in a principled manner, seven pre-raters not involved in any other part of the study performed similarity judgments on these candidate exemplars. A plot reflecting the conceptual space of the candidate jealousy-inducing exemplars was produced using CA (see below for fuller descriptions of both similarity judgment and graphical representation methodologies). Finally, exemplars were retained as stimuli in the study if they were conceptually unique or if they maintained the full range of the variation (i.e., were on the edge of the data cloud).[2] These final 24 exemplars are listed in Appendix 1; many were similar to stimuli in other jealousy studies (Buss et al., 1992; Dijkstra, Barelds, & Groothof, 2010; Hupka, Buunk, Falus, Fulgosi, Ortega, Swain, & Tarabrina, 1985; Schützwohl, 2005).

[1] For example, the candidate exemplars — "I caught my boyfriend kissing another girl" and "My boyfriend made out with someone else at a party" — were considered redundant. Conversely, the candidate exemplars — "My boyfriend mentioned an ex-girlfriend and that they had a strong connection" and "My boyfriend compares me to his ex" — were considered distinct threats and were further evaluated. We erred on the side of caution and subjected all nominated exemplars that seemed unique to further analysis.

[2] The candidate exemplars listed below occupied a similar space in the preliminary CA. The first two exemplars were retained because they were most distant within the cluster; the last four were omitted from subsequent analyses. Other exemplars were retained or omitted in a similar fashion.
"You find out from a friend that your partner had dinner with an ex-girlfriend.", "Your partner mentions an ex-girlfriend and that they had a strong connection.", "Your partner compares you to an ex.", "Your partner calls you by her ex-boyfriend's name.", "Your partner discusses past relationships with unnecessary detail.", "Your partner tells you she considered marrying her last boyfriend."

Phase 2 involved conducting similarity judgments among these 24 jealousy-inducing exemplars using the successive pile sort methodology (Boster, 1986, 1994). Successive pile sorts require participants to make hierarchical similarity judgments by sorting the exemplars into groups and then naming the groups with a brief description of its main feature (e.g., "things that don't bother me much"). With this method, each participant's judgment of inter-exemplar similarity and their major unifying themes were simultaneously identified.

Phase 3 was risk class assignment. Participants involved in the similarity judgment task were classified as either high- or low-risk for a partner employing an MRS based on their assessments of mating rivals. First, participants estimated the percentage of same-sex people in their local environment (cf. Zhang et al., 2012) who are of an age to be mating rivals. Participants then rated perceived qualities of these rivals on a 6-point Likert scale. For men, the target quality was physical attractiveness relative to the participant — a commonly-used proxy for genetic quality rated perceived qualities of these rivals on a 6-point Likert scale. For men, the target quality was physical attractiveness relative to the participant — a commonly-used proxy for genetic quality (Pillsworth & Haselton, 2006; Puts, Welling, Burriss, & Dawood, 2012; Thornhill & Gangestad, 1993; Zahavi, 1975). For women, the target quality was degree of sexual accessibility. To determine MRS risk, the percentage of local rivals and scores on rivals' target quality were z-scored and summed. Using this z-score, high- and low-risk classes were assigned by mean split. While a mean split reduces variability, this dichotomization was necessary for the statistical method employed (see within-sex comparisons below). Fifty-six men and 69 women were deemed high-risk.

Phase 4 was the graphical representation of participants' similarity judgments. To do so, participants' similarity judgments were collapsed, both into a total participant population and, separately, into one of four sex-by-risk-class subpopulations. Judgments made by each of these five populations were used to produce both representative dendrograms and 3D plots. The dendrograms were produced using average link hierarchical clustering. For clarity, dendrograms are shown as reduced trees, displaying only the top five splits between the jealousy-inducing exemplars. The 3D plots — created using CA (Greenacre, 1984; Hirschfeld, 1935) — represent the participants' implicit conceptual mapping of exemplars. These *jealousy spaces* were arranged with physical proximity between exemplars reflecting perceived similarity by the participants. The plots' dimensions were ordered by the amount of variance explained: The first dimension (explaining the most variance) is represented by the x-axis, the second dimension is represented by the y-axis, and so on. Only the first three dimensions were explored in our analyses.

Phase 5 was the ascertainment of the first three dimensions of the jealousy spaces. This was achieved by correlating the exemplars' coordinates in the 3D plots with independent ratings of the exemplars on six qualities using 6-point Likert scales. For example, to characterize the first dimension, we correlated the x-coordinates of the 24 exemplars with their Likert ratings on each of six rated qualities (below). In the cases where more than one quality significantly correlated with a particular axis, we evaluated which correlations were stronger and whether there were mediating effects among them.

The six rated qualities were chosen either on the basis of pre-existing theory or empirical examination of the jealousy spaces. Pre-existing theory about the adaptive function

of jealousy (see Introduction) suggests that sexual and emotional infidelity pose distinct threats to romantic relationship (Buss et al., 1992; Sagarin et al., 2012). To acknowledge this perspective, exemplars were rated on the degree to which they indicated sexual infidelity and on the degree to which they indicated emotional infidelity and also along a continuum anchored by these two kinds of infidelity. Three additional ratings were elicited, based on inspection of the 3D plots. These qualities were: threat severity, the presence of a specific rival, and deception by the romantic partner. Specific wording of the ratings scales were:

A) Sexual infidelity: "If your partner did this, would it indicate that your partner is having a sexual relationship with someone else?" (anchor 1 = "Definitely no"; anchor 6 = "Definitely yes").

B) Emotional infidelity: "If your partner did this, would it indicate that your partner has a strong emotional bond with someone else?" (anchor 1 = "Definitely no"; anchor 6 = "Definitely yes").

C) Sexual infidelity-emotional infidelity continuum: "If your partner did this, would it indicate that your partner has an exclusively-sexual relationship with someone else, an exclusively-emotional relationship with someone else, or a relationship with someone else that has both sexual and emotional elements?" (anchor 1 = "Exclusively sexual"; anchor 6 = "Exclusively emotional").

D) Threat severity: "If your partner did this, how serious a problem would it be for your relationship?" (anchor 1 = "Not a problem"; anchor 6 = "Very big problem").

E) Rival specificity: "If your partner did this, would you think (s)he is generally uncommitted to you or interested in another particular individual?" (anchor 1 = "Generally uncommitted"; anchor 6 = "Interested in particular individual").

F) Deception: "If your partner did this, would you think (s)he was being sneaky or open?" (anchor 1 = "Open and honest"; anchor 6 = "Sneaky and dishonest").

Phase 6 was within-sex comparisons of similarity judgments. Here the contrast was between men (women) at high versus low risk of their partner's MRS. For each sex, we tested for *both* (1) significant similarity and (2) significant difference in the patterns of judged similarity among the 24 relationship threat exemplars using the Quadratic Assignment Program (QAP) (Hubert & Schultz, 1976). Both tests rely on a large set of 24-by-24 exemplar similarity matrices, one for each participant's similarity judgments. Each cell of each matrix contains an integer that represents the judged similarity between those exemplars as indicated by the pile-sort decisions of that participant.

To test for significant *similarities* between subpopulations, the judged similarity matrices from all the participants in the same sex and risk class were averaged, producing a single similarity matrix for each of the four sex-risk classes. Using QAP, the aggregate similarity matrix of high-risk men (women) was compared to the aggregate similarity matrix of low-risk men (women). This addresses the question "Do high- and low-risk men (women) generally agree on the pattern of similarity among these threats to romantic relationships?"

To test for significant *differences* between subpopulations, analysis again began with participants' judged similarity matrices; however, the matrices were further transformed. Here they were inputs to a larger participant-by-participant matrix where the cell entries represented the correlation between the individual similarity matrices of that pair of participants. (For men, this matrix was 131 by 131 and, for women, it was 129 by 129, due to slight differences in the size of the participant pool for each sex.) Again using QAP, this

participant-by-participant correlation matrix was compared to a model matrix with zeros corresponding to pairs of participants from different risk classes and ones corresponding to pairs from the same risk class. This analysis addressed the question "Are the differences between high- and low-risk men greater than the differences within high-risk men (and low-risk men)?"

For tests of both significant similarities and differences, QAP comparisons can be evaluated with a z-statistic and also with Monte Carlo simulations. QAP z-scores reflect agreement between the compared matrices; higher z-scores indicate greater agreement. Monte Carlo simulations are a more direct test of significance. These simulations reflect the percentage of times the compared matrices were more similar than a random permutation of the data. Because the two tests were based on different kinds of matrices (see above), when assessing *similarities* between subpopulations, random permutations alter similarity judgments among threat exemplars; when assessing *differences* between subpopulations, random permutations alter whether a pair of participants is from the same risk-class. For a 5% tolerance of Type I error, the observed data must be more similar than random permutations of the compared matrices 95% of the time to be deemed significant. One million permutations were used for each test in this study.

We also made qualitative comparisons between the jealousy spaces and dendrograms of high- and low-risk classes. With the jealousy spaces, we contrasted the configuration of exemplars wherein physical proximity of exemplars reflected perceived similarity. In the dendrograms, the configuration reflected major and minor distinctions between exemplars. Thematic analysis of group names provided by participants' was used to identify major

qualities assigned to the suite of relationship threats (Lacey & Luff, 2007; Ryan & Bernard, 2003).

RESULTS

The Overall Jealousy Space

Considering all participants together, the overall jealousy space was best described by the severity of threat, the presence/absence of a specific rival, and the deceptive/honest nature of the romantic partner's behavior. The first dimension was most strongly correlated with and best described by severity ($r = .93$, $p < .01$); severity accounted for all the variance between the first dimension and both the sexual ratings ($\beta = .03$, $p > .10$) and the emotional ratings ($\beta = -.04$, p > .10). This severity dimension is represented by the x-axis of the overall jealousy space (Fig. 1). The second dimension was marginally correlated with rival specificity ($r = .35$, $p < .10$) and uncorrelated with the other ratings. This is reflected by the y-axis of the overall jealousy space. The third dimension was most strongly correlated with and best described by rival specificity ($r = .60$, $p < .01$) and deception ($r = .78$, $p < .01$) ratings; deception ratings accounted for all variance between the third dimension and sexual-emotional continuum ratings ($\beta = -.12$, $p > .10$). Deception and specificity ratings were not correlated ($r = .22$, $p > .10$).

High-risk men compared to low-risk men

High-risk and low-risk men's judgments of the jealousy-inducing exemplars were significantly *similar* (QAP $z = 14.29$, $r = .87$, Monte Carlo = 1.00): High- and low-risk men

generally agreed on the pattern of judged similarity among these 24 threats to romantic relationships. Agreement was apparent in the equivalent descriptors of high- and low-risk men's trees (Fig. 3). However, high-risk and low-risk men's judgments of the jealousy-inducing exemplars were also significantly *different* from each other (QAP $z = 2.09$, $r = .05$, Monte Carlo = .97): The jealousy space was more alike within risk-class than between risk-class. Differences were apparent in the overall shapes and branching structure of the reduced trees (Fig. 3).

For high-risk men, the first dimension of the jealousy space was most strongly correlated with and best described by severity ($r = .94$, $p < .01$); severity ratings accounted for all the variance between the first dimension and both sexual ratings ($\beta = -.05$, $p > .10$) and emotional ratings ($\beta = -.12$, $p > .10$). The second dimension was correlated only with rival specificity ratings ($r = .50$, $p < .05$). The third dimension was most strongly correlated with and best described by deception ($r = .73$, $p < .01$); deception ratings accounted for all variance between the third dimension and the sexual-emotional continuum ratings ($\beta = -.22$, $p > .10$).

For low-risk men, the first dimension was most strongly correlated with and best described by severity ratings ($r = .94$, $p < .01$); severity accounted for all the variance between the first dimension and sexual ratings ($\beta = -.01$, $p > .10$), emotional ratings ($\beta = -.09$, $p > .10$), and sexual-emotional continuum ratings ($\beta = -.04$, $p > .10$). The second dimension was correlated only with rival specificity ($r = .46$, $p < .05$). The third dimension was most
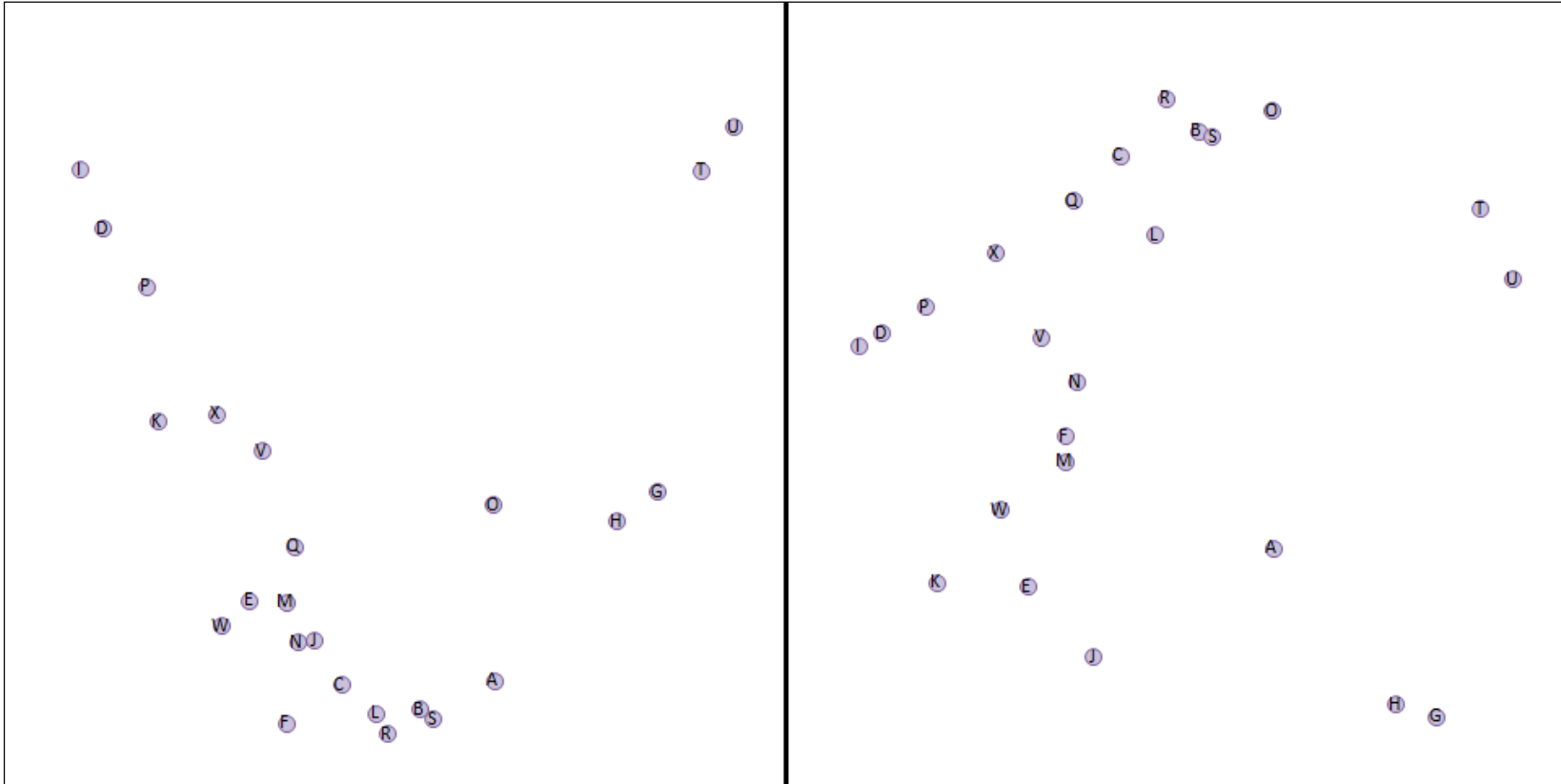
Fig. 1. Overall jealousy space for all participants: (a) first-by-second dimension, best described by severity of threat (1st) and specificity of rival (2nd); (b) first-by-third dimensions, best described by severity of threat (1st) and both deception by partner and specificity of rival (3rd).

strongly correlated with and best described by deception ratings ($r = .75$, $p < .01$); deception ratings accounted for all variance between the third dimension and sexual-emotional continuum ratings ($\beta = -.16$, $p > .10$).

Both high- and low-risk men principally divided exemplars into non-severe threat groups and severe threat groups: exemplars AGH-(O)TU. This division is seen at Split 1 in each reduced tree (Fig. 3). Also, both reduced trees showed a further division of the severe threats into two groups. Thematic analysis of these groups suggests both high- and low-risk men considered these groups to indicate a severe threat to sexual exclusivity — exemplars (O)TU — or a severe threat to emotional exclusivity — exemplars AGH. However, when analyzing only the judgment of severe threats, there were significant differences between high- and low-risk men. The distinction between severe sexual threats and severe emotional threats was more salient for high-risk men, evidenced by the difference in split levels in the reduced trees (Split 2 vs. Split 4); also, high-risk men considered more exemplars severe sexual threats, due to their inclusion of exemplar O with T and U. These structural differences between the severe branches of high- and low-risk men's reduced trees were significant by Fowlkes-Mallows test. (For helpful literature on inferential tests of differences in the branching pattern and group membership between comparison dendrograms, see Fowlkes & Mallows, 1983; Nemec & Brinkhurst, 1988). Differences in judgment of the severe threats were also apparent in the group names. When naming the severe emotional threat group, high-risk men were more likely to state their partner was undecided about maintaining the relationship (e.g., "She is doubting" and "Maybe over") whereas low-risk men assumed she wanted to end it (e.g., "She'll break up with me" and "She doesn't want to stay").

When considering the non-severe exemplars, high-risk men were more attentive to their partners' physical contact with a rival, as evidenced by a separate group, generally named "Physical contact" or "Touching" — exemplars NVX — two of whose members were rated as unimportant by low-risk men.

Table 1. Dimension descriptors for all four subpopulations.

| | Men | | Women | |
	High-risk	Low-risk	High risk	Low risk
First	Severity	Severity	Severity	Severity
Second	Specificity	Specificity	Deception	Specificity
Third	Deception	Deception	Specificity, S-E cont., Deception	Deception

Fig 2. High-risk men's jealousy space: (a) first-by-second dimensions, best described by severity of threat (1st) and specificity of rival (2nd); (b) first-by-third dimensions, best described by severity of threat (1st) and deception by partner (3rd). Low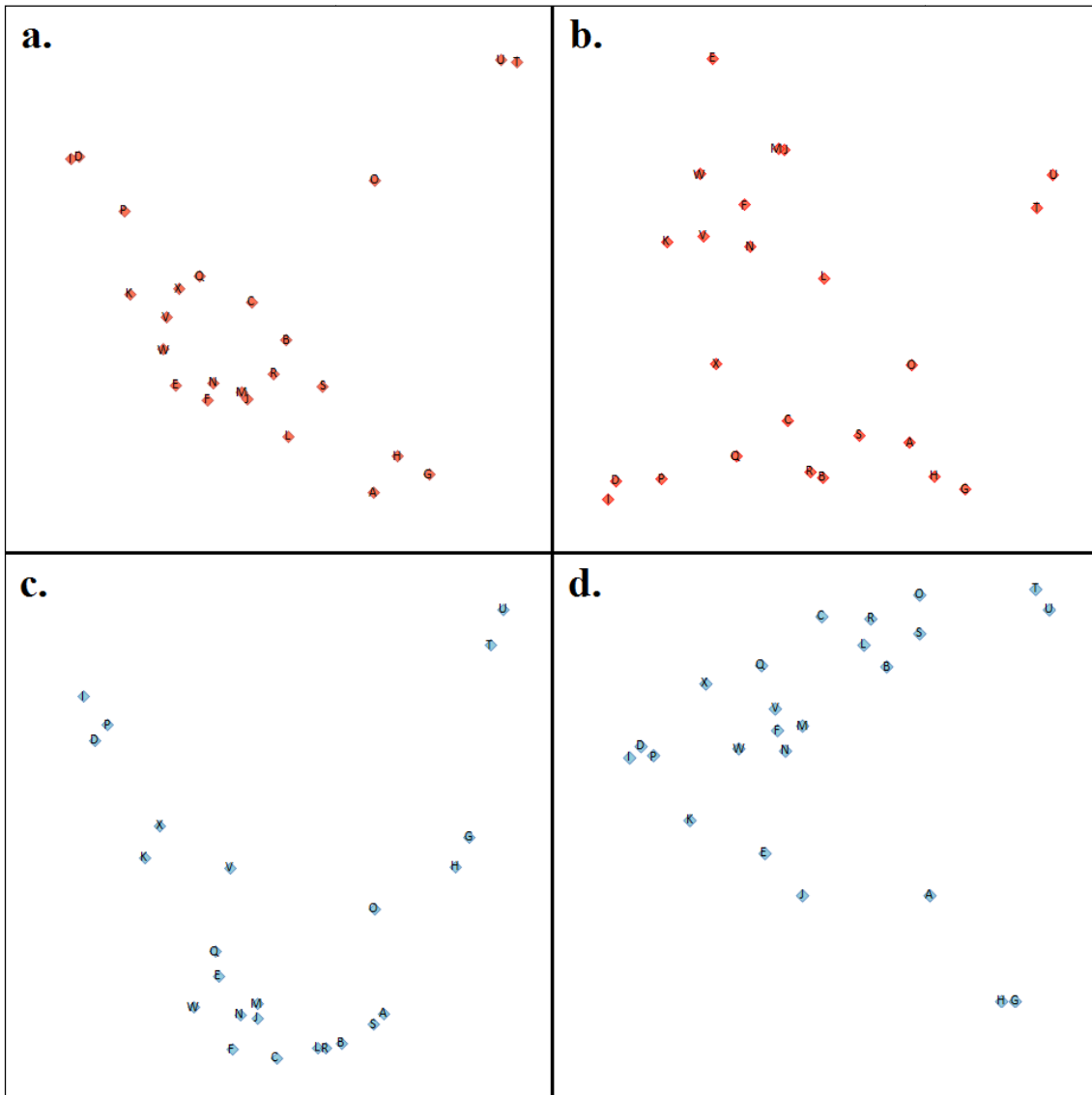-risk men's jealousy space: (c) first-by-second dimensions, best described by severity of threat (1st) and specificity of rival (2nd); (d) first-by-third dimensions, best described by severity of threat (1st) and deception by partner (3rd).
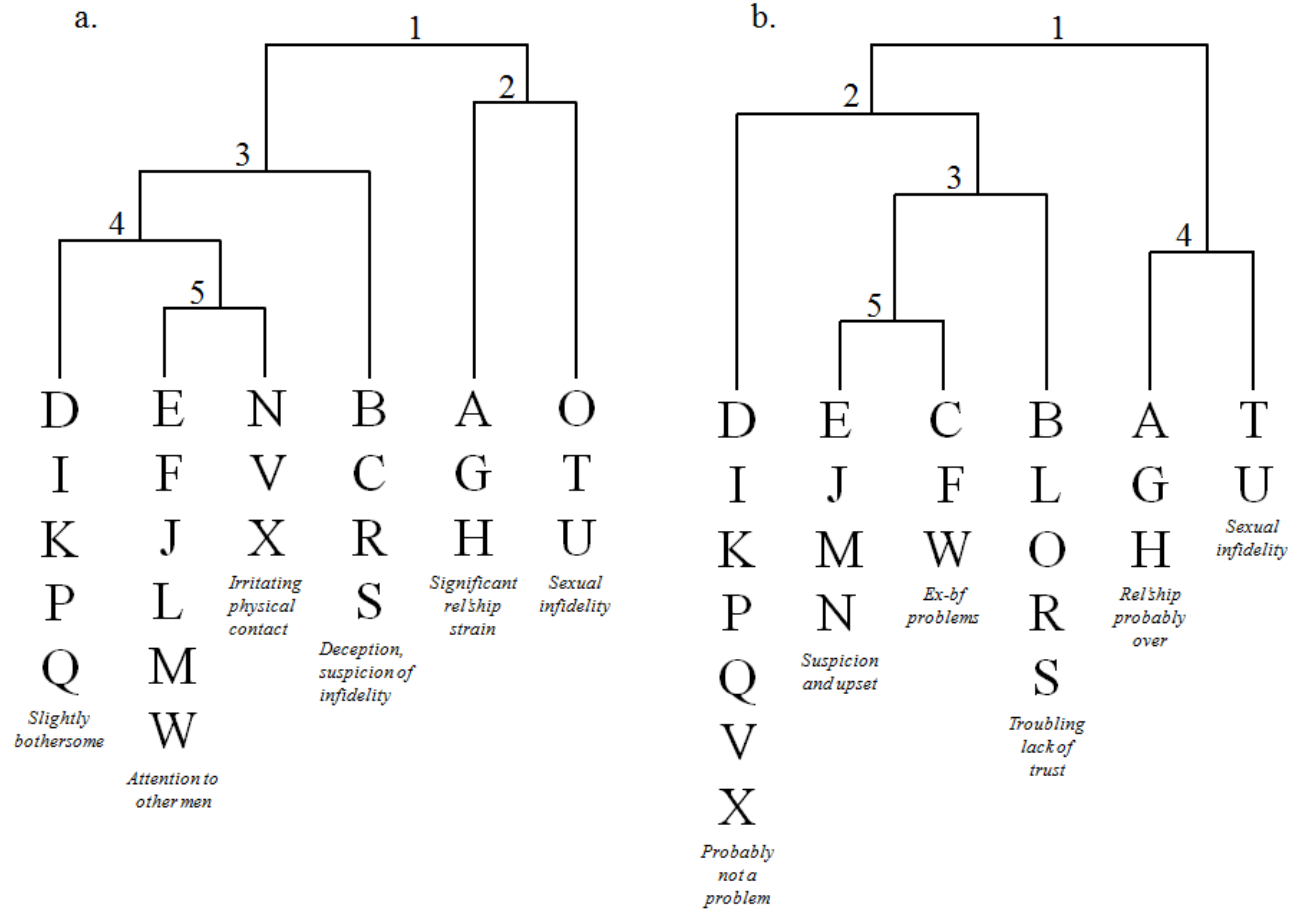
Fig. 3. Reduced trees for high-risk men (a) and low-risk men (b) with major group names.

High-risk versus low-risk women

High-risk and low-risk women's judgments of the jealousy-inducing exemplars were significantly *different* from each other (QAP z = 3.03, r = .09, Monte Carlo = 1.00): The jealousy space was more alike within risk-class than between risk-class. Differences were apparent in the descriptors of each subpopulations' jealousy spaces (Table 1, Fig. 4) and in their reduced trees (Fig. 5). High-risk and low-risk women's judgments of the jealousy-inducing exemplars were also significantly *similar* to each other (QAP z = 13.62, r = .83, Monte Carlo =1.00): High- and low-risk women generally agreed on the pattern of judged similarity among these 24 threats to romantic relationships. Agreement was apparent in the overlap in group membership seen in the reduced trees (Fig. 5).

For high-risk women, the first dimension of the jealousy space was most strongly correlated with and best described by severity (r = .88, p < .01); severity accounted for all the variance between the first dimension and both the sexual ratings (β = .01, p > .10) and the emotional ratings (β = .64, p > .10). The second dimension was correlated only with deception ratings (r = .70, p < .01). The third dimension was correlated with rival specificity (r = .63, p < .01), sexual-emotional continuum (r = .45, p < .05), and deception (r = .46, p < .05); there were no mediating effects.

For low-risk women, the first dimension of the jealousy space was most strongly correlated with and best described by severity ratings (r = .92, p < .01); severity accounted for all the variance between the first dimension and sexual ratings (β = .27, p > .10), emotional ratings (β = -.01, p > .10), and sexual-emotional continuum ratings (β = .04, p > .10). The second dimension was correlated only with rival specificity ratings (r = .71, p <

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.01). The third dimension was correlated only with deception ratings ($r = .55$, $p < .01$).

Summaries of dimension descriptors are shown in Table 1; plots are shown in Fig. 4.

Descriptors of the second and third dimensions were "switched" between high- and low-risk women: The position of exemplars along the high-risk second dimension was strongly correlated with the low-risk third dimension ($r = .93$, $p < .01$), and the high-risk third dimension was strongly correlated with the low-risk second dimension ($r = .87$, $p < .01$). This indicates that high-risk women were more attentive to deceptive actions whereas low-risk women were more attentive to the presence of a specific rival.

Both high- and low-risk women principally divided exemplars into non-severe and severe threat groups — exemplars (A)GH-TU — seen at Split 1 in the reduced trees (Fig. 5). However, high-risk women further differentiated severe threats into a severe sexual threat group — exemplars TU — and a severe emotional threat group — exemplars AGH — with group names describing sexual infidelity and a probable cessation of the relationship, respectively (e.g., sexual: "Physical cheating" and "Legit cheating"; cessation: "We would break up, no question" and "End of relationship"). Low-risk women did not make this distinction, considering these exemplars components of a more cohesive group of unacceptable behaviors (e.g., "Deal-breakers" and "Not okay"). This structure of the severe branches of high- and low-risk women's reduced trees was significantly different (Fowlkes & Mallows, 1983; Nemec & Brinkhurst, 1988).
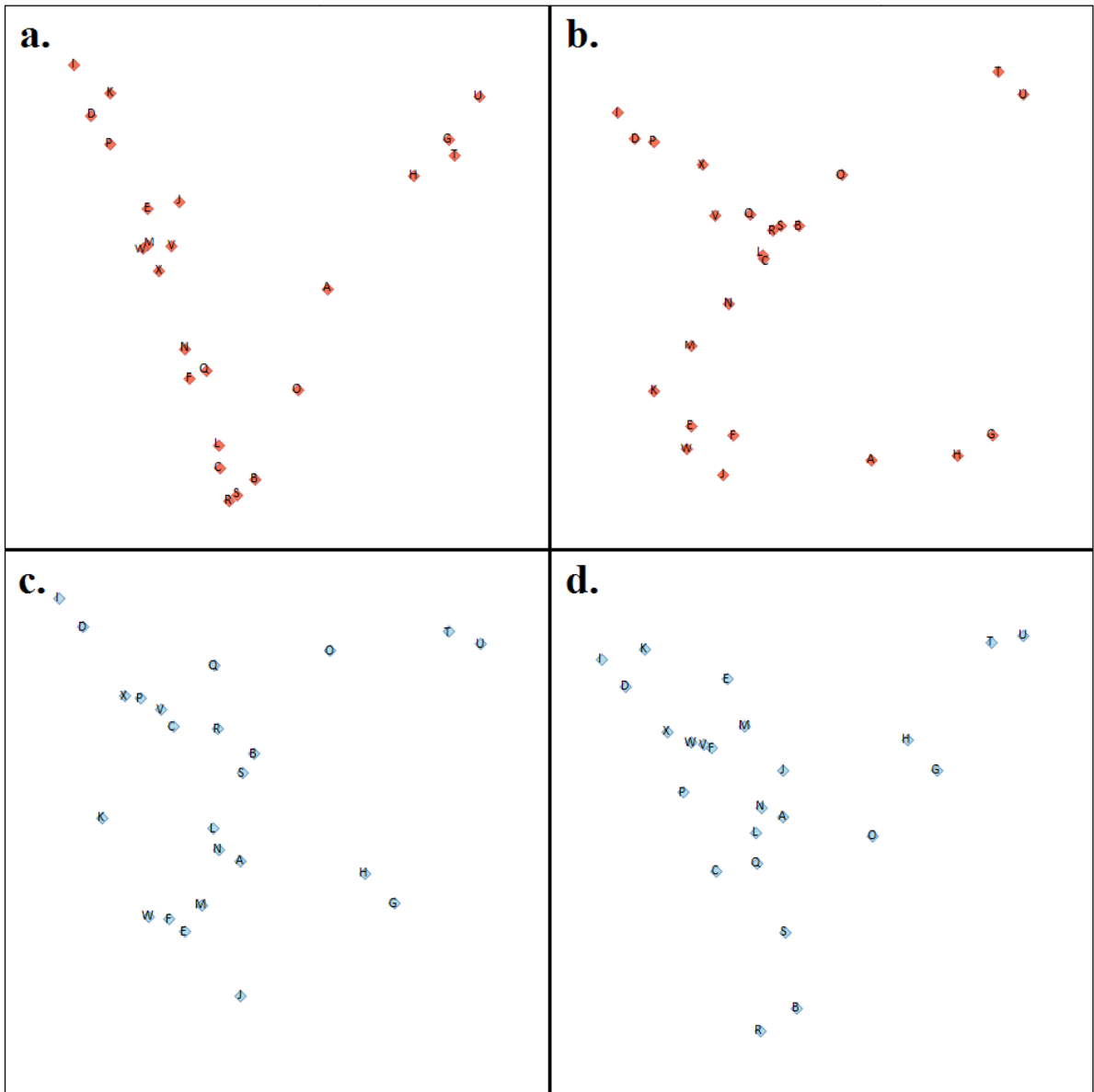
Fig. 4. High-risk women's jealousy space: (a) first-by-second dimensions, best described by severity of threat (1st) and deception by partner (2nd); (b) first-by-third dimensions, best described by severity of threat (1st) and specificity of rival, sexual-emotional continuum, and deception by partner (3rd). Low-risk women's jealousy space: (c) first-by-second dimensions, best described by severity of threat (1st) and specificity of rival (3rd); (d) first-by-third dimensions, best described by severity of threat (1st) and deception by partner (3rd).
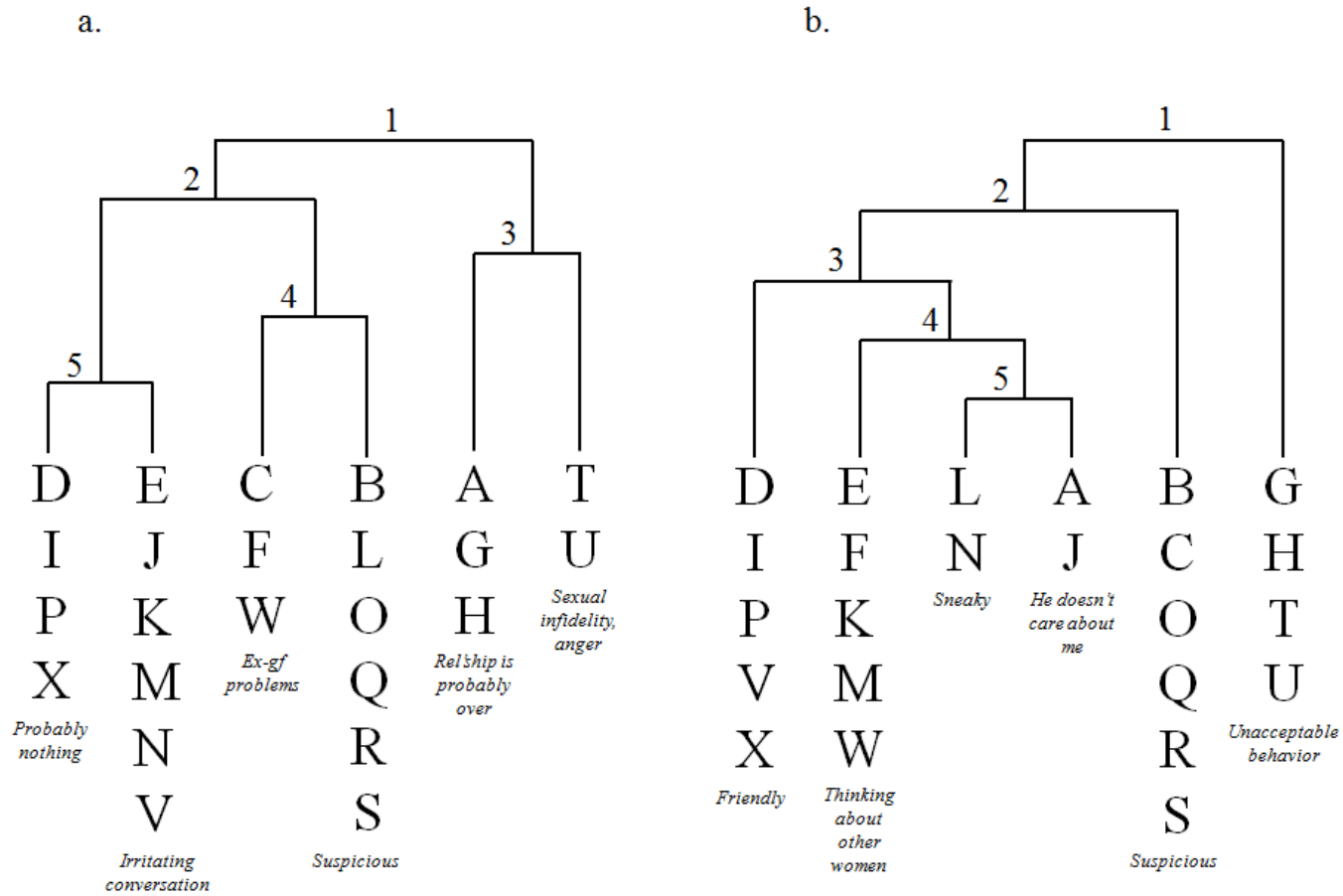
Fig. 5. Reduced trees for high-risk women (a) and low-risk women (b) with major group names.

DISCUSSION

The Overall Jealousy Space

A large literature suggests that romantic jealousy motivates attention to romantic relationship threats and promotes appropriate counterstrategies. Because men and women face different threats in romantic relationships, this perspective has been usefully invoked to explore and explain between-sex differences in responses to relationship threats (Hanson Sobraske et al., 2013; Sagarin et al., 2012). But vulnerability to particular threats also varies within men and within women, based on their own and their rivals' characteristics. The predicted within-sex variation in response to relationship threats has received relatively little attention.

Using methods designed to unobtrusively map the conceptual structure of jealousy and identify its implicit features, we ascertained the jealousy space — both for a large population of participants and for smaller subpopulations separated by sex and risk of a partner's MRS. The overall jealousy space was best described by severity of threat, rival specificity, and deception by the partner. Each descriptor was consistent with the emotion's adaptive function of motivating and orienting appropriate counter-measures when jealousy is triggered: Threat severity indicated the magnitude of the necessary response; rival specificity targeted the response towards either a weakly-committed partner or towards a particular rival; a partner's deceptive acts motivated greater vigilance regarding the partner's activities. We do not suggest these counter-measures are the only means by which to deal with threats posed by romantic rivals. However, our data suggest that these are the most appropriate

means to deal with threats and, further, that the relative appropriateness of each response varied predictably by the composition of the local mating environment.

Risk of a partner's MRS predicts facultative shifts in attention to relationship threats

The pile sort method used in this study identified implicit features of threats to romantic relationships and ranked their saliency. Severity, specificity, and deception described the jealousy spaces of men and women at high- and low- risk of a partner MRS. However, the explanatory power of each — as indicated by axis rank — differed between subpopulations, suggesting MRS risk affects judgments of threats to romantic relationships. This notion was further supported by significant differences in the branching structure of the reduced trees and in the names assigned to major exemplar groups. Our data suggest risk of a partner's MRS motivates facultative shifts in attention to particular types of relationship threats, allowing for strategic deployment of adaptive counterstrategies designed to limit costs associated with this MRS. A facultative shift shows economy of design (Williams, 1966): When MRS risk is high, it can promote behavior designed to reduce costs associated with this MRS before it has been employed or, when MRS risk is low, it can decrease costs of unnecessary vigilance. These novel findings were consistent with and advance the existing literature on the adaptive function of jealousy (Sagarin et al., 2012), on the threats rivals pose to romantic relationships (Bleske-Rechek & Buss, 2006; Buss, Shackelford, Choe, Buunk, & Dijkstra, 2000; Buunk & Dijkstra, 2004; Dijkstra & Buunk, 2002; Haselton & Gangestad, 2006; Maner, Miller, Rouby, Gailliot, 2009; Pillsworth & Haselton, 2006; Schmitt & Buss,

1996), and on facultative shifts in attention to other classes of fitness threats (Barrett, 2005; Lima & Dill, 1990).

Comparing high- and low-risk men

Overall, men at both high and low risk of a partner's MRS perceived jealousy-inducing exemplars similarly; this was statistically evident by a significant QAP *z* score and by the Monte Carlo results. The dimensions of the jealousy spaces were described similarly and the major groups of the reduced trees were alike. Overall similarity between men was expected because all men are vulnerable to cuckoldry — albeit to differing degrees.

However, differences were predicted and found between men at high- and low-risk of a partner's MRS. Major differences between high-risk and low-risk men were evident in the reduced trees. Both high- and low-risk men made a primary distinction between non-severe and severe threat exemplars and, further, both high- and low-risk men divided severe threats into severe emotional threats — exemplars AGH — and severe sexual threats — exemplars (O)TU. However, this distinction was significantly more salient for high-risk men, evidenced by its higher position in the reduced tree. This finding was consistent with the prediction that high-risk men were more attentive to cues their partner was having sex with a rival than were low-risk men. Further, the severe sexual threat group of high-risk men was 50% larger than that of low-risk men, due to the inclusion of exemplar O with exemplars TU. Thematic analysis of the labels assigned to the severe sexual threat groups suggests high-risk men believed exemplar O — along with exemplars TU — indicated a certainty of sexual infidelity whereas low-risk men believed exemplar O — along with exemplars BLRS — demonstrated untrustworthy behavior and suspected sexual infidelity.

Configuration of the reduced trees also revealed high-risk men were more attentive to their partners' non-severe physical contact with rivals than were low-risk men. If physical contact is predictive of later sexual access, this result further supported our prediction that high-risk men, more than low-risk men, will attend to cues their partner is having — or is likely to have — sex with a rival.

Exemplar group labels also suggested high- and low-risk men attended to threats to romantic relationships differently. This was especially apparent in the severe emotional threat group: The names participants provided for this group suggested low-risk men believed their partners would end the primary relationship whereas high-risk men believed their partners were undecided about whether to maintain or end it. In other words, given the same ambiguous relationship threats, low-risk men were more likely to believe these threats implied abandonment by their partner and high-risk men were more likely to believe these threats implied they were vulnerable to cuckoldry. This supports the prediction that high-risk men were more sensitive to cues their partners were employing an MRS.

Comparing high- and low-risk women

Overall, high- and low-risk women perceived jealousy-inducing exemplars similarly. This similarity was statistically evident by a significant QAP z score and by the Monte Carlo results. It was also graphically evident: Major groups of the reduced trees were significantly similar. As with men, this result was expected: Although we primarily focused on differential vulnerability, all women were vulnerable to resource loss.

While similarities were expected, we also predicted and found differences between women, based on their risk of incurring costs associated with their partners' MRS. We predicted high-risk women — more so than low-risk women — would attend to cues their partners were having sex with a rival. This was supported by the configuration of the reduced trees. High-risk women split the severe threats into separate sexual and emotional threat groups, providing names that indicated, respectively, sexual infidelity and a probable dissolution of the relationship. In contrast, low-risk women did not separate the severe threats, considering them a single group of unacceptable behavior. This was consistent with the prediction that high-risk women were more sensitive to cues of a partner's sexual infidelity than are low-risk women.

The prediction that high-risk women would attend to cues their partner was employing an MRS was further supported by the jealousy spaces. When considering threats to romantic relationships, both high and low-risk women attended to threat severity, rival specificity, and deception by their partner; however, the weight placed on these qualities differed. High-risk women attended more to deception by their partner than to the presence of a specific rival. This supported the prediction that women at high risk of their partners' MRS should preferentially attend to cues he is trying to covertly acquire or hide EPC partners. Low-risk women attended to the presence of a particular rival more than to the deceptive nature of their partners' actions. This suggests low-risk women consider mate switching to be a greater threat to the relationship than is an EPC (cf. Davies, Shackelford, & Hass, 2007; Schmitt et al., 2004; Schmitt & Buss, 2001).

Strengths, Limitations, and Conclusions

Using a wide range of participant-generated stimuli in a manner relatively free of researcher-imposed constraints, we plotted the jealousy space comprising a suite of threats to romantic relationships. Our method allowed for description of the jealousy space and for hypothesis-testing about its configuration. Using both qualitative and quantitative analysis, data from men and women were consistent with the prediction that greater risk of a partner's MRS would promote increased attention to cues predicting its employment.

The jealousy-inducing exemplars were generated by free-list rather than investigators. This procedure depended on participants' ability to recall or predict circumstances that could elicit jealousy in a romantic relationship and may disproportionately promote particularly salient events. However, we believe this limitation was mitigated by selecting a set of stimuli from candidate exemplars provided by over 600 people and by reducing those candidates to a manageable size that still spanned the jealousy space in an atheoretic manner. Additionally, it is probable that participants' assessments of their position in the mate pool — and hence their vulnerability to a partner's MRS — was imperfect. However, our hypothesis only required that people attend to relationship threats in a fashion consistent with their perceptions of relative vulnerability. Finally, we note that the use of physical attractiveness as a proxy for genetic quality is ultimately a phenotypic gambit (Grafen, 1984); albeit one that is well-supported and widely used (Jennions, Møller, & Petrie, 2001; Petrie & Halliday, 1994; Roberts et al., 2005; Thornhill, Gangestad, Miller, Scheyd, McCollough, & Franklin, 2003; for an opposing opinion, see Hadfield, Nutall, Osorio, & Owens, 2007).

In sum, this study presented novel data suggesting that the attention to romantic relationship threats was facultatively dependent on the perceived risk of a partner's MRS. More specifically, men in high-risk environments made stronger distinctions between severe sexual threats and severe emotional threats, suggesting greater attention to cues their partners were having sex with a rival; they were also more likely to attribute ambiguous threats as indicative of their partners' intention to maintain the primary relationship in spite of her perceived infidelity. Similarly, women in high-risk environments were particularly attentive to cues their partners were being deceptive about their interactions with rival women, as would be expected if an EPC was being concealed. These results complement and extend prior research on the selective pressures that romantic rivals generate, supporting the larger notion that human psychology is evolved to attend to fitness threats posed by rivals, and that these adaptations would be most effective if they were appropriately calibrated to relative risks.

Acknowledgements

Appendix

Jealousy-inducing exemplars, men's version.

A   You say "I love you" and your partner does not respond

B   Your partner cancels a date with you to spend time with another man

C   You find out from a friend that your partner had dinner with an ex-boyfriend

D   Your partner starts loaning her favorite books and music to another man

E   Your partner talks about casual flings she has had with men she didn't know

F   Your partner remembers ex-boyfriends' birthdays but always forgets yours

G   Your partner says she would rather be in a relationship with someone else

H   Your partner has told you she's not certain if she will stay with you or find another

     partner

I   Your partner helped care for another man when he was ill

J   Your partner talks about how much she values certain traits in other men; traits she

     knows that you don't have

K   Your partner talks about other men she knows that make her laugh

L   Your partner flirts with other men when she thinks you aren't looking

M   Your partner obviously enjoyed when another man pursued a relationship with her

N   Your partner does not make physical contact with you when there are other men around

O   Your partner spends the night at another man's house

P   Your partner begins working late nights with a male co-worker

Q   Your partner gives another man a very expensive gift for no reason

R   Your partner has a very close relationship with another man but won't let you spend time

     with the two of them

S   Your partner gets drunk at a party, leaves for a while, and refuses to tell you where she

     was

T   You catch your partner kissing another man

U   Your partner tells you she has been having sex with another man

V   Your partner initiates physical contact with another man while talking with him

W   Your partner mentions an ex-boyfriend and that they had a strong connection

X   Your partner dances with another man

Chapter V

Importance of fidelity in a partner:

within-sex comparisons between university and community members

Under preparation for submission for publication

"Beauty is in the adaptations of the beholder" Don Symons (1979) memorably wrote in his prescient book, *The Evolution of Human Sexuality*. This insightful twist on an older aphorism suggests that perceptual systems should be tuned to the local landscape of fitness-relevant risks and (in the case of beauty, especially) rewards. In the realm of mating, this perspective predicts that the traits most valued in a long-term mate would be those associated with the greatest increases in reproductive success (RS). Considering the array of known adaptations, there are many traits that could elevate RS, and potential long-term mates who manifest high levels of these traits should be targeted by evolved preference modules. However, vanishingly few individuals will offer maximum doses of all these beneficial traits. Therefore, there should be selection to prioritize partner traits most strongly correlated with increased RS. Moreover, because men are limited by the reproductive capacity of their mates in ways that women are not (Bateman, 1948; Clutton-Brock and Vincent, 1991; Symons, 1979), and because both the minimum parental investment and the primary avenues of parental investment differ by sex (Anderssen, 1992; Clutton-Brock, 1991; Trivers, 1972), the set of strongly valued traits will probably be sex-specific. The core logic is simple: When certain traits are more strongly correlated with RS in sex A than in sex B, then such traits should be more strongly preferred in mates by sex B. While this logic has been widely argued and accepted, the empirical evidence on which it rests (stronger correlations between certain traits and RS in one sex versus the other) has yet to be fully demonstrated. This study will not address that particular empirical gap but will proceed with the prevailing assumptions, detailed immediately below.

Based on existing theory, men should manifest evolved preferences that prioritize a prospective long-term mate's *genetic quality* (revealed in the phenotype by an attractive face; Fink and Penton-Voak, 2002; Perrett, Lee, et al., 1998), *immunocompetence* (revealed by good health status; Fink, Grammar, and Thornhill, 2010; Pawłowski, Nowak, Borkowska, and Drulis-Kawa, 2014; Zahavi and Zahavi, 1997), and *physiological investment capacity* (revealed by a feminine body shape; Lassek and Gaulin, 2008; Rilling, Kaufman, Smith, Patel, Worthman, 2009). Moreover, due to paternity uncertainty and the associated costs of cuckoldry, men should have evolved to prioritize a potential mate's *sexual fidelity* (Hanson Sobraske et al., 2014; Sagarin et al., 2012 and citations therein). Due to the cooperative alliance and social support needed in a biparental, social species such as humans, a long-term mate's *kindness* should also boost RS (Li, Bailey, Kenrick, Lisenmeier, 2002; Lukaszewski and Roney, 2009). Conversely, traits associated with resource procurement and investment — such as a mate's hard work (Fletcher et al., 2004; Flynn, Geary, and Ward, 2005; Jonason et al., 2012; Low, 1989; cf. Gurven, et al., 2013), *good social skills* (Dunbar and Shultz, 2007; Li, 2007), and *ability to have a high status job* (Russock, 2001) — are expected to be comparatively less valued because these traits predict comparatively smaller increases in RS.

Because women are limited by material resources (Symons, 1979; Trivers, 1972), women's RS is increased by a mate's ability to procure and retain resources — such as a mate's *hard work* (Buss, 2003; Gurven et al., 2013), *intelligence* (Fisman, Iyengar, Kamenica, and Simonson, 2006; Kaplan, Gurven, and Lancaster, 2007), *ability to have a high status job* (Campos, Otta, and siqueria, 2002; Russock, 2011), and *good social skills* (Townsend and Levy, 1990; Von Rueden, Gurven, and Kaplan, 2011). However, a mate's ability to procure resources is insufficient in itself to increase women's RS; those resources

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must also be invested. Therefore, women are predicted to value cues of resource investment, like *kindness* (Lukaszewski and Roney, 2009) and *emotional fidelity* (Buss et al., 1989; Sagarin et al., 2012). Cues of a mate's physical quality — such as such as *health* (Gagnestad, Haselton, and Buss, 2006; Li, 2007), an *attractive face* (Lie, Rhodes, and Simmons, 2008; Penton-Voak et al., 2004), and a *masculine body* (Fredrick and Haselton, 2004; cf. Nettle, 2002) — are expected to be comparatively less valued in a long-term mate because they predict comparatively smaller increases in RS.

Sex-specific mate preferences are well-supported across cultures (e.g., Bereczkei et al., 1997; Buss, 1989; Buunk, Dijkstra, Fetchenhauer, and Kenrick, 2002; Chang, Wang, Shackelford, and Buss, 2011; Gil-Burmann, Peláez, and Sánchez, 2002; Hatfield and Sprecher, 1995; Minervini and McAndrwews, 2006; Pearce, Chuikova, Ramsey, and Galyautdinova, 2010; Shackelford, Schmitt, and Buss, 2005; and references above). To my knowledge, only one study has considered the valuation of sexual fidelity relative to other traits (Mogilski, Wade, and Welling, 2014). However, this study approached intra-trait valuation in an ordinal fashion: informants valued "a history of sexual fidelity" more than "similarity" in a long-term mate but it is unclear how much more. Further, I am unaware of any study that has considered the value of emotional fidelity in a long-term mate, either in isolation or relative to other traits. To address this empirical gap, I conducted a within-sex study of mate preferences between several RS-enhancing traits, including both sexual fidelity and emotional fidelity.

As with many findings in the field of adaptive behavior, the sex-specific pattern of mate preferences is best documented in Western populations; particularly from undergraduates

and, to a lesser extent, university-adjacent community populations (e.g., Buss and Barnes, 1986; Feingold, 1990, 1992; Fletcher, Tither, O'Loughlin, Friesen, and Overall, 2004; Jonason, Li, and Madson, 2011; Kenrick Sadalla, Groth, and Trost, 1990; Stewart, Stinnett, and Rosenfeld, 2000; Waynforth and Dunbar, 1995). Occasionally, the mate preferences of undergraduate and community populations are evaluated in parallel (Buss, et al., 2001; Li et al., 2002; Wiederman and Allgeier, 1992) but, to our knowledge, they have never been quantitatively compared. The lack of comparative data is not trivial given the recurring critique that undergraduates are not representative samples of Western adults (Arnett, 2000, 2008; Harris, 2002; Hooghe, Stolle, Maheo, and Vissers, 2010; Rozin, 2010; Tagler, 2010; Voracek, 2001). Indeed, this critique is often provided as rationale for the use of community populations in research on human mating psychology (e.g., Dijkstra and Buunk, 2002; Green and Sabini, 2006). To evaluate the extent of homogeneity in human mate preferences in Western, American adults, we conducted quantitative within-sex comparisons between community members and undergraduates. These samples were regionally matched to help control for geographical variations in preferences (cf. McGraw, 2002).

Mate preferences were determined using two zero-sum allocation tasks. For each task, participants allocated "mate dollars" to "purchase" traits that are theoretically desirable in a long-term mate (as reviewed above and described below). The two tasks differed in the size of the budget, one being more constrained than the other (cf. Li et al., 2002). Following Li and colleagues' reasoning, the smaller, constrained budget was used to reveal traits that participants considered "necessary" in a mate, whereas the larger, moderate budget was used to reveal traits that participants considered "luxuries". We expected the mate preferences of both community members and undergraduates to follow previously-described sex-specific

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valuation patterns, especially so for the constrained budgets. Specifically, men were expected to prioritize physical attractiveness, kindness, and sexual fidelity; women were expected to prioritize resource investment, kindness, and emotional fidelity.

Methods

Procedure

To recruit community members, research assistants approached people who appeared to be 20-45 years of age to (1) restrict the community samples to those in a mate-seeking age range, and (2) limit potential confounds associated with menopause. Recruitment occurred in semi-social environments (e.g., coffee shops, bus stops). Assistants asked if community members were affiliated in any way with the local university; those reporting an affiliation were immediately excluded from the study. Those that did not report an affiliation then completed the study in a self-selected area at a comfortable distance from the research assistant. Paper forms (described below) were returned to the research assistant in an envelope mixed with previously-collected forms from other participants to insure anonymity. Community members received no compensation for their participation.

Undergraduates were students in a lower-division anthropology course who self-enrolled for participation in exchange for course credit. They completed their forms in groups of one to four in an on-campus lab. Paper forms were placed into a locked box in the lab.

All data were collected via a three-page paper form. The first page collected demographic data. Participants provided their age, sexual orientation, education history,

current relationship status, and desired relationship status. Both the current and desired

relationship status options included no/low-involvement options and high-involvement

options (no/low-involvement options: "single and do not want a relationship", single and

would like a relationship", "casually dating"; high-involvement options: "seriously dating",

"living together/engaged", "married"). Data from people self-identifying as mostly or

exclusively homosexual were removed prior to analysis (14 undergraduate members and 8

community members). The final participant populations are described below.

Pages two and three of the form each presented a separate zero-sum allocation task

wherein participants described a *preferred* serious, long-term partner by allocating between 0

and 10 mate dollars to each of 12 traits (described below). The larger the allocation, the more

the described mate would manifest the trait. The allocation tasks differed only in mate dollar

budget: the constrained budget was, 20 mate dollars, the moderate budget was 60 mate

dollars. Because there were 12 potential target traits, the constrained budget allowed, on

average, a mere 1.67 mate dollars per trait, thus forcing participants to make difficult

tradeoffs among these attributes. Both the order of budgets and the order of traits were

pseudo-randomized.

Traits

The twelve descriptive traits were selected based on previous research and on the

adaptive logic outlined above.

"*Commits time and energy to the relationship*", "*good sense of humor*", and "*kind to

me*" were used as cues of a willingness to engage in a cooperative relationship and to

share resources (Dunbar and Dunbar, 1980; Moore, Cassidy, Law Smith, and Perrett, 2006; Weisfeld, Nowak, et al., 2011; Lukaszewski and Roney, 2009).

"*Ability to have a high-status job*", "*good social skills*", and "*hard working*" were used as cues of a mate's ability to procure and retain resources (Fletcher et al., 2004; Flynn, Geary, and Ward, 2005; Jonason et al., 2012).

"Attractive face", "*healthy and has plenty of energy*", and "*curvaceous, feminine body*" or "*muscular, masculine body*" were used as cues of a mate's genetic quality, immunocompetence, and sex-specific hormone profile, respectively (Gangestad and Scheyd, 2005; Wedekind and Folstad, 1994; Jasieńska, Ziomkiewicz, Ellison, Lipson, and Thune, 2004; Fredrick and Haselton, 2004).

"*Intelligence*" was used as a cue of both genetic quality and ability to procure resources (Alexander, 1971; Prokosch, Yeo, and Miller, 2005).

"*Has romantic feelings only for me*" was used as a cue of emotional fidelity, theorized to predict a relative monopoly on a mate's resource investment.

Finally, "*sexually faithful to me*" was used as a strong cue of paternity certainty and a weaker cue of investment fidelity (Buss et al., 1989; Sagarin et al., 2012).

Participants

 The sample of community men comprised 113 participants, aged 26.45 years (*SD* = 5.09, range 19-41). Most men (76.11%) had, at minimum, some college-level education. A majority of community men were both currently in and also desired to be in high-

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involvement relationships (61.10% and 66.10%, respectively). Per the exclusion criterion discussed above, no community men reported being affiliated with the university.

The sample of undergraduate men comprised 189 participants, aged 19.42 years (SD =1.78, range 18-24). Most undergraduate men were currently in and also desired to be in a no/low-involvement relationship (88.89% and 87.83%, respectively). Undergraduate men were younger than community men ($t = 17.38$, $p < 0.001$). Undergraduate men were more likely than community men to be in a no/low-involvement relationship ($\chi^2 = 19.718$, $p < 0.001$). Undergraduate men were more likely than community men to desire a no/low-involvement relationship ($\chi^2 = 31.464$, $p < 0.001$).

The sample of community women comprised 104 participants, aged 27.61 years ($SD = 6.28$, range 22-43). Most women (78.85%) had, at minimum, some college-level education. A majority of community women were both currently in and also desired to be in high-involvement relationships (60.58%, and 68.27%, respectively). Per the exclusion criterion discussed above, no community women reported being affiliated with the university.

The sample of undergraduate women comprised 204 participants, aged 19.39 years ($SD = 1.64$, range 18-26). Most undergraduate women were in low/no-involvement relationships (84.80%) but the majority desired to be in a high-involvement relationship (59.31%). Undergraduate women were younger than community women ($t = 15.201$, $p < 0.001$). Undergraduate women were more likely than community women to be in a no/low-involvement relationship ($\chi^2 = 64.776$, $p < 0.001$). There were no significant differences between undergraduate and community women's desire to be in a high-involvement relationship ($\chi^2 = 1.987$, $p = 0.159$).

Statistical analysis

To assess the valuation of sexual fidelity and emotional fidelity relative to other RS-enhancing traits and to assess the homogeneity of mate preferences in Western adults, we made five types of comparisons.

One, t-tests were used to identify significant differences among the highest- and lowest-valued traits within a budget. For example, in the, 20-dollar budget, the least valued trait was *ability to have a high status job* but its value did not differ from *good sense of humor* ($t = 1.410$, $p = 0.160$). This test addressed the questions "Are the highest-ranked traits definitely more valued than those that were allocated fewer mate dollars? Are the lowest-ranked traits definitively less valued than those ranked more?"

Two, Spearman's rank correlations were used to identify significant covariations in trait rankings, within-population and between-budget. For example, university women's rank order of traits in the constrained budget was compared to the rank order of traits in the moderate budget. This test addressed the question "Does the order of importance among traits differ when someone is considering what is necessary in a mate versus when someone is considering what is a luxury?"

Three, Bonferroni-corrected paired-sample t-tests were used to identify differences in trait valuations between-budgets within a single population. For example, comparing the mate dollars that university men spent on "Healthy" in the constrained budget versus in the moderate budget. Percents of budget — rather than absolute mate dollars — were used to permit comparisons among the $20 and $60 budgets. This test addressed the questions "Is a

trait considered a necessity or luxury? Does this trait have a low or a moderately-high satisficing threshold?" These comparisons of individual trait valuation in the 20- and 60-dollar budgets can be viewed in concert with the comparisons of the overall patterns of mate preferences provided in Test Two, thus producing a fuller description of the necessities and luxuries in mate preferences.

Four, Spearman's rank correlations were used to identify significant covariations in trait rankings, between-population and within-budget. For example, comparing the rank orders of university women's and community women's constrained budgets. This test addressed the questions "Do university members value this suite of traits in a similar fashion to community members? Do they do so when considering what is necessary in a mate as well as when considering what is a luxury?"

Five, Bonferroni-corrected t-tests were used to identify significant differences in trait valuations between-population and within-budget. For example, when comparing university men's spending to community men's spending on "Healthy" within the constrained budget. This test addressed the question "Do university members value a particular trait in a similar fashion as community members?" These comparisons of individual trait valuation by university and community members can be viewed in concert with the comparisons of the overall patterns of mate preferences provided in Test Four, thus producing a fuller description of differences between populations.

Results

Men

Community men: In both the 20-dollar and 60-dollar budgets, community men valued *sexually faithful* was more than all other traits (all $t > 8.085$, $p < 0.001$) (Table 1). In the 20-dollar budget, the least valued trait was *ability to have a high status job* but its value did not differ from *good sense of humor* ($t = 1.410$, $p = 0.160$). In the 60-dollar budget, the least valued trait, again, was *ability to have a high status job* but its value did not differ from either *commits time and energy to the relationship* and *good social skills* (all $t < 1.363$, $p > 0.174$).

The order of trait preference in the 20-dollar budget and the 60-dollar budget significantly covaried ($\rho = 0.734$, $p = 0.007$).

However, community men spent a greater percent of their 20-dollar budget — as compared to the 60-dollar budget — on *sexually faithful* ($t = 16.351$, $p < 0.001$) and *commits time and energy to the relationship* ($t = 3.268$, $p < 0.001$). Conversely, a greater percent of the 60-dollar budget went towards *kind to me* ($t = 5.103$, $p < 0.001$), *intelligent* ($t = 3.082$, $p < 0.004$), *hard working* ($t = 3.382$, $p < 0.004$), and *curvaceous body* ($t = 3.153$, $p < 0.004$).

Undergraduate men: In both the 20-dollar and 60-dollar budgets, university men valued *sexually faithful* more than all other traits (all $t > 8.085$, $p < 0.001$) (Table 1). In the the 20-dollar budget, the least valued trait was *ability to have a high status job* but its valuation did not differ from *hard working* ($t = 1.184$, $p = 0.237$). In the 60-dollar budget, *ability to have a high status job* was valued less than all other traits (all $t > 2.034$, $p < 0.043$).

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The order of trait preference for the 20-dollar budget and the 60-dollar budget significantly covaried ($\rho = 0.881$, $p < 0.001$).

However, undergraduate men spent a greater percent of their 20-dollar budget — as compared to the 60-dollar budget — on *sexually faithful* ($t = 17.781$, $p < 0.001$). Conversely, a greater percent of the 60-dollar budget — as compared to the 20-dollar budget — went towards *kind to me* ($t = 5.243$, $p < 0.001$), *hard working*, ($t = 3.626$, $p < 0.001$), *good social skills* ($t = 3.207$, $p < 0.001$), and *attractive face* ($t = 3.522$, $p = 0.001$).

Community versus undergraduate men: The order of trait preferences between community and undergraduate men covaried in both the 20-dollar budget or the 60-dollar budget ($\rho = 0.902$, $p < 0.001$ and $\rho = 0.902$, $p < 0.001$, respectively).

There were no significant differences between community and undergraduate men's dollar allocation in the20-dollar budget (Fig. 1). For the 60-dollar budget, community men spent more on *intelligence* ($t = 7.856$, $p < 0.001$), *hard working* ($t = 3.378$, $p < 0.001$), and *sense of humor* ($t = 5.509$, $p = 0.001$) (Fig. 2). Undergraduate men spent more on an *attractive face* ($t = 9.798$, $p < 0.001$).

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Figure 1. Comparison of University and Community men's allocation of mate dollars within the restricted budget. Bold lines indicate significant differences between the populations in valuation of the indicated trait. Dashed lines indicate a truncation of the vertical dimension; displayed components of the figure are otherwise to-scale.

University Men, $60   Community Men, $60

Sexually Faithful 8.29   8.02   Sexually Faithful

Attractive Face 7.81

Feminine Body 7.10   6.73   Feminine Body

                                                       6.47   Kind

Kind 6.29   6.31   Attractive Face

                                                       6.07   Romantic Feelings

                                                       5.76   Intelligent

Romantic Feelings 5.71

Healthy 4.16   4.21   Hard Working
Intelligent 4.11
                                                       4.04   Humor
Commits Time 3.89   3.82   Healthy

Social Skills 3.42
Hard Working 3.37

                                                       3.06   Commits Time

Humor 3.04

High Status Job 2.80   2.84   Social Skills

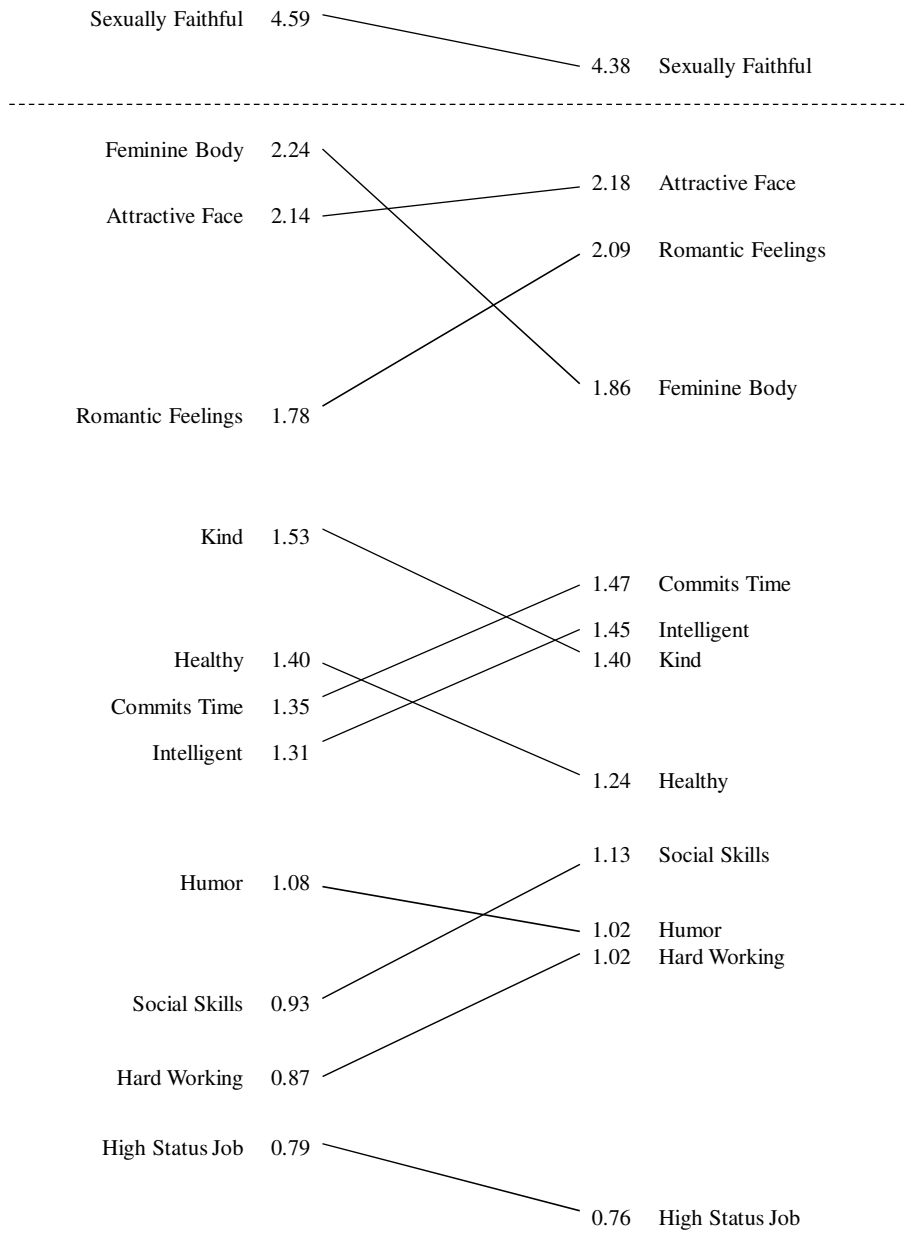   2.67   High Status Job

Figure 2. Comparison of University and Community men's allocation of mate dollars within
the moderate budget. Bold lines indicate significant differences between the populations in
valuation of the indicated trait. Dashed lines indicate a truncation of the vertical dimension;
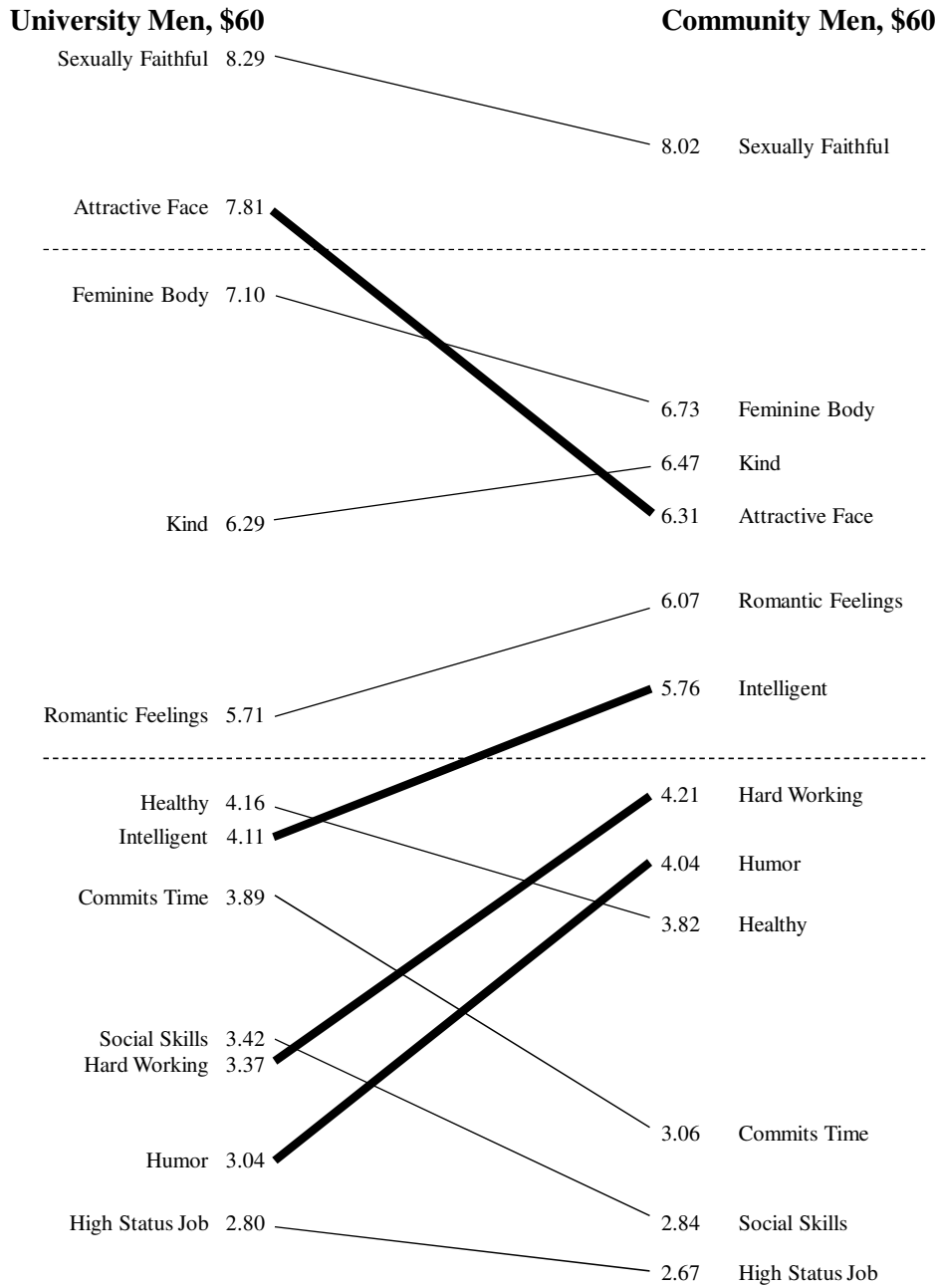displayed components of the figure are otherwise to-scale.

Women

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Community women: In the 20-dollar budget, community women most valued *kind to me* but its valuation did not differ from either *has romantic feelings only for me* or *commits time and energy to the relationship* (all $t < 0.856$, $p > 0.393$) (Table 1). In the 60-dollar budget, *kind to me* was most valued but its valuation did not differ from *has romantic feelings only for me* ($t = 0.494$, $p = 0.622$). In the 20-dollar budget, the least valued trait was *masculine body good social skills*, *good sense of humor*, *healthy and has plenty of energy*, and *attractive face* (all $t < 1.465$, $p > 0.144$). In the 60-dollar budget, the least valued trait was *attractive face* but its valuation did not differ from *healthy and has plenty of energy*, *ability to have a high status job*, *good social skills*, *good sense of humor*, and *masculine body*, (all $t < 1.988$, all $p > 0.048$).

The order of trait preference for the 20-dollar budget and the 60-dollar budget significantly covaried ($\rho = 0.846$, $p < 0.001$).

However, community women spent a greater percent of their 20-dollar budget — as compared to the 60-dollar budget — on *kind to me* ($t = 6.513$, $p < 0.001$), *has romantic feelings only for me* ($t = 10.990$, $p < 0.001$), and *commits time and energy to the relationship* ($t = 13.523$, $p < 0.001$). Conversely, a greater percent of the 60-dollar budget went towards *intelligent* ($t = 4.283$, $p < 0.001$), *hard working* ($t = 3.576$, $p < 0.001$), *healthy and has plenty of energy* ($t = 7.286$, $p < 0.001$), *ability to have a high status job* ($t = 13.523$, $p < 0.001$), *good social skills* ($t = 5.222$, $p < 0.001$), *good sense of humor* ($t = 4.892$, $p < 0.001$), *masculine body* ($t = 5.692$, $p < 0.001$), and *attractive face* ($t = 5.280$, $p < 0.001$).

Undergraduate women: In the 20-dollar budget, university women valued *kind to me* most but its valuation was not different from *sexually faithful* ($t = 0.362$, $p = 0.717$) (Table 1).

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For the 60-dollar budget, *sexually faithful* was valued more than all other traits (all $t > 2.498$, $p < 0.013$). In the 20-dollar budget, the least valued trait was *ability to have a high status job* but its valuation was not significantly different from *healthy and has plenty of energy*, *hard working*, and *intelligent* (all $t < 1.118$, $p > 0.264$). In the 60-dollar budget, *intelligent* was valued less than all other traits (all $t > 4.163$, $p < 0.001$).

The order of trait preference for the 20-dollar budget and the 60-dollar budget significantly covaried ($\rho = 0.853$, $p < 0.001$).

However, undergraduate women spent a greater percent of their 20-dollar budget — as compared to the 60-dollar budget — on *kind to me* ($t = 13.412$, $p < 0.001$) and *sexually faithful* ($t = 11.939$, $p < 0.001$). Conversely, a greater percent of the 60-dollar budget — as compared to the 20-dollar budget — went towards *has romantic feelings only for me* ($t = 3.576$, $p < 0.001$), *commits time and energy to the relationship* ($t = 7.112$, $p < 0.001$), *hard working* ($t = 6.301$, $p = 0.004$), *healthy and has plenty of energy* ($t = 6.327$, $p < 0.001$), and *ability to have a high status job* ($t = 5.411$, $p < 0.001$), *good social skills* ($t = 8.762$, $p < 0.001$), and *good sense of humor* ($t = 3.264$, $p < 0.001$).

Community versus undergraduate women: Community and undergraduate women differed in their ordering of trait preferences in both the 20-dollar budget ($\rho = 0.056$, $p = 0.863$) and the 60-dollar budget ($\rho = -0.161$, $p < 0.618$).
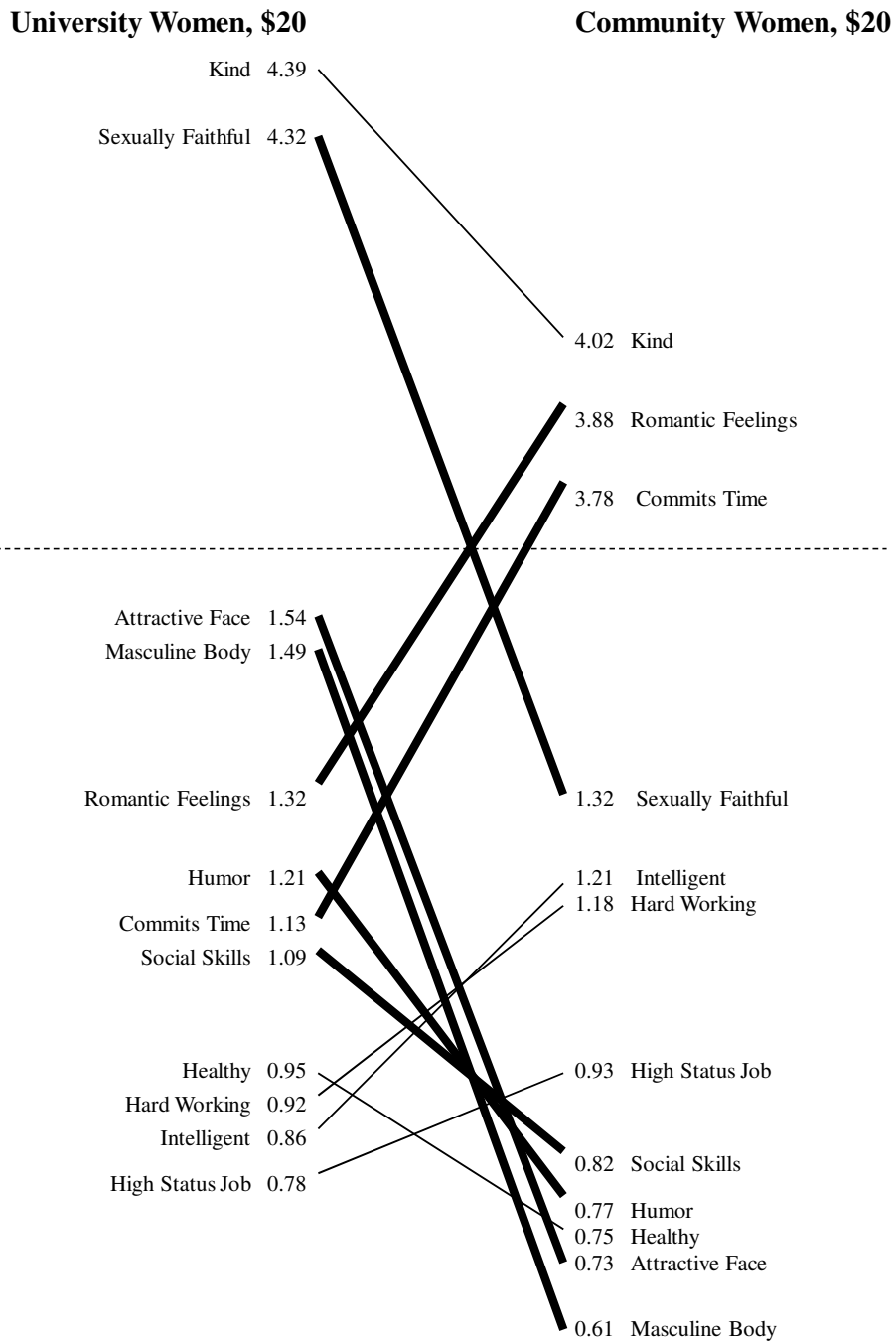
University Women, $20   **Community Women, $20**

Kind 4.39

Sexually Faithful 4.32

                                              4.02 Kind

                                              3.88 Romantic Feelings

                                              3.78 Commits Time

- -

Attractive Face 1.54
Masculine Body 1.49

Romantic Feelings 1.32   1.32 Sexually Faithful

Humor 1.21   1.21 Intelligent
                                              1.18 Hard Working
Commits Time 1.13
Social Skills 1.09

Healthy 0.95   0.93 High Status Job
Hard Working 0.92
Intelligent 0.86
                                              0.82 Social Skills
High Status Job 0.78
                                              0.77 Humor
                                              0.75 Healthy
                                              0.73 Attractive Face

                                              0.61 Masculine Body

Figure 3. Comparison of University and Community men's allocation of mate dollars within the restricted budget. Bold lines indicate significant differences between the populations in valuation of the indicated trait. Dashed lines indicate a truncation of the vertical dimension; displayed components of the figure are otherwise to-scale.

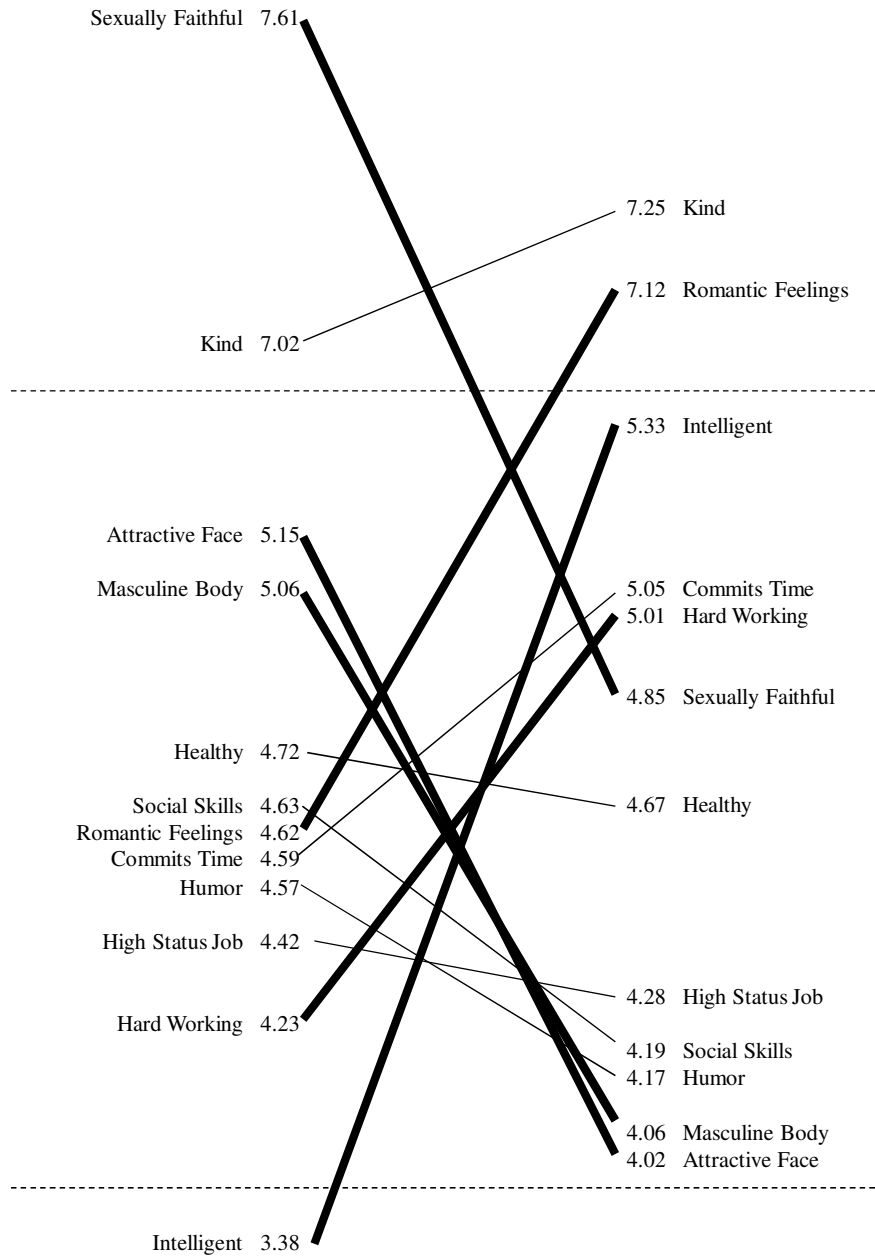**University Women, $60**   **Community Women, $60**

Figure 4. Comparison of University and Community women's allocation of mate dollars within the moderate budget. Bold lines indicate significant differences between the populations in valuation of the indicated trait. Dashed lines indicate a truncation of the vertical dimension; displayed components of the figure are otherwise to-scale.

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Table 1. Descriptive statistics of mate preferences.

	Community Men		University Men		Community Women		University Women	
	M	SD	M	SD	M	SD	M	SD
$20 Budget								
Kind to Me	1.4	1.47	1.53	1.42	4.02	2.38	4.39	1.96
Romantic Feelings	2.09	1.68	1.78	0.35	3.88	1.31	1.32	0.55
Intelligent	1.45	1.62	1.31	0.8	1.21	1.06	0.86	1.58
Commits Time	1.47	1.91	1.35	0.78	3.78	1.47	1.13	0.57
Hard Working	1.02	0.88	0.87	0.43	1.18	1.32	0.92	0.83
Sexually Faithful	4.38	1.07	4.59	1.27	1.32	1.46	4.32	1.98
Healthy	1.24	0.86	1.40	1.31	0.75	0.89	0.95	1.23
High Status Job	0.76	0.63	0.79	0.66	0.93	0.86	0.78	1.72
Social Skills	1.13	0.59	0.93	0.75	0.82	0.71	1.09	0.62
Sense of Humor	1.02	1.82	1.08	1.29	0.77	1.08	1.21	1.24
Masculine Body	1.86	1.20	2.24	1.38	0.61	1.24	1.49	1.5
Attractive Face	2.18	1.14	2.14	1.72	0.73	0.53	1.54	1.69
	M	SD	M	SD	M	SD	M	SD
$60 Budget								
Kind to Me	6.47	1.27	6.29	1.37	7.25	2.39	7.02	2.35
Romantic Feelings	6.07	1.91	5.71	1.62	7.12	1.42	4.62	2.06
Intelligent	5.76	1.02	4.11	2.09	5.33	2.47	3.38	1.93
Commits Time	3.06	2.65	3.89	2.41	5.05	1.74	4.59	1.71
Hard Working	4.21	2.51	3.37	1.48	5.01	1.34	4.23	2.17
Sexually Faithful	8.02	0.72	8.29	1.86	4.85	2.84	7.61	2.40
Healthy	3.82	1.46	4.16	1.73	4.67	2.08	4.72	2.07
High Status Job	2.67	1.35	2.8	1.04	4.28	2.46	4.42	1.89
Social Skills	2.84	2.23	3.42	1.56	4.19	2.62	4.63	1.20
Sense of Humor	4.04	1.86	3.04	1.27	4.17	2.11	4.57	1.76
Masculine Body	6.73	1.54	7.10	1.25	4.06	1.39	5.06	1.82
Attractive Face	6.31	1.10	7.81	1.40	4.02	3.16	5.15	2.14

In the 20-dollar budget, community women spent more on *has romantic feelings only for me* ($t = 23.981$, $p < 0.001$) and *commits time and energy into the relationship* ($t = 22.623$, $p < 0.001$). Undergraduate women spent more on *sexually faithful* ($t = 13.701$, $p < 0.001$), *good social skills* ($t = 3.456$, $p < 0.004$), *good sense of humor* ($t = 3.069$, $p < 0.004$), *masculine body* ($t = 5.152$, $p < 0.001$), and *attractive face* ($t = 4.741$, $p < 0.001$) (Fig. 3). In the 60-dollar budget, community women spent more on *has romantic feelings only for me* ($t = 11.084$, $p < 0.001$), *intelligent* ($t = 7.605$, $p < 0.001$), and *hard working* ($t = 3.382$, $p < 0.004$). Undergraduate women spent more on *sexually faithful* ($t = 8.957$, $p < 0.001$), *masculine body* ($t = 4.933$, $p < 0.001$), and *attractive face* ($t = 3.713$, $p < 0.001$) (Fig. 4).

Discussion

Overall, with one striking exception, the mate preferences we observed followed sex-specific patterns that are consistent with both adaptive logic and prior research. In particular, the consistency between community members' mate preferences and those previously reported for undergraduates suggests — at minimum — that undergraduates are *generally* representative of young American adults, vis-à-vis mating preferences. We stress, though, that this conclusion is made possible only because there are several converging lines of evidence from multiple undergraduate populations. Specific results are discussed below.

Men

Community and undergraduate men showed no significant differences in their trait rankings for the 20-dollar budget. Moreover, there were no differences in allocations to

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individual traits. In other words, community and undergraduate men were matched, both in the traits they considered necessary and the extent to which they considered these traits necessary. There were some differences between community and undergraduate men's allocations to individual traits in the 60-dollar budget. However, these differences were comparatively slight; as such, the differences between rankings were marginally significant, missing a highly-conservative alpha by one thousandth. In other words, community and undergraduate men were similar — but not matched — in the traits they considered "luxuries" in a mate.

Both undergraduate men and community men valued *sexually faithful* most highly and, to a lesser extent, an *attractive face*, *curvaceous body*, and *kind to me*. The proportion of mate dollars spent on each of these traits was equally high across both the 20-dollar and 60-dollar budgets, suggesting that there was no satisficing threshold for these traits. This is consistent with adaptive logic: the traits men most value in a mate are those that predict the greatest increases in men's reproductive success. More specifically, men's valuation of sexual fidelity, an attractive face, curvaceous body, and kindness each respectively predicts paternity certainty, a mate's genetic quality, her biological investment capacity, and cooperative alliance.

Of all the considered traits, both undergraduate men and community men least valued a mate's ability to have a high status job. Again, this is consistent with adaptive logic because neither a women's social status nor the skills involved in professional success are as predictive of reproductive success as the other traits considered.

In sum, community and undergraduate men's mate preferences were similar to each other, and concordant with adaptive logic. Together, these data suggest that male undergraduate populations are representative of American adults regarding mate preferences.

Women

Unlike men, community and undergraduate women differed in their trait rankings for both the restricted and moderate budgets. Considering the restricted budget, allocations significantly differed for seven of the twelve traits considered; for the moderate budget, allocations significantly differed for six of the twelve traits. In other words, community and undergraduate women differed considerably in both the traits they considered necessary and the traits they considered luxuries.

Community women highly valued kindness, emotional fidelity and, to a lesser extent, a mate's commitment of time and energy into the relationship. Both kindness and commitment of time and energy were valued more in the restricted budget than in the moderate budget, suggesting that community women (1) considered these necessary traits in a mate but, (2) there was a satisficing threshold, albeit a high one. In other words, community women desired very high — but not infinitely high — levels of kindness and commitment in their mates. The high valuation of kindness, emotional fidelity, and a mate's commitment of time and energy into the relationship is consistent with adaptive logic. For women, valuing kindness, emotional fidelity, and commitment of time and energy to into the relationship predicts increased reproductive success via a mate's cooperative alliance, exclusivity of resource investment, and paternal investment.

Community women lacked a single, least-valued trait. In both of their budgets, the least-valued traits were good social skills, a good sense of humor, healthy and has plenty of energy, an attractive face, and a masculine body with no statistical differences among them. Of note, the three lowest-valued traits were cues of immune, genetic, and hormonal quality; all are predicted to be relatively less valuable than cues of investment by a long-term mate as it relates to increasing RS. Therefore, we conclude that community women's mate preferences were concordant with both adaptive logic and with previously-established patterns of mate preferences.

Conversely, the overall pattern of undergraduate women's mate preferences neither conformed to established adaptive logic nor to patterns of previously-described female populations. Aside from the high valuation of kindness — and, perhaps, some moderately-valued traits that were unassociated with strong predictions — undergraduate women's allocations to individual traits were atypical and did not match the predictions of conventional sexually differentiated mate-choice theory. Sexual fidelity was highly valued, as were an attractive face and a muscular body. The least-valued traits were hard working, intelligent, and ability to have a high status job.

I propose that the atypical mate preferences of this sample of university women must be the result of an atypical mating environment. The considerable breadth of published data on undergraduates' mate preferences indicates that, generally, university women conform to a sex-typical and theoretically-derived pattern. Therefore, it is unlikely that the atypical preferences observed among UCSB women were the product of sampling from an undergraduate population. The sample sizes were sufficient to detect small to moderate

effects, suggesting these results were not a statistical fluke (Cohen, 1988). Subsequent research (Chapter 6) based on semi-structured interviews analyzed using framework analysis suggested that a combination of uncommon geography and demography — affecting undergraduates but not community members — were prime movers in influencing undergraduate women's mate preferences. These prime movers promoted women's use of sexual fidelity — rather than kindness, emotional fidelity, or hard work — as the strongest predictor of a mate's commitment to the relationship (Hanson Sobraske, *under review*). Under these unusual mate-pool conditions, undergraduate women's high valuation of sexual fidelity can be seen as consistent with adaptive logic.

Because the community women's preferences were concordant with preferences previously described for undergraduates, it suggests that undergraduates *can* be representatives of non-university adults. However, the discordance between UCSB's undergraduate women's preferences — both as compared to other populations of undergraduate women and as compared to the community women — suggest that (1) variance exists among undergraduate populations, and, therefore, (2) undergraduate populations are not inherently representative of non-university populations. These results further suggest that mating behaviors are flexible across and perhaps even within populations (cf. Matson, Chung, and Ellen, 2014; Penton-Voak, Jacobson, and Trivers, 2004). Given the prevalence of undergraduate study populations, we believe these nuances and variants of undergraduate subcultures should be considered when drawing conclusions about human mating behaviors (DeKeseredy and Schwarz, 1998; Hanson Sobraske, *under review*; Hummon, 1994; Kramer and Berman, 2001; Moffatt, 1991; Ronen, 2010; Zwicker, 2005).

Strengths and Limitations

To our knowledge, this is the first study of mate preferences to directly quantitatively compare undergraduate and community populations, a comparison especially powerful in this case because of their geographic adjacency. This situation allowed us to evaluate the extent of homogeneity in human mate preferences in a Western population. Further, we were able to address the broad critique that undergraduates are not representative of non-university adults — due to "emerging adulthood" (Arnett, 2000), "lifestage" (Green and Sabini, 2006), lack of "adult relationships", and/or "unique life transition" (Rozin, 2010).

We also note that, to our knowledge, this is the first study to predict and report the value of emotional fidelity in a long-term partner in relation to other traits. Moreover, to our knowledge, this is the first study to consider the valuation of sexual fidelity using ratio data, thus specifying both the relative difference in value as well as the magnitude of the difference (cf. Polk, Ellen, Chung, Huettner, and Jennings, 2011; Mogilski et al., 2014). Moreover, This contribution compliments and extends expansive literatures on both mate preferences (for a recent review, see Schmitt, 2014) as well as on the costs associated with and sex differences in upset over sexual infidelity versus emotional infidelity (for a recent review, see Sagarin et al., 2012).

Despite the strengths of this study, it is not without limitations. Our study emulated Li and colleagues' (2002) zero-sum allocation task for both theoretical and methodological reasons. Theoretically, this task mirrors actual mating decisions; specifically, that a mate who rates a "perfect 10" on all desirable attributes is rarely available — or attainable — thus requiring trade-offs among mate traits. Methodologically, providing moderately-constrained

and highly-constrained budgets — rather than a generous budget or, alternatively, providing Likert scales for rating traits — prevented ceiling effects and allowed for variance across responses. However, we recognize that providing all participants equal budgets did not reflect realistic differences in participant mate value and likely concomitant differences in "purchasing power" in the mating market.

We also note that the community members were about 8 years older than the undergraduates and acknowledge that it is possible that these age differences affected mate preferences. However, if age affected preferences, it affected the sexes differently. Community and university men were similar in their mate preferences, education level, and sexual experience; they differed in their age, current relationship status, and desired relationship status. Community and university women differed in their overall mate preferences, current relationship status, and age; they were similar in their education level, sexual experience, and desired relationship status. In short, there were no systematic sex differences associated with age. Moreover, the hypothesis that age explains the community-university differences among women does not speak to the confluence of these community members' mate preferences and those of previously-described undergraduates. We are unaware of any previously-described notion that might explain how age would produce this pattern of results.

Finally, we note that this study focused only on preferred traits in a long-term mate. Our results do not — and, logically, *should* not — speak to preferences for particular traits in short-term mates. While a methodological replication would certainly be both possible and appropriate to evaluate preferred traits in a short-term partner, we suggest theory-driven

alterations to the set of traits; for example, "commits time and energy to the relationship" could be removed in favor of "eager to have sex with me".

In sum, our data suggests that university populations may be generally — but not always — representative of non-university adults, vis-à-vis mate preferences. When construed broadly, these preferences are concordant with adaptive logic, including the novel finding of sex-specific valuations of sexual and emotional fidelity. Finally, our data suggests that variation in undergraduate subcultures can alter preferences such that they differ from both the preferences of other undergraduate populations and of regionally-matched, non-university populations.

Chapter VI

An Atypical Environment Shifts Women's Mate Preferences:

Possible Causes from a Framework Analysis of Semi-Structured Interviews

Currently under review at *Psychology of Women Quarterly*

Abstract

Contrary both to existing theories and to normative patterns from prior empirical research, quantitative measures showed uncommon mate preferences in a population of young women. Specifically, these women valued sexual fidelity over both emotional fidelity and earning potential in a serious romantic partner; intelligence, status, and wealth were valued much less than existing theories and prior research would predict. To examine these uncommon preferences in depth, I conducted semi-structured interviews with 58 women from this population. Thematic framework analysis revealed three themes that influenced mate preferences; one theme — local demography and geography — appears to be a prime mover. Results are discussed in the light of sexual selection theory, the double-shot hypothesis, and social role theory. The interview data provide better support for the first two approaches than for the last.

Keywords: Double-shot hypothesis, evolutionary psychology, mate selection, sexual behavior, social role theory

The study of mate preferences — preferred qualities, the origin of preferences, and influences on preferences — has been a focus of research for several decades. While results vary somewhat with study population, theoretical approach, and research methodology, some patterns are robust. For example, researchers employing both adaptive sexual-selection logic (*sensu* Symons, 1979) and social role theory (Eagly, 1987) have argued that women prefer qualities in a partner that indicate investment of resources into the relationship. These include qualities indicating an *ability* to acquire resources — such as hard work (Buss & Schmitt, 1993; Fletcher, Tither, O'Loughlin, Friesen, & Overall, 2004; Marlowe, 2005), high social status (Buss, 1989; Buss & Schmitt, 1993; Wilke, Hutchinson, Todd, & Kruger, 2006), and intelligence (Bressler & Balshine, 2006; Gangestad, Garver-Apgar, Simpson, & Cousins, 2007; Kenrick, Sadalla, Groth, & Trost, 1990; Li, Bailey, Kenrick, & Linsenmeier, 2002; Prokosch, Coss, Scheib, & Blozis, 2009) — and cues of *willingness* to invest these resources — such as kindness (Buss, 1989; Lukaszewski & Roney, 2010; Gangestad et al., 2007) and emotional fidelity (Cashdan, 1993; Davies & Shackelford, 2006; Greenlees & McGrew, 1994). Researchers employing sexual selection logic have argued that women value resource investment ultimately because, for female mammals (including women), greater access to resources predicts higher reproductive success (Buss, 1989; Hatfield & Sprecher, 1995; Geary, Vigil, Byrd-Craven, 2004; Khallad, 2005; Lippa, 2007; Pawłowski, 2000; Schmitt, 2005; Shackelford, Schmitt, & Buss, 2005; Stewart, Stinnett, & Rosenfeld, 2000; cf. Pillsworth, 2008). Alternatively, researchers employing social role theory have argued that women's social role is domestic, creating a pressure to choose a partner with qualities predicting success in a complementary economic role (Agars, 2004; Diekman &Schneider, 2010; Eagly, 1993; Eagly & Karau, 2002; Eccles, 1994; George, Carroll, Kersnick, &

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Calderon, 1998; Kite, Stockdale, Whitley, & Johnson, 2005; Leaper & Robnett, 2011;

Schwartz & Rubel, 2005; Wilde & Diekman, 2005; Wood, Rhodes, & Whelan, 1989).

Similarly, researchers using various theoretical approaches have studied what is to be avoided in a romantic relationship. Again, variation exists across population, theoretical approach, and methodology, but robust patterns exist. For example, researchers employing both sexual selection logic and the double-shot hypothesis (DeSteno & Salovey, 1996) have found that young Western women are typically more upset and distressed by a partner's emotional infidelity than by his sexual infidelity. Sexual selection logic predicts greater distress over emotional infidelity because it signals a decrease or loss of the partner's investment, ultimately harming reproductive success (Buss, Larsen, Westen, & Semmelroth, 1992; Fernandez, Vera-Villarroel, Sierra, & Zubeidat, 2007; Geary, DeSoto, Hoard, Sheldon, & Cooper, 2001; Guadagano & Sangarin, 2010; Sagarin, Martin, Coutinho, Edlund, Patel, Skowronski, & Zengel, 2012; Shackelford, Buss, & Bennett, 2002; Wiederman & Kendall, 1999). The double-shot hypothesis argues that, for men, emotional infidelity predicts sexual infidelity (whereas the converse is less likely). Therefore, women typically find emotional infidelity more distressing than sexual infidelity because it signals a "double-shot" of infidelity (DeSteno, Bartlett, Braverman, & Salovey, 2002; DeSteno & Salovey, 1996; Harris, 2003; Harris & Christenfield, 1996; Nannini & Meyers, 2000; Whitty & Quigley, 2008).

Uncommon Mate Preferences

When I conducted a study on mate preferences of young Western women, I expected data similar to those cited above. Specifically, I expected high valuation of intelligence, kindness, status, and wealth; and — as a means to avoid future infidelity and associated loss of resources — I expected greater valuation of emotional fidelity than valuation of sexual fidelity. With the exception of a high valuation of kindness, my results did not match these expectations. In summary, using zero-sum allocations tasks to describe preferred qualities in a romantic partner, two separate populations (*N*s=176 and 204) of undergraduate women from University of California, Santa Barbara (UCSB) valued *sexual* fidelity and kindness most highly. Conversely, the least-valued qualities were intelligence, being hard-working, and ability to have a high-status job (see forthcoming manuscript for quantitative data; author, in preparation).

It is possible that the differences between UCSB women's preferences and the preferences of similar populations is an example of a "file-drawer problem" wherein null or counter-theoretic results are not published and, therefore, results from other universities with patterns similar to those of UCSB women are unavailable for comparison. However, it is also possible that these results are relatively unique to women in the Santa Barbara area or to UCSB women in particular. To evaluate this possibility, I conducted the same study on a non-university, local population of similarly-aged women (*N*=104). Non-university women followed the pattern established by prior research, not the pattern exhibited by UCSB women: Non-university women most valued kindness, predictors of resource investment, and cues of emotional fidelity.

In contrast to the unique mate-preference profile exhibited by UCSB women, the preferences of both UCSB men and local non-university men were similar to patterns established in the literature (Asendorpf, Penke, & Backet, 2011; Buss & Barnes, 1986; Fisman, Iyengar, Kamenica, & Simonson, 2006; Geary et al., 2004; Kenrick, Groth, Trost, & Sadalla,1993; Li et al., 2002; Regan, 1998; Schmitt & Buss, 1996; Schwarz & Hassebrauck, 2012; Simpson & Oriña, 2003; Sprecher, Sullivan, & Hatfield, 1994; Stewart et al., 2000; Wierderman & Algeier, 1992; cf. Kurzban & Weeden 2005). The typicality of the local male results further highlights the unique mate preferences UCSB women.

Semi-structured Interviews

The quantitative data on UCSB women's preferences differed from those in similar studies, as well as from what would be predicted by three prominent theoretical approaches. This suggested the presence of additional environmental or social influences on mating strategies that were not operating in other studied populations (see Garcia & Reiber, 2008 for discussion of "ecological differences" affecting sexual behaviors). Moreover, these influences appeared to principally affect UCSB women because members of comparison groups — UCSB men and local, non-university women — had preferences that followed patterns predicted by sexual selection theory, the double-shot hypothesis, and social roles theory, and were consonant with prior research. While the quantitative mate-preference data suggested the presence of unusual influences on UCSB women's mate preferences, the data specified neither the nature nor the mechanism of these influences (cf. Denzin & Lincoln, 2000; Silverman, 2000). A different type of data was required to identify the unusual social or environmental influences on women's mate preferences.

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To examine influences on UCSB women's mate preferences, I conducted semi-structured interviews using purposeful sampling of female informants who were exposed to the UCSB mating environment. Interviews were chosen over alternative methods of data collection (e.g., focal follows, scan samples) for a number of reasons. Interviews offer emic insight into informants' reasoning and motivations. They also allow access-by-proxy to scenarios where an outsider's presence is suspicious or unwelcome (e.g., sexual encounters). Methodologically, interviews are not associated with a particular theoretical paradigm so they are inherently compatible sexual selection logic, social role theory, and the double-shot hypothesis. The semi-structured interview format ensures that informants discuss the same overarching topics — thus providing a means of comparison across informants — while still allowing for flexible, idiosyncratic discussion of those topics (Gubrium & Holstein 2002; McCracken, 1988). Because the outstanding questions centered on mate preferences, topics of discussion did as well. Four very general topics were discussed, each plausibly related to UCSB women's valuation of sexual fidelity and resource investment. One, since it was possible that UCSB women were somehow inherently peculiar in their valuations, informants were asked about themselves. Two, because women's valuations might have been a response to their rival's traits or behaviors, informants were asked about other UCSB women. Three, because women's valuations might have been a response to potential mates' traits or behaviors, informants were asked about UCSB men. Finally, because unique aspects of relationships between men and women at UCSB might have affected valuations of sexual fidelity and resource investment, informants were asked about romantic relationships at UCSB.

Because three theoretical approaches are considered, I outlined below how each approach might use the interview data to inform the quantitative preference data. I also outlined what results would constitute support for each theory.

Sexual Selection and the Interviews

Contrary to standard sexual selection logic, UCSB women valued sexual fidelity more highly than emotional fidelity; also contrary, cues of resource investment were the least valued of all qualities considered. Nonetheless, UCSB women's atypical preferences may be consistent with sexual selection logic if additional social or environmental influences on mate preferences were present. Specifically, any influences that were present at UCSB would have to have altered evolutionarily relevant payoffs such that, in those unusual conditions, a high valuation of sexual fidelity and a low valuation of wealth, status, and intelligence would have led to greater access to reproductively relevant resources than would the more typical and widely reported mate-preferences. Further these influences would have to have been unique to UCSB, thus creating a distinction from both local non-university women and from women in other college populations.

I was unable to hypothesize candidate social or environmental influences that satisfied the above criteria to test *a priori*. Likewise, I was unaware of other studies with applicable hypotheses about women's greater valuation of sexual fidelity than emotional fidelity or other studies with applicable hypotheses about women's low valuation of cues of resource investment. Nonetheless, the quantitative preference data suggested UCSB was a unique environment and therefore I considered the possibility that the atypical preferences of UCSB women would have led to greater access to resources within this environment.

Strong support for sexual selection logic would involve informants' responses suggesting a candidate reason why high valuation of sexual fidelity ultimately led to greater access to resources. Additionally, informants' responses would suggest a candidate reason why low valuation of wealth, status, and intelligence does, in fact, predict greater access to resources.

Social Role Theory and the Interviews

UCSB women's preferences were not overtly compatible with social role theory: American women's role as the primary domestic worker predicts a preference for qualities in a mate that lead to success in a wage-earning role (Eagly, 1987; Johannesen-Schmidt & Eagly, 2002). As noted above, this is a widely-supported notion. Further, studies directly considering social roles in college environments have supported the standard social role theory (Ronen, 2010; Tessema, Ready, & Malone, 2012). Nonetheless, the quantitative preference data suggested that UCSB was a unique environment and, therefore I considered the possibility that the psychological processes involved in mate preferences resulted from UCSB women adhering to an atypical social role (cf. Diekman & Schneider, 2010).

Strong support for the social role theory would involve a general consensus among interview informants whereby they believed that men's social role did not involve considerable economic investment in the romantic partnership, perhaps — but not necessarily — because they believed economic investment was a component of women's social role. Moreover, strong support would include a general consensus among informants whereby they believed men's social role involved sexual fidelity. The mate valuation data indicated that local, non-university women adhered to the typical social role, as did undergraduate

women from other universities; therefore, strong support of the social role theory would also include informants' discussion about unique factors influencing UCSB women's atypical social role.

Double-Shot Hypothesis and Interviews

As stated above, preemptively valuing fidelity in a mate is strategic if one is to avoid distress, upset, and loss of resources associated with a mate's infidelity. This logic can extend the double-shot hypothesis: People will value the type of fidelity — sexual or emotional — that will allow avoidance of a double-shot of a mate's infidelity. Women typically endorse the notion that men's emotional infidelity implies men's sexual infidelity (DeSteno et al., 2002; Harris 2002; Sagarin, Becker, Guadagno, Nicastle, & Millevoi, 2003); therefore, it is reasonable to expect women to value emotional fidelity more than sexual fidelity when choosing a mate. This was not the case for UCSB women. However, it is important to note that the double-shot hypothesis is agnostic about which infidelity type should be more upsetting and, by extension, which fidelity type should be more valued. Therefore, I considered the possibility that the atypical qualitative data on UCSB women's mate preferences were driven by atypical beliefs about the implications of sexual fidelity and emotional fidelity.

Previous researchers have noted that the double-shot hypothesis does not provide an ultimate explanation for why a particular type of partner infidelity might be more upsetting — nor why, by extension, a particular type of fidelity is more valued (Buss, Shackelford, Kirkpatrick, Choe, Hasegawa, Hasegawa, & Bennett, 1999). DeSteno and Salovey stated that "socially derived problems" may influence which type of infidelity is more upsetting and

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"past experience [affects] beliefs concerning the implications of each of the two types of infidelity" (1996; pp. 367 and 368, respectively). I agree with this notion in the abstract but the problem at hand is, why "socially-derived problems" and "past experience" might systematically differ between UCSB women on the one hand and both Santa Barbara community women and other female undergraduate populations on the other hand. The double-shot hypothesis offers no clear guidance in this respect. Further, I am unaware of prior research that can offer candidate problems or experiences that could explain a female preference of sexual fidelity over emotional fidelity. Therefore, I examined the interview data for candidate problems and/or experiences that might elevate the salience of sexual infidelity.

Strong support of the double-shot hypothesis would involve a general consensus that informants believed that sexual fidelity implies emotional fidelity, influenced by informants' past experiences and/or from a socially-derived problem inherent in the UCSB environment. Because influences of the double-shot hypothesis are abstract, undefined concepts, it is possible that the interview data could support the double-shot hypothesis and sexual selection logic and/or social role theory simultaneously, depending on how informants defined past experiences or socially-derived problems.

Finally, it should be noted that the double-shot hypothesis is agnostic about behaviors or valuations outside of sexual infidelity and emotional infidelity. As such, it is unable to account for the totality of the quantitative mate valuation patterns expressed by UCSB women, specifically the low valuation of wealth and intelligence.

The Present Study

The present study was conducted to identify factors in UCSB women's lives that shaped their uncommon mate preferences. Specifically, I was interested in (1) why sexual fidelity — rather than the expected emotional fidelity — was valued so highly, and (2) why cues to resource investment were not more highly valued. Data was evaluated using framework analysis (Ritchie & Spencer, 1994). Results of the analysis were considered as they relate to three theoretical approaches: sexual selection logic, social role theory, and the double-shot hypothesis.

Methods

Informants

Fifty-nine informants were self-selected students enrolled in either an upper- or lower-division anthropology course at UCSB. One woman identified herself as homosexual; an interview was conducted but — because the goal of the study was to understand uncommon heterosexual mate preferences — her statements were not included in this analysis. The remaining women were predominantly juniors and seniors (65.50%); three women were recent transfers.

Semi-structured interviews

Forty-two semi-structured interviews were conducted over two sessions, each lasting about 50 minutes; sixteen interviews were conducted in one session, each lasting about 100 minutes. There were no systematic differences in responses between the one-session and

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two-session interviews. The interview data set thus included roughly 97 hours of audio-recorded interview, which were subsequently transcribed for analysis.

Interviews addressed four central topics — the informants themselves, women at UCSB, men at UCSB, and relationships between men and women at UCSB — and were conducted in a small room by the author (female, 29 years old at the time of the interviews). Prepared interview questions focused on these topics and were generally open-ended (see Appendix 1 for the list of planned questions relevant to this report). Follow-up questions were asked when a potentially relevant subject was broached by the informant; these questions generally took the form of "Can you tell me more about [subject]?"

Overview of Framework Analysis

Framework analysis (Ritchie & Spencer, 1994) is a type of grounded thematic analysis (Glaser & Strauss, 1967). As with all types of thematic analyses, it is used to identify important, overarching themes influencing informants' thoughts about a topic — in this case, the mating environment. Framework analysis differs from a general thematic analysis by its methodological systemization and in providing data summaries in figure or table form. In summary, framework analysis is systematic and replicable; it is theoretically agnostic, placing competing theoretical perspectives on an even playing field; and it allows for the characterization of both consensus and minority views.

A general outline of the five stages involved in framework analysis is provided below. Those seeking further information are encouraged to see Braun and Clark (2006) and

Ryan and Bernard (2003) for discussion on conducting thematic analysis, as well as Lacy and Luff (2007) for discussion on conducting a framework analysis.

Stage one was "familiarization". Familiarization with the data began during the interviews themselves by careful listening for issues discussed consistently across topics and between informants. Familiarization continued during audio recording transcription. Both the recordings and transcriptions were reviewed multiple times, in whole and in part.

Stage two was "identifying a thematic framework". During familiarization, preliminary themes suggested themselves, as did more specific subthemes (c.f., Brogdan & Taylor, 1975; D'Andrade, 1991; Guba, 1978). These were noted and used in Stage 3.

Stage three was "indexing". During indexing, themes and subthemes were assigned to components of the data set. This process was iterative with considerable refining between initial indexing and the final product. Ultimately, five themes were identified.

Stage four was "charting". Once themes and subthemes were identified and the data were indexed appropriately, thematic charts were created. In these charts, every instance of the theme was recorded in shorthand. Charting organized the data and facilitated the description of the themes based on their scope, consensus and dissenting opinions, and components that affected these statements.

Stage five was "mapping and interpretation". Mapping collapses data into visual representations. These representations are tools for the reader to quickly and succinctly digest summaries of the data. Framework analysis is flexible in permitted representations, provided that the data are summarized into "an organized, compressed assembly of information that

permits conclusion-drawing" (Miles & Huberman, 1984). The data presented here were organized into a matrix summarizing influences on women's mate preferences (Table 1).

Because mapping compressed the data, idiosyncrasies were lost and nuances were glossed over. To provide greater exposition, interpretation is also presented as a report of data relevant to the research questions at hand. Below are summaries of the data, organized by theme, with a focus on how each theme affects UCSB women's valuations of sexual fidelity and cues of resource investment in a serious romantic partner. Additionally, relevant quotes are provided, each attributed to informants via a unique, anonymous code.

Results and Discussion

The interviews focused on four topics: the informants themselves, UCSB women, UCSB men, and relationships between men and women at UCSB. Across these four topics, five themes were identified: parties, Isla Vista (IV) demography and geography, sober IV, school, and identity. Each theme's focus, scope, and relation to women's mate preferences are discussed below.

Informants uniformly made strong distinctions between UCSB and IV, the community where most UCSB students lived. Often this distinction was reinforced by hand gestures indicating isolation or compartmentalization. This distinction was accurate as it related to geography: IV is adjacent to the UCSB campus and, with few exceptions, UCSB does not encroach on IV. However, informants did not seem to be referencing a geographical distinction but rather differences in types and quality of interactions, how time was spent,

with whom time was spent, and safety. In this sense, 'UCSB' and 'IV' can loosely be treated

as meta-themes (Ryan & Bernard, 2003) where UCSB was for coursework and IV was for

socializing.

You get into IV and it's so different from UCSB [I21].

Because IV — and, by extension, UCSB — is well-known for its party environment,

it occurred to me before the interviews began that women's mate preferences could have

been a function of a self-selected group of people who chose to attend UCSB for its parties.

To that end, informants were asked "When you were in the process of applying to UCSB,

were you aware of its social reputation?" Fifty-three of fifty-eight informants asked a version

of the clarifying question of "Do you mean 'party school'?" before responding. It is possible

that this question prompted later discussion about the effect parties have on UCSB and IV

life. However, the frequency with which this theme was mentioned along with the extent of

its influence suggests that broaching the topic had little — if any — effect on responses.

Theme 1: Parties

House parties were described as a defining feature of IV life, particularly because of

their ubiquity. On any given day, most residential blocks were host to multiple parties. For

both men and women, drinking at parties was typical and expected (cf. Vander Ven & Beck,

2009). Cocaine use was common. Both alcohol and cocaine were used as social lubricants to

facilitate meeting members of the opposite sex, dancing, flirting, and engaging in casual

sexual relationships.

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Informants stated that the "party scene" was attractive to those applying to UCSB, themselves included. When asked if they were aware of UCSB's social reputation when they applied, most informants (89.66%) responded "yes". Further, about half the women said it influenced them positively: they felt it offered a fuller college experience and opportunities for contacts later in life. The other half stated that it was neither a positive nor a negative and that they knew parties were available if they wanted to participate. One informant was initially attracted to the party scene when applying but had since soured on it and was in the process of transferring to a different university. Therefore, there seems to have been some degree of self-selection among UCSB students, with people who, at minimum, were not opposed to parties more likely to enroll.

Parties continued to be attractive to students throughout their UCSB tenure as a means to relax, offset anxieties associated with coursework, and to meet people. Many informants noted it is "easy to get sucked into the party scene [I33]" and that finding a party-school balance was necessary to succeed at UCSB, both academically and socially. This party-school balance was idiosyncratic and students were expected to find their personal balance by the end of freshman year. Freshmen who partied too frequently or who were markedly out of control when partying were given leeway; older students displaying the same behaviors were considered wasteful of academic opportunities and, in short, "just stupid [I4]".

The UCSB party scene was also attractive to non-UCSB students; informants most often said these people were either out-of-towners or students who attended a less-rigorous local junior college — Santa Barbara City College (SBCC). Informants considered out-of-

towers and SBCC students to be similar: people who did not need to manage a long-term

party-school balance and, thus, were able to party "harder" and more frequently. Informants

often blamed out-of-towners and SBCC students for inflating UCSB's party reputation.

Likewise, informants considered these women particularly willing to engage in casual sex;

informants considered these men particularly sexually-coercive.

Parties were typically held in male-occupied houses; hosts provided free alcohol,

dance music, and accessories for drinking games. Informants said hosts stand at the door to

control who is admitted. Women could get into parties easily provided they were wearing the

expected party attire: tight and/or revealing clothing, high heeled shoes, and full-face make-

up. Conversely, men were typically barred from entry unless they were either friends of the

hosts or in a group with several appropriately-dressed women. To counteract disadvantages

inherent in this male-exclusion norm, men regularly hosted their own parties, resulting in

their ubiquity.

Informants provided only one reason for why men host parties: "to hook up with

chicks [I28]". This goal was not unobtainable. Women commonly went to parties with intent

to engage in some form of casual sexual behavior (i.e., "hooking up"); 72.4% of informants

spontaneously stated they had intentionally done this.

> [Guys here] really are looking for a hook-up more than anything else because
>
> they can get it any night they want [I10].

I feel like there's a lot of girls here now who are just willing to have sex with guys and [they] don't have to be exclusive, [they] don't have to be anything; they're just willing to give it away [I53].

Not surprisingly, sexual intercourse was strongly linked to parties but the relationships between sexual partners varied. One-night stands between strangers (or near-strangers) who met at a party were common. Informants said most men seek these out but only women heavily into the party scene did so; generally, according to informants, these were SBCC women or out-of-towners. When UCSB women engaged in one-night-stands, it was often because they were too drunk and/or high to prevent it, because they felt pressured to conform to the IV party reputation (cf. Yost & McCarthy, 2012), or because they failed to extend the contact into a recurring sexual relationship, thus leaving it as a single encounter. The first two cases more often described freshmen who had both low alcohol/cocaine tolerances and weak resolves against peer pressure and sexual coercion; the latter case was more typical of older women.

Recurring sexual relationships that initially formed at parties were typically non-monogamous with little emotional investment (e.g., "casual"; informants differentiated casual relationships based on degree of non-sexual social interaction and whether or not the relationship was covert). Informants stated that women often attempted to use these recurring relationships as gateways to serious, monogamous relationships; no informant stated that men did so. This gateway strategy was reported as having a low success rate because men rarely agreed to monogamy, preferring instead to engage in casual sex with many women, unencumbered by a partner to whom they are serious.

I just feel, like, whenever people want boyfriends it starts as hooking up [I34].

I've never talked to a guy who's like 'I'm tired of being with different girls, I want to be with just one girl'; I haven't talked to that guy [I36].

Nonetheless, the possibility of converting a casual, non-monogamous relationship to a serious, monogamous one strongly influenced women's acquiescence to entering into a casual relationship in the first place. This acquiescence fed a cycle: women engaged in casual sex in hopes of securing a serious, monogamous, emotionally-investing partner; men did not feel the need to invest in a monogamous relationship because they can easily get sex from these same women hoping to initiate a monogamous relationship.

Girls don't want to force that and be possessive or controlling so they say, 'Oh, yeah, you know, let's just date casually', but when they really, I don't think, want that most of the time. They feel that if they push for that exclusivity then the guy will just run away and not want anything to do with it … It seems like a lot of girls have really low self-esteem and they're willing to put up with that because they want that companionship, they want that; they want to have that option of, 'Well, maybe if we just date a little longer, if he gets to know me a little better he'll realize he realize he really wants to be with me'. That's a lot of my friends' situation ... I don't think it really works out; that's not something I would be willing to do, but I guess for some girls they feel they're getting what they want out of it to some extent, or maybe the hopes of getting what they want [I55].

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Most informants discussed the rarity of serious, monogamous relationships between people who both attended UCSB. The most common reasons for this were women avoiding serious relationships with UCSB men, preferring non-UCSB men for serious relationship partners; men's reluctance to agree to a serious relationship where monogamy was expected; and men failing to be sexually faithful while in a serious relationship. When asked to provide a free list of qualities women desire in a serious partner, informants listed sexual fidelity, honesty, and kindness most frequently (16.22%, 12.16%, and 10.81%, respectively). The informants who listed honesty were asked to define it in the context of a romantic relationship; 100% said it referred to a match between the relationship title and people's behavior; for a serious relationship, 'honesty' and 'sexual fidelity' were considered synonymous. When, on this basis, the free list qualities 'honest' and 'sexually faithful' were merged, it overwhelmingly became the most valued quality in a serious relationship partner (28.38% of all qualities spontaneously provided). Informants stated that women who desired a serious relationship typically did not consider UCSB men reasonable candidate mates because they could not be trusted to remain sexually faithful. Indeed, all informants in serious relationships at the time of interview had partners who were not UCSB men.

> I think if you're in a relationship here it's pretty solid because I don't see why someone would want to start a relationship here with there being so many possible ways for it to go bad. I mean, you can just drink one night way too much and meet a girl one night and something can go wrong in your relationship. There's just so many things that a single person does here that you couldn't do in a relationship, so if you were in a relationship here I would give you [a lot of credit] [I31].

Theme 2: IV Demography and Geography

The theme of IV demography and geography comprises two disparate subthemes: 'concentration' and 'beach'. Both affected women's mate preferences.

The subtheme 'concentration' included discussion about how the density of people in IV affected both the party mentality and women's intra-sexual completion. IV is a 1.85 square-mile area immediately adjacent to the western boundary of the UCSB campus. IV is flanked on the south by bluffs and beaches along the Pacific Ocean, and on the west by protected coast habitat. The fourth side is defined by a four-lane road, serving as the primary traffic feeder for both IV and the western part of the UCSB campus. IV is one of the most densely populated areas in the US at over 12,000 people per square mile (US Census, 2013). Its population was overwhelmingly student-aged: 85.1% of people were between 15 and 24 years old (US Census, 2013). This combination of density and homogeneity in population age was unique: Considering the 100 densest areas in the United States with more than 10,000 inhabitants, the percent of student-aged people in IV was eight standard deviations above the mean (15.61 ± 7.61); the area with second-highest percentage of student-aged people was Cambridge, MA at 22.4% (US Census 2013). IV's boundaries and homogeneity were apparent to informants, one succinctly noting "It's like our own little pod [I54]."

Informants believed the concentration of IV promoted a party lifestyle and cited a number of reasons why. First, it was easy for most people to walk to and from parties. This eliminated logistical issues of parking near the party and driving home while intoxicated. It also reduced the coordination effort needed to meet up with others over the course of the evening because a friend or hook-up partner was always in close proximity. Second, women

who lived in IV tautologically lived near the parties. This made it less uncomfortable for women to go out in revealing party clothes because they would only be in the cool night air for a short time. Third, people migrating to parties were typically loud and obvious to onlookers; informants reported that this, in combination with the concentration of IV, made it seem as though the proportion of people going out was higher than it actually was. This exerted a pressure to conform. Fourth, the concentration of IV was high because, typically, many people lived in each house. Housemates excited to party would often recruit reluctant others. Five, near-by parties were often so loud that women would give up on a quiet night indoors and join the party.

Informants also noted the concentration in IV promoted competition between women for men. In social environments — particularly parties — informants described competing with both the women in immediate proximity and also with most women in IV because a man's hook-up partner "is, like, five minutes away [I33]". Women felt threatened by the number of rivals with whom they were competing and, therefore, offered more sexually than they otherwise would in order to keep a man's attention. This was described as a common scenario and most informants said the number of near-by rivals had affected their mating strategies.

> When you throw that many people together into such a tight space and there's
> no other adults or kids, you know, the dynamics of it are just different than
> any other town ... Here it's like you throw everyone together, everyone wants
> to party, everyone's attractive, everyone's fertile and it's just kinda, it's like

who can be the hottest? How else do you stand out because that's what people

are looking for. It's very superficial all the time [I21].

I kind of feel like guys here think they can have whatever they want to

because some girls give them whatever they want. It kind of puts everyone

else in an awkward position of being like, 'Well no, like, why would you

expect that?' 'Well everyone else is doing it'. Like, and if you like a guy and

he's like 'Well, I mean I like you too but if you're not going to do this I'm just

gonna go mess with someone else', and it's kind of like, what do you do?

[I56].

As mentioned above, IV is immediately adjacent to a beach along the Pacific Ocean.

Informants stated that the beach was visited often, typically for exercise or relaxing. Its

proximity influenced men's and women's activities and appearance. Specifically, the beach

promoted an active, fit lifestyle and created pressures to be physically attractive.

Informants described UCSB women as physically attractive and thought that the

beach created pressures — both direct and indirect — for women to increase and maintain

their good looks. The direct pressure was women's desire to be attractive in minimal beach

clothing; informants cited that clothes "look better" and were "cuter" on slender bodies.

Many informants noted that the mild weather made women feel that they should be "bikini-

ready" at all times; about half the informants mentioned this pressure affected them.

Informants also described indirect pressure stemming from intra-sexual competition: while

looking good in minimal clothing might not have pressured any one particular woman, it did

for many. Therefore, women were motivated to increase their attractiveness to be at a

comparable level with others. This intrasexual competition was frequently mentioned, especially as it applied to the informants themselves. Many described feeling guilty when seeing others exercise if they had not done so recently.

> I just feel like the majority of people that go here are fit and then that would
>
> be pressure for people who aren't to become fit … You see other people and
>
> you're like, 'Woah, I could be better' [I41].

Most informants considered UCSB men attractive and noted that their peers did as well. In isolation, this was considered a good thing. However, there was a strong consensus that attractive men were arrogant and treated women poorly. Informants believed this was a result of attractive men engaging in short-term sexual relationships with mdifferent women, thus suggesting — perhaps rightly — that they "don't have to be nice to get girls [I58]".

Many informants also said the beach promotes a party environment, however, it was never explicitly stated how this manifested or how this differed from the party mentality of IV in general. When directly questioned about this connection, no informant could provide a concrete reason, generally stating that they did not know why but that was how it seemed to them. When asked why people go to the beach, the most common answers were for exercise, surfing, or relaxing; no informant stated it was a means to start a party. It may be the case that the beach instead promoted social activities that ultimately led to parties or informants were misattributing an IV social tradition to IV's proximity to the beach. Ultimately, I do not believe there was sufficient data to explain this connection with any certainty.

Theme 3: Sober IV

The "IV scene" affected informants' lives, even in situations independent of demography and geography or of parties. Informants expected daytime, sober IV to be a casual, social, active — but not anxious — environment. Deviations from a "laid back" or "chill" demeanor were peculiar and, informants said, occasionally policed by others. The slower pace of sober IV was generally enjoyed and considered a beneficial — if not necessary — counterpoint to the urgency produced by academic stressors. A few informants did not care for sober IV, labeling it superficial.

Sober IV did not play an overt role in influencing women's mate preferences. Typically, women did not choose potential mates in IV while sober: Sober women were aware of attractive men but rarely made any actions towards establishing a relationship of any kind, preferring to wait until they were drunk and/or high at a party. There were no intrinsic properties of the sober IV environment that had downstream affects on mate preferences. In short, sober IV was described as a "hang out" place and discussions about it focused on who was hanging out and what hanging out entailed.

Theme 4: School

The theme 'school' comprised three relatively disparate subthemes: 'UCSB image', 'background', and 'coursework'. Each subtheme spoke to different influences on women's mate preferences.

The subtheme 'UCSB image' included discussions about UCSB's reputation for having hard-partying, intelligent, attractive students and motivations for conforming to this image. At the time of interview, all informants were aware of UCSB's image. Most believed

that it was commonly known by college-age Californians and that the image made UCSB a desirable, high-status university. As mentioned above, no informant came to UCSB despite an aversion to the party reputation. Many informants expressed pride at being able to succeed at UCSB, having found their party-school balance. No informant mentioned a personal motivation to conform to either the academic or the partying images; informants who did conform provided other motivations for doing so. However, some said that other students might feel pressured to support the party image — freshmen, most commonly. No informant mentioned others feeling pressured to conform to the academic image.

UCSB's reputation for having attractive students was a consideration for a number of informants, especially during the application phase: About half mentioned being concerned that they would not be "hot enough" to conform. A few mentioned that they had female high school friends who did not apply to UCSB for that reason. This suggests a degree of self-selection on both attractiveness and vanity in UCSB women.

The subtheme 'background' included discussions of wealth. Many informants noted that both the tuition and the cost of beachside living suggested that the average UCSB student had a high-income background. It was common for informants to then go on to say that they *knew* from campus orientation programs that about half of UCSB students received some form of financial aid but it *seemed* as though most students' families were wealthy. Mentioning wealth was more common in informants self-identifying as having a low-income background. These informants were also more likely to note that the average UCSB student had a sheltered background. Occasionally wealth was ascribed to fraternity and sorority members because membership dues cost thousands of dollars per year. This was the complete

extent of spontaneous mentions of wealth: No specific attributes were assigned to presumed-wealthy students; wealth was not disproportionately attributed to men or to women.

The subtheme 'coursework' included discussions of intelligence, work ethic, and future prospects for both men and women. Informants uniformly respected their female peers' academic caliber; they considered the average UCSB woman to be intelligent, hard working, involved, and as having good future prospects. Opinions were not as favorable for men. Many informants inferred that men must be at least reasonably intelligent because (1) UCSB has high admission criteria, and (2) if men were present then, tautologically, they had not been expelled for academic failures. However, few informants were willing to grant men much more than that, saying that men were more concerned with simply doing their work rather than doing it well. Similarly, men were often described as procrastinators. Informants were less likely to note that men, as compared to women, had clear plans for the future and were less likely to state they had good prospects following graduation. Often informants used these behaviors as evidence that UCSB men were neither mature nor consistently responsible.

I feel like the guys are not that smart [I10].

Where they're my gym partner, I'm their study buddy and I'll be like [mimes telephone conversation with hand] 'I'm already at the 24-hour study room, where are you?' [I44].

Generally everyone here is pretty smart, educated, goal-oriented. I think that

the women particularly here show that a lot and, you know, I think that's

something to be admired [I54].

Theme 5: Identity

All informants discussed aspects of themselves, other women, and other men that

related to their fundamental identity: dimensions of themselves that were independent of

USCB and IV. As expected, descriptions of people's identity were highly idiosyncratic with

very few trends or patterns emerging. Nonetheless, some general subthemes emerged;

including ethnicity, physical descriptions, personality, intrapersonal characteristics, and

activities enjoyed. No subtheme obviously spoke to the overarching questions of why UCSB

women value sexual fidelity as strongly as they did, nor why they valued cues to resource

investment as little as they did.

What did sexual fidelity imply and why was it highly valued?

Informants considered their female rivals inherently threatening to serious,

monogamous relationships. They thought their rivals were both promiscuous and physically

attractive, a highly desirable combination of characteristics (from a male perspective) in a

casual sex partner. Furthermore, informants believed that men preferred having casual sex

with as many women as possible rather than being in a publicly-acknowledged relationship

of any kind; particularly a serious, monogamous one. Since men were less likely than women

to agree to monogamy, they controlled whether a relationship was casual or serious (cf. Fine,

1988; Laner & Ventrone, 2000; Tolman, 2002). Informants unanimously said that even in

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serious, monogamous relationships, men were more likely than women to "slip up" by having extra-pair relations. Because of these beliefs, informants reasoned that a man who was, in word and deed, monogamous did so because he cared about his partner, her feelings, and their relationship. As such, a partner's *sexual* fidelity was used as a key indicator of his *emotional* fidelity. This notion was supported by data from informant-provided free lists. When asked to describe sexually faithful UCSB men, informants said most often that these men were devoted (26.47% of free-list responses), kind (21.53%), respectful (11.76%) romantic partners who were likely upperclassmen (13.24%). If sexual fidelity served as an umbrella quality that subsumed sexual exclusivity, emotional devotion, kindness, and respect, it reconciles quantitative data on UCSB women's preferred qualities in a serious, monogamous partner that seemed incongruous with both sexual selection logic and the double-shot hypothesis. Namely, these women *did* value cues predicting resource investment by a serious relationship partner; they simply used sexual fidelity as a cue rather than emotional fidelity. This finding is discussed below in terms of both sexual selection logic and the double-shot hypothesis.

Women's use of sexual fidelity as an indicator of devotion, emotional fidelity — and therefore resource investment — is consistent with sexual selection logic *in the context of IV's unusual social environment*. Outside of IV, most men most of the time are unable to be sexually unfaithful because many potential extra-pair partners are unwilling to engage in casual sex. Therefore, in a typical social environment, sexual fidelity is only a weak cue of a man's emotional devotion because it is unclear if his fidelity is due to his commitment or to his inability to attract a woman willing to be his extra-pair sex partner. IV does not appear to be a typical social environment: Informants believed women willing to engage in casual

sexual behavior were ubiquitous; indeed 72.4% of the informants spontaneously described themselves as such. Therefore, women mated to UCSB men were in a relatively unique position of being able to use their partners' sexual fidelity as an indicator of his emotional devotion.

Informants' statements provided strong support for the double-shot hypothesis: UCSB women value a mate's sexual fidelity because it predicts his emotional fidelity. If valuation of fidelity is a strategy to preemptively avoid the costs of infidelity, prior research suggests that women will value *emotional* fidelity more than sexual fidelity (e.g., DeSteno et al., 2002; Harris, 2003). However, I identified an influence on UCSB women's mate preferences in the form of a socially-derived problem with which most women had experience: UCSB men could easily acquire and preferred low-involvement sex with many women rather than a serious relationship with one woman (further discussion below). Experience with a specific socially-derived problem was not predicted *a priori* but it was not necessary to satisfy the double-shot hypothesis. Presumably all that is required is a reasonable, logically-consistent influence; DeSteno and Salovey (1996) were silent on criteria for evaluating such influences.

In addressing social role theory, I considered the possibility that adherence to an atypical social role was responsible for women's high valuation of sexual fidelity and low valuation of wealth and intelligence. Support for this notion was mixed. On the one hand, informants' general perception that UCSB women were intelligent and had good future prospects — and therefore, might not require men's additional investment — supported the possibility that women were adhering to an atypical social role (cf. Kasser & Sharma, 1999).

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On the other hand, informants said women generally avoid UCSB men as serious relationship partners, themselves included. The most frequently-provided reason for this was that women do not trust UCSB men to be sexually faithful. Additionally, UCSB men were often described as immature, irresponsible, and sexually coercive. These are not qualities that predict success in the male-typical, wage-earning role (Eagly & Wood, 1999; Johannesen-Schmitt & Eagly, 2002), nor do they predict the resource investment needed to supplement the female-typical, domestic role. In other words, UCSB women who were looking for a serious relationship partner rejected men who did not fit the male-typical social role. Not surprisingly, informant-produced free-lists indicated that the most desired qualities in a serious relationship partner were those that predicted resource investment — specifically, sexual fidelity and kindness (Cashdan, 1993; Davies & Shackelford, 2006; Greenless & McGrew, 1994). Given the mixed evidence, I do not think there is strong support either for or against the proposed atypical social role theory's efficacy in addressing UCSB women's high valuation of sexual fidelity and low valuation of wealth and intelligence.

Why did this happen at UCSB?

Most informants considered their rivals to be attractive, a trait — in part — rooted in the IV geography. The beach motivated women to increase and/or maintain the attractiveness of their bodies and, thus, promoted intrasexual competition in beauty. Living near a beach is uncommon for people in the contiguous United States: only 6.4% of the population lives within 1 km of an ocean coast of any type (e.g., rocky cliff, sandy beach; IAI, 2010). Similarly, there are very few student sectors of college towns located on the coast; fewer still

that are located on a year-round temperate beach ("Beach Schools", 2013). Thus, IV, its beach, and the associated intrasexual competition in beauty were relatively unique.

More to the point, informants also described their rivals as willing to engage in casual sex — particularly at parties, the primary environment where all types of sexual relationships begin. They identified three main types of willing women, varying in the reasons for their sexual accessibility. The first type of willing woman was a freshman. Freshmen were presumed to have low tolerance for the alcohol and cocaine prevalent in IV and, thus, were more amenable to — or coercible into — casual sex. In this sense, IV was likely similar to other environments where previously-prohibited substances became easily-acquired. However, informants also noted that freshmen were more likely to be pressured to conform to IV's party reputation, including associated sexual behaviors. Presumably this type of pressure is strongest in environments with notable party reputations, such as IV. The second type of sexually willing woman was either an out-of-towner or an SBCC woman. Both out-of-towners and SBCC women were thought to be in IV only for the party scene and were considered very interested in casual sex. The third type of promiscuous woman was a "normal" woman, affected by the concentration of IV and thereby in intrasexual competition for men's attention. This competition affected the majority of women; consequently the majority of women were classified as "normal". I contend that the unique environment of IV suggested that the normal woman and her mate preferences were also relatively unique.

The IV demography and geography drove women's attractiveness and willingness to engage in casual sex; the resulting sexual availability of many young, attractive rivals, in turn motivated women to place a high valuation on sexual fidelity in any serious relationship

partner. Given these associations, IV demography and geography can be considered a prime mover in influencing women's valuation of a serious partner's desired qualities. The uniqueness of IV's demography and geography supports the notion that it contributed to the unique patterns of UCSB women's mate preferences.

What was learned about resource acquisition?

The amount of resources a man could invest is determined both by his ability to acquire resources and his willingness to invest. Informants discussed predictors of men's willingness but little was said about predictors of men's ability to acquire resources. When mentioned, it was more often to say UCSB *women* displayed resource acquisition abilities. Men were typically described as intelligent but procrastinators; that their work was done but rarely done well. Similarly, men were rarely described as well-prepared for the future.

Wealth was mentioned by about half the informants but usually only in passing. Most frequently this topic was broached by informants who first described themselves as coming from a low-income background and then made contrasts between themselves and other students, irrespective of sex.

In summary, neither intelligence nor wealth was discussed at length by multiple participants. To my thinking, the question about why UCSB women do not value cues of resource acquisition abilities is still outstanding. This is not to suggest framework analysis of semi-structured interviews cannot provide a candidate answer, but merely that I was unable to do so with this particular data set.

Strengths, Limitations, and Conclusions

Interviews provided a wealth of emically-derived qualitative data that (1) reconciled seemingly-inconsistent quantitative data on UCSB women's mate preferences with prior research and with two major theoretical approaches, and (2) identified factors influencing UCSB women's mate preferences. In other words, qualitative data provided context to quantitative data. Of the factors that influenced mate preferences, the theme 'IV demography and geography' appeared to be a prime mover: It promoted increases in women's attractiveness, escalated the frequency and extent of women's casual sexual behaviors in intrasexual competition for men's attention, and thereby motivated men away from monogamy. Consequently, women treated sexual fidelity as an indicator of their partners' devotion and emotional fidelity. This supports both sexual selection logic and the double-shot hypothesis. To my knowledge, this is the first study to provide data indicating sexual fidelity implies devotion and emotional fidelity — probably because, as suggested above, in most mating contexts a man's sexual fidelity is not entirely of his own making.

Per the double-shot hypothesis, I identified a candidate socially-derived problem — men's avoidance of monogamy — that was likely part of most UCSB women's past experience. The socially-derived problem led to women using sexual fidelity as an indicator of devotion and emotional fidelity. This was also consistent with sexual selection logic because, in IV, it predicted greater access to resources. Ergo, it may not be possible to attribute greater explanatory efficacy to sexual selection logic or to the expanded double-shot hypothesis. Readers may decide for themselves if they prefer the more proximate explanation (*sensu* Tinbergen, 1963) of the expanded double-shot hypothesis — sexual fidelity predicted emotional fidelity, therefore sexual fidelity was more valued — or the ultimate explanation provided by sexual selection logic — in the unique IV environment, preferring sexual fidelity

over emotional fidelity was likely to lead to greater access to resources. Tension between proximate and ultimate explanations is not uncommon in studies of human behavior (e.g., rape: Goetz, Shackelford, & Camilleri, 2008; Martin, Taft, & Resick, 2007; cooperation: Hamilton, 1964; Johnson, 2005; receptivity to casual sex: Buss & Schmitt, 2011; Conley, 2011), and was first highlighted for studies of behavior in general by Tinbergen (1963).

Of course, this study is not without limitations. Quantitative data suggested two things: (1) that UCSB women valued sexual fidelity more than would otherwise be expected, and (2) that UCSB women valued cues of resource investment less than would be expected. Analysis of semi-structured interview data provided candidate explanations for the former but not for the latter.

Like all grounded analysis methods, framework analysis is dependent on informants' truthful, accurate, and complete statements. While some informants seemed guarded about answering particular — or, in the case of one informant, most — questions, I believe that informants were generally candid. When talking, they did not seem constrained or formal; body posture was typically loose, most swore, and all used slang. Expressive language and effusive tone of voice was common; informants were just as likely — if not more likely — to discuss frustration and disappointment as they were to express desire or pride. In short, the interviews felt conversational. Informants offered information about their own one-night-stands, failed attempts at securing a serious dating partner, and the occasional sexual success story. They were similarly candid about their underage alcohol use as well as their experience with cocaine. I was ultimately provided with a considerable number of both socially- and legally-incriminating statements; I do not believe this would be the case if the

informants did not trust me. Further, the strong consistency across informants suggests either truthfulness or a wide-spread conspiracy to falsify the data; the latter seems unlikely.

In conclusion, qualitative methods were used to explain quantitative data on women's mate preferences. Five themes were: IV demography and geography, parties, sober IV, school, and identity. Of these, IV demography and geography was likely the prime mover. These factors helped describe a strong female preference for sexual fidelity in a mate that has not been explained by prior adaptively-minded research or double-shot research but is nonetheless consistent with both theories, once one details the highly unusual mating dynamics of the study population.

Table 1. Summary of results affecting women's mate preferences.

Parties	IV Demography and Geography		School
	Concentration	Beach	
Alcohol and cocaine increase women's acquiescence to hooking up	Promotes intrasexual competition between women for men's attention	Motivates women to increase physical attractiveness	Promotes self-selection on attractiveness, vanity, and parting
Pressure to conform to hook-up norms	Promotes women's acquiescence to casual sex	Promotes self-selection on attractiveness and vanity	Little discussion of wealth
Women's sexual availability promotes men's unwillingness to monogamously commit	Promotes men's unwillingness to monogamously commit		Women have good future prospects
UCSB reputation promotes self-selection on partying			Men not considered to have as good future prospects as women

Appendix 1

Planned Questions Relevant to this Report

Were you where aware of UCSB's social reputation when you applied when you applied?

Did that affect your decision to come here? (How so? if no exposition was spontaneously provided)

To your perception, do most people know about UCSB's social reputation when they're applying?

If you were to describe yourself, what would be some words you would use?

Tell me about being [descriptor]. (Repeated until list was exhausted)

Is there anything you'd like to add to your list?

If you were to describe the average UCSB woman, whatever that looks like for you, what would be some words you would use?

Tell me about the [descriptor] women. (Repeated until list was exhausted)

Is there anything you'd like to add to your list?

I want you to think of the average IV party, whatever that looks like for you. Now imagining this party, are there women there that decided to go because they wanted to hook-up with someone there? I only want you to consider women who — sober — have an agenda to hook up that evening.

(If yes) What percent of women at this average party are the ones looking to hook up?

(If yes) Now again considering this party, what percent of women there, after a few drinks or whatever, are OK with hooking up with somebody?

If you were to describe the average UCSB undergraduate guy, whatever that looks like for you, what are some words you would use?

Tell me about the [descriptor] guy. (Repeated until list was exhausted)

Is there anything you'd like to add to your list?

Now we're going to talk about male-female relationships between undergrads at UCSB. What are some relationships that you see?

Can you define [relationship] for me please?

What percent of guys/women find themselves in [this relationship] sometime in their UCSB career?

If a guy/woman wanted to be in [this relationship], how easy would it be for him/her to find someone here? Easy, difficult, or somewhere in between?

Why?

If a guy/woman wanted to be in [this relationship], what qualities would he/she look for in a potential partner?

What percent of guys are in [this relationship] right now?

How does [this relationship] start?

How does [this relationship] end?

Can guys trust the women here?

Can women trust the guys here?

Chapter VII

Summary and Concluding Remarks

The benefits and suitability of my uncommon methods

Since all results depend on the methods used, I will begin with a discussion of my relatively uncommon methods.

To assess the perception of threats — through both the more obligate and more facultative lenses described in Chapters 3 and 4 — I employed a suite of methods designed to minimize researcher-imposed constraints while maximizing emic descriptions provided by informants. The successive pile sort provided nuanced detail of informants' similarity judgments, allowing quantitative comparisons among the jealousy-inducing exemplars and between comparison populations using QAP and the Fowlkes-Mallows index. Additionally, interpretations of resultant multidimensional plots were validated by independent samples of informants. Likewise, a wealth of qualitative data came from informant-provided labels of exemplar groups; these labels informed both population-level descriptions and between-population contrasts. The quantitative and qualitative components of my mixed method design worked in concert to provide comprehensive and efficient descriptions of informants' jealousy spaces — descriptions that evaluated existing suppositions, identified novel dimensions of threat organization, and supported *a priori* hypotheses. These methods are time consuming; however, they provide a powerful means of acquiring statistically robust yet emically-derived data. Analysis of this type of data is a hallmark of quantitative anthropology (Bernard, 1995; Weller and Romney, 1998).

Because my data on mate preferences signaled the presence of uncommon pressures within the social environment, I used semi-structured interviews to conduct follow-up analyses. The semi-structured format allowed for comparison among informants' responses since the topics of discussion were predetermined. However, informants were free to respond in the ways best suited to them, using their own words and focusing on the details relevant to them. This ultimately provided a rich description of the mating environment that was nonetheless organized and able to undergo further evaluation. For this, I used framework analysis: a niche method used most commonly in the fields of health and public policy. I thought it was the best method for analyzing interviews data on the mating environment for two reasons. One, framework analysis is emically grounded. This allowed informants to actually *inform*. Two, framework analysis is unique among analysis methods in that it has clear stages of analysis and presentation of conclusions. This provided rigor while conducting the analysis and also allows for evaluation of the conclusions by a third party. Together, these benefits of framework analysis preserved the descriptive power inherent in interview data and also provided the robusticity more typical of qualitative analyses.

Summary of Results

The jealousy space

The evaluation of jealousy and threats to long-term romantic relationships from an adaptive perspective could easily be described as a booming industry. Entire sections of conferences are devoted to this topic (HBES, 2012); Sagarin and colleagues' (2012) recent

review and meta-analysis included 47 studies. Despite the obvious depth of research on certain threats to long-term romantic relationships, the field overwhelmingly lacks breadth. Prior to my research, studies using an adaptive perspective have operated under the tacit assumption that threats to long-term romantic relationships were organized, into sexual threats and emotional threats (cf. Buss et al., 1992). While this approach has succeeded in documenting predicted sex differences, it has necessarily neglected questions about the wider conceptual landscape of jealousy and the relative salience of the sexual/emotional components vis-à-vis other elements of that landscape. To continue with the landscape metaphor: The yard was well-surveyed but there was no information about the larger neighborhood; indeed, there was no indication that anything beyond the yard even existed.

Using the same adaptive approach but exploring a wider scope, I provided the first data on how threats to romantic relationships are spontaneously organized. In doing so, I was also able to specify the extent to which threats are considered to be either sexual or emotional in nature, when a researcher does not deliver them in those explicit forms. The answer in short is: not by much; a result that is consistent with the adaptive function of jealousy. Both sexual access and a deep emotional connection take time to establish. As such, cues that a mate *might eventually* be sexually unfaithful or emotionally unfaithful are likely to be ambiguous, especially considering there is no predetermined way by which someone establishes these types of extra-pair relationships. If the adaptive function of jealousy is to motivate counterstrategies *before* costs are incurred — not after infidelity has been confirmed — then these ambiguous cues of possible eventual infidelity should be organized by the most appropriate counterstrategy, not by perceived outcome. This is not to suggest that previous research is somehow inaccurate but that the volume of research on sexual threats versus

emotional threats is disproportionate to its saliency as a normative organizing criterion. In other words, my data are the first to suggest that this sexual-emotional yard takes is a small one in the jealousy neighborhood.

My results indicate that, in order of salience, the major organizing criteria of threats to romantic relationships are best described as severity of the threat, the presence of a specific rival, and extent to which the partner is engaging in deception. From the perspective that emotions, like all adaptations, exist because they mitigate reproductive challenges, each of these three organizing criteria specifies a means of addressing a threat to the relationship. "Severity" indicates the magnitude of the potential cost to RS and, therefore, indicates the magnitude of appropriate investment in a counterstrategy (e.g., time in mate guarding, expenditures on courtship). "Rival specificity" directs the behavioral response, either towards a loosely-bonded partner or towards a specific rival who might be repelled or undermined with targeted strategies. "Deception" suggests infidelity of some type — occurring before any confirmation of its occurrence — and therefore motivates increased attention to the partner's behavior, whereabouts, and associates. As revealed by my analyses of the successive pile-sort data, these covert grouping criteria were used by various subpopulations of people — men, women, younger adults, older adults, those with varying experiences with sexual and emotional infidelity, those at varying risk of experiencing a partner's MRS — suggesting that these three dimensions comprise a robust organizing framework that is consistent with the adaptive priorities of a biparental species.

Differential sensitivity to particular threats based on the composition of the mate market

Just as the literature on jealousy and threats to long-term romantic relationships is based almost entirely on the sexual-emotional dichotomy, it is also based almost entirely on studies examining sex differences. Out of 47 selectionist studies of romantic jealousy, I am aware of only three that have evaluated within-sex differences (Buss, et al., 1992; Murphey et al., 2006; Tagler, 2010); none of these considered the composition of the local mate market. Considering that 1) "success", from an adaptive perspective, is defined relative to others and 2) competition is closest between same-sex peers in the same life history stage (Williams, 1966), the lack of data on how rivals affect the perception of threats to romantic relationships is a glaring omission. On these grounds I again suggest that the literature on perceived threats to long-term romantic relationships is deep but narrow.

In this context, my research is the first to consider the composition of the mate market as a force that facultatively adjusts the perception of threats to romantic relationships. Men in mate markets with many rivals of higher genetic quality were more attentive to cues that a partner was having an EPC (as revealed by my highly unobtrusive measures). Moreover, these men were also more likely to imagine that ambiguous threats imply cuckoldry, rather than abandonment. Together, these findings support the prediction that men who offer relatively low-quality genes are more sensitive to cues their partners are employing an MRS.

In parallel, women in mate markets with many sexually-accessible rivals were more attentive to cues that their partner is covertly acquiring or hiding EPC partners. Moreover, women in such markets particularly attended to sexual threats whereas women who had relatively few sexually accessible rivals did not, indicating that high-risk women were more attentive to cues a partner was engaging in an MRS. Contrarily, low-risk women were more

attentive to cues that a partner was interested in a particular rival, indicating these women considered mate-switching to be a greater threat.

These results can be summarized simply: The composition of the mate market affects perception of and attention to particular types of relationship threats, allowing for strategic deployment of adaptive counterstrategies designed to limit costs associated with a given MRS. A facultative shift shows economy of design: When MRS risk is high, it promotes behavior designed to reduce costs associated with this MRS before it has been employed or, when MRS risk is low, it can decrease costs of unnecessary vigilance. My findings are consistent with and advance the existing literature on the adaptive function of jealousy, on the threats rivals pose to romantic relationships, and on facultative shifts in attention to fitness threats.

Mate preferences and the valuation of sexual fidelity and emotional fidelity

There are many different means by which a mate could harm one's RS: a mate's sexual infidelity and emotional infidelity are only two of these. As with any long-standing threat to RS, there should be an adaptive counterstrategy designed to mitigate or avoid harm to RS. In this case, a logical, straight-forward strategy would be a preference for fidelity in a mate. More specifically, given that a mate's sexual fidelity is critical for men's RS, men should value sexual fidelity in a mate very highly relative to other RS-enhancing traits. Similarly, given that a mate's emotional fidelity — and thereby, access to current and future resources — is critical for women's RS, women should value emotional fidelity very highly in a mate relative to other RS-enhancing traits. I conducted the first study that formally evaluated these notions. This contribution compliments and extends expansive literatures on

both mate preferences and on the costs associated with sexual infidelity and emotional infidelity.

Moreover, this study was the first to directly compare the mate preferences of undergraduate and community populations. This comparison allowed me to evaluate the extent of homogeneity in human mate preferences in a Western population, thereby addressing the critique that undergraduates are not representative of non-university adults. I found that undergraduate and community men differed very little from each other in their preferences. Moreover, these two populations had preferences that were in harmony with standard sexual selection principles: they valued sexual fidelity, physical attractiveness. In short: no surprises. Similarly, community women's preferences were different from men's and in accord with standard sexual selection principles: they valued emotional fidelity, kindness, and resource investment. University women, on the other hand, differed considerably from community women and, therefore, also from what would be expected given standard sexual selection principles: they valued sexual fidelity, kindness, and physical attractiveness. Together, these data suggested that undergraduates *can* serve as representatives of non-university adults, at least insofar as mate preferences are concerned. However, these data also suggest that variance exists among undergraduate populations, and, therefore, undergraduate populations are not inherently representative of non-university populations. Finally, these results suggest that mating behaviors are flexible across, and within, populations.

"Atypical" mate preferences and the influence of an uncommon social environment

Quantitative data suggested undergraduate women were experiencing unusual factors influencing their mate preferences; however, the factors themselves were neither obvious from quantitatively derived data nor from first-order principles of sexual selection. Therefore, I used long-form, semi-structured interviews to elicit thick, emically-derived data on women's motives, women's reasoning, and the factors that influenced their behaviors. To ensure clarity and confidence in analysis, I gathered six times the data necessary (Bernard, 1995). To my knowledge, this is the first evaluation of (seemingly) atypical mate preferences in an undergraduate population.

Using framework analysis, I identified several factors that impacted UCSB women's mate strategies, one of which appears to be a prime mover: the IV geography. IV is unmatched in its youth-biased age homogeneity, being eight standard deviations from the mean in the United States. Further, IV's immediate proximity to the beach creates a pressure to be both fit and minimally-clothed. Together, this means that women are literally surrounded by sexually attractive rivals. To compete in this unusual environment, women increase their sexual accessibility. In an environment flooded with attractive, accessible rivals, women use a partner's sexual fidelity as an indicator of his emotional fidelity. In many environments, a man's sexual fidelity may not be of his choosing if he is unable to acquire an EPC partner; therefore, a man's sexual fidelity a noisy signal of his emotional commitment. However, this is not the case in IV. herefore, women in IV are in a unique position to use a partner's sexual fidelity as an accurate indicator of his commitment. This suggests that these women's mate preferences are not, ultimately, atypical — they do value cues of resource investment — although their proximate means of assessing investment is uncommon and, perhaps, only relevant in the context of Isla Vista's uncommon social environment. More

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generally, this suggests that variation in biotic and abiotic factors can produce variation in the most common of study populations.

Possible next steps

My research on threats to romantic relationships points to many avenues of further research. Below are logical extensions of the results presented in this dissertation.

How universal are the dimensions of the jealousy space?

I have defined the jealousy space's major organizing criteria and replicated it in a second population. However, this study should be replicated in another society to evaluate the extent to which severity, rival specificity, and partner deception are universal — or, alternatively, culturally-specific — organizing features. This work is underway. I have trained research assistants in Brazil who are currently collecting data. All the analyses presented in this dissertation will be conducted on Brazilian men and women; additionally, US-Brazil contrasts will also be conducted. Ideally, similar analyses would be conducted in hunter-horticulturalist societies; however, the current format of the task requires literacy. Substantial alterations would be necessary to conduct a similar task within a non-literate population, thus preventing a pure replication.

Can these results help people?

Given that a considerable amount of spousal abuse stems from a partner's jealousy, I think it is important to understand how morbidly jealous individuals (cf. Daly et al., 1995;

Daly and Wilson, 1998; Easton et al. 2007; Wilson and Daly, 1996) — i.e., those more likely to abuse — perceive threats to romantic relationships. My methods — including the pile sort and subsequent thematic analysis of group labels — would provide these data. Hopefully, these results would allow for the identification of effective strategies that could be used by police, social workers, and/or women in abusive relationships to mitigate or prevent assault.

Once a threat is perceived, what do people do?

I believe my data are clear and specific about how threats are organized, thus allowing for targeted counterstrategies to be employed before costs to RS are incurred. But what are these counterstrategies? The nature of the jealousy space makes some suggestions that, nonetheless, ought to be empirically assessed. For example, a moderately deceptive threat might not warrant an aggressive mate guarding tactic and would be better addressed by greater vigilance of the partner, either by the treat-perceiver or by his/her social allies. If so, the saliency of partner deception might be greater for those with few social allies (e.g., women in patrilocal environments).

Does valuation of sexual and/or emotional fidelity facultatively adjust based on MRS risk?

The logic that predicts facultative attention to particular threats based on MRS risk also predicts differential valuation of sexual fidelity and/or emotional fidelity in a mate. A straight forward replication of my mate preferences study could be conducted with an inclusion of the dependent variables used to assess MRS risk.

How variable are mate preferences?

After acquiring — and replicating — "atypical" mate preferences in undergraduate UCSB women, I was able to provide a reason why these preferences exist and how they are perhaps concordant with sexual selection logic. To my knowledge, this is the first adaptive evaluation of "atypical" undergraduate mate preferences. These unusual preferences may exist because IV truly is an extreme social environment and therefore the pressures are unique. Alternatively, there may be no *published* studies because results that do not support established theory are tucked away in a file drawer. I suspect that both options are true. If IV is indeed an example of an extreme social environment, it would be beneficial to replicate the study in a similar environment. No place in the US has the same degree of homogeneity and population density so a perfect replication is not possible. However, if the density criterion is relaxed, some places in New York and Los Angeles approach a similar degree of homogeneity, making these places attractive as candidate populations for study.

American undergraduates are clearly a very well-studied group and extrapolating their behaviors, preferences, etc. to all humans is, at best, a questionable strategy. Given their inherent WIERDness (Henrich, Heine and Norenzayan, 2010), it is tempting to consider American undergraduates as a single population, all facing similar pressures. To my knowledge, this supposition has not been formally evaluated. In fact, my data strongly suggest that — at minimum — one undergraduate population faces atypical social pressures, produced by atypical biotic and abiotic factors, resulting in atypical mate preferences. I therefore suggest that, because American undergraduates are so well studied, they are a good resource for identifying sources of variation in mate preferences.

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Chapter VIII

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