

presented in the target article argue not for a specific focus on single perspectives in attempting to model and understand human sociosexuality but rather seem to suggest that a holistic meta-approach, inclusive of ethnographic, psychological, sociological, and biological perspectives, although difficult, will produce the most comprehensive and effective results.

Although I wholeheartedly agree with many of Schmitt's conclusions, aspects of the analyses remain rooted in a reductionist perspective that can inhibit further elaboration of trends and patterns in human sexuality. It is on this point that I will focus my commentary, not in derision of the overall contribution of the target article but as a consistent reminder of the importance of including anthropological contexts and complex evolutionary perspectives.

Like many studies of sexuality, this one is focused primarily on one subculture (college students) and thus should also include other correlates of these specific populations, such as type of education, media exposure, integration with other generations in the same society, general and specific health issues/status, and economic status, for example. Schmitt uses United Nations reports and psychological surveys of sex roles and sexism as cultural variables. However, using these statistical data sets does not actually provide ethnographic measures as much as it provides broad demographic and nation-level sociological ones (such as gross domestic product [GDP], mean age at marriage, or percentage of women in parliament). Using the International Sexuality Description Project (ISDP) SOI data set as partial support for some very broad adaptive hypotheses regarding human mating strategies can miss the power of the data set and paint an incomplete picture. The data presented here are not truly a study of evolutionary strategies (because measures of reproductive success are not included) but rather one of SOI responses. In this sense the title of the target article could have been "the sociosexuality of college students: a 48-nation study of the SOI measure of sexuality" and remain a substantial contribution to the study of sexuality.

Schmitt refers to Wood and Eagly (2002) frequently but does not fully include an important aspect of that source's methodology: the inclusion of anthropological databases (ethnographic sets) to contextualize the differences and similarities in human sexualities. Providing an ethnographic context facilitates attempts to uncover patterns of behavior that may reflect adaptive mating strategies in humans. Without ethnographic inclusions, the data set rests outside the complex interconnective biocultural web of humanity and thus may present a functionally incomplete picture of actual behavioral patterns.

Schmitt states that "culture has an important influence on sociosexuality, but biological sex is the larger and stronger predictor of human mating strategies across the nations of the ISDP" (sect. 6.6). Here, answers to the SOI questions made by primarily urban, educated individuals are taken first as accurate indicators of their sociosexuality and then translated into representations of mating strategies. This leap is arguably justified by the fact that many of the responses are statistically similar across samples used. However, it is not clear to me that, for example, the measure of "nation" defined as half the partial η^2 -effect size of "sex" adequately addresses actual cultural and biological complexities. Neither the target article nor the other SOI reports clearly link the sociosexuality indicators as measured by the SOI to actual reproductive success or even actual mating patterns or behavior by individuals. Therefore, the leap from SOI answers to adaptive patterns of human behavior remains tenuous at best. The use of proxy measures for reproductive success (even if they are internally valid in the sample) remains highly speculative as evidenced from the primatological and animal behavior literatures. Proxy measures on generally young individuals (as in this study) may result in missing substantial components of their lifetime strategies. Experience affects behavior, and a focus on mainly reproductively young individuals can produce incomplete or artificial results.

The target article would have benefited from inclusion of the discourse arguing for less dramatic differences in male and fe-

males attitudes towards partner number and mating patterns (Miller et al. 2002; Pederson et al. 2002). Also, in an overview of mating strategies theory, one should be careful about heavy reliance on simplistic interpretations of the Trivers' model for obligatory parental investment and subsequent differences in sociosexual strategies, given the substantial complexities in the actual impacts of sexual selection, choice, and mating strategies reviewed in recent literature in evolutionary and ecological studies (Borg-erhoff-Moulder 2004; Kokko & Jennions 2003; Tang-Martinez 2000).

Finally, the use of unrealistic figures of potential male reproductive success is counterproductive because there is no evidence that in humans or other primates such a dramatic lifetime reproductive skew occurs with any regularity in any population studied. Using such assumptions as a jumping off point, even if hypothetical, lays an unrealistic baseline that can then be used to create a variety of scenarios, all of which are faulty given the erroneous basal assumption. True potential reproductive success in a human society is dependant on much more than whether that society practices polygyny or monogamy as its primary marriage system. Marriage systems should not be seen simply as proxies for mating systems, nor should they necessarily be seen as reflective of adaptive strategies. This again stresses the need for a cultural context in which to place interview data on sexuality in humans.

Despite my criticisms, it is important to note the Schmitt is very aware of the limitations of the data set and explicitly points them out in section 7.1, entitled "Sociosexuality and psychometrics." He explicitly states that the current findings are "tentative until more sophisticated sampling techniques can be employed" (sect. 7.1), but this does not dissuade him from making some broad claims about adaptations and strategies throughout the target article.

In all, this is an extremely important contribution to the study of human sexuality, and Schmitt and his colleagues are to be congratulated on the ISDP and its far-reaching implications. The diverse sets of data produced from the project, especially those discussed in the target article, will provide substantial fodder for multiple theoretical and practical innovations in sexuality theory, as Schmitt clearly outlines in his discussion and conclusion.

Sperm competition theory offers additional insight into cultural variation in sexual behavior

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Abstract: Schmitt recognized that research is needed to identify other factors associated with sex ratio and with sociosexuality that may explain cross-cultural variation in sexual behavior. One such factor may be the risk of sperm competition. Sperm competition theory may lead us to a more complete explanation of cultural variation in sexual behavior.

Schmitt found that sex ratio, as predicted by Pedersen (1991), is correlated negatively with sociosexuality. That is, in those nations where women outnumber men (low sex ratio), individuals tend to be more sexually promiscuous. It is not yet known whether the sex ratio in a population causes a shift in sociosexuality, and Schmitt acknowledged appropriately that future research will identify other factors associated with sex ratio and with sociosexuality that may help to provide a more complete theory of cross-cultural variation in sexual behavior.

One such factor likely related to sex ratio and to sociosexuality that warrants future investigation is sperm competition, defined as the competition between the sperm of two or more males for fertilization of a female's eggs (Parker 1970). In humans, sperm competition is a consequence of female sexual infidelity and fe-

male sexual promiscuity (Smith 1984). Anatomical, physiological, psychological, and behavioral data suggest that sperm competition was an important selection pressure throughout human evolution (Baker & Bellis 1993; Gallup et al. 2003; Goetz et al. 2005; Shackelford et al. 2002; Smith 1984).

At first, one might posit that a high sex ratio would generate more sperm competition because there is a surplus of males in the population and therefore, more males' sperm competing for fewer females' eggs. However, sperm competition is independent of the general area of intrasexual competition. Instead, it is a low sex ratio (more women than men) that is likely to generate more intense sperm competition. As predicted by sex ratio theory and documented by Schmitt, a low sex ratio is associated with greater sexual promiscuity because men are the scarce, valued resource and can actualize their preference for promiscuous sex. Sexual promiscuity or unrestricted sociosexuality increases the likelihood that sperm from two different men will occupy simultaneously a woman's reproductive tract and thus generates an increased risk of sperm competition (Smith 1984). Risk of sperm competition therefore is hypothesized to be a consequence of variations in sex ratio and in sociosexuality. That is, variations in sex ratio and sociosexuality are expected to influence the risk of sperm competition, which will consequently produce variations in particular sexual behaviors.

One sexual behavior that may be facultatively contingent on the risk of sperm competition is copulatory frequency. High in-pair copulatory frequency has been proposed as a corrective measure in the context of sperm competition, because the relative abundance of sperm from the primary male would outnumber rival sperm, as a result of differential insemination frequency (Parker 1984). An increase in the frequency of in-pair copulations in response to cues of increased risk of sperm competition has been documented in several species of birds, insects, and mammals (e.g., Dickinson & Leonard 1996; Evans et al. 2003; Møller & Birkhead 1989). We therefore predict that in societies with a low sex ratio (more women than men) and unrestricted sociosexuality, men will initiate more copulations with their in-pair partner. Accordingly, there is substantial variation in the copulatory rates of peoples in different societies. Ford and Beach (1951), for example, reviewed anthropological records and identified tribes in which couples copulated an average of once per week, tribes in which couples copulated an average of three to four times per week, and tribes in which couples copulated more than seven times per week.

Existing data related to the interrelationships among sex ratio, sexual behavior, and the risk of sperm competition are not abundant, but some data can be reexamined to assess informally if copulation frequency (a sperm competition parameter) is related to local sex ratio. Ford and Beach (1951), for example, documented that the Keraki tribe of Papua New Guinea report copulating once per week on average. If sex ratio, sociosexuality, and sperm competition risk are related, as we predict, we expect the Keraki to have had a high sex ratio. A high sex ratio is associated with lower sociosexuality and (theoretically) with lesser risk of sperm competition. We examined data taken from the same time period and, indeed, found some evidence that New Guinea had a correspondingly high sex ratio (Keesing 1952). Data from the Keraki are consistent with the hypothesis that a high sex ratio and restricted sociosexuality are likely to generate lesser sperm competition in a population.

Another society in Papua New Guinea for which there are records of the sex ratio and of sexual behavior is the Chimbu of Mintima (Brown 1978). Although the sex ratio was not formally recorded, Brown (1978) repeatedly mentions the noticeable surplus of women, attributable to the death of men in warfare. The Chimbu, therefore, had a low sex ratio. Although polygyny was practiced among one-third to one-half of the population, female sexual infidelity was frequent. Brown (1978) describes several conflicts arising from adulterous wives and jealous husbands. Brown also writes, "A pregnant bride or unmarried girl is thought

to be promiscuous; it is believed that the baby has been fathered by 'all the men,' and her husband may deny responsibility" (p. 176). Data from the Chimbu are consistent with the prediction interrelationships among a low sex ratio, unrestricted sociosexuality, and greater sperm competition risk.

We cannot rule out the possibility that copulatory frequency is an artifact of sociosexuality, for example, independent of sperm competition risk. Multiple sperm competition parameters (e.g., cuckoldry rates, testis size) are needed to determine if sex ratio, sociosexuality, and sperm competition are interrelated.

Schmitt recognized that future research is needed to discover other factors associated with sex ratio and with sociosexuality. Sperm competition theory, in conjunction with sex ratio theory (Pedersen 1991) and strategic pluralism theory (Gangestad & Simpson 2000), may help to provide a more complete theory of cross-cultural variation in sexual behavior.

Medical advances reduce risk of behaviours related to high sociosexuality

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Abstract: Although statistically significant correlations have been found among political, economic, and social indices, on the one hand, and measures of sociosexuality, on the other, it is likely that these correlations are second-order effects. Underpinning the reproductive freedom associated with higher sociosexuality are factors more closely related to biology, namely, easy access to safe, effective contraception and reproductive medical care.

Schmitt summarised his findings by reporting *inter alia* that "sex differences in sociosexuality were significantly larger when reproductive environments were demanding but were reduced to more moderate levels in cultures with more political and economic gender equality" (abstract). This conclusion was based on his investigation of both social structural theory and strategic pluralism.

Schmitt opted for "political and economic gender equality" as his criterion for looking at social structural theory and used as measures "percentage of women in parliament, percentage of women in ministerial positions, percentage of women-headed households, and divorce rates across cultures" (sect. 6.7.1). While investigating strategic pluralism, he looked at the prevalence of low birth weights, women's mean age at marriage, and GDP (gross domestic product per capita). He noted that the "same sex-differentiated pattern of correlations was evident for infant mortality rate, teen pregnancy rate, mean age at marriage, and the Human Development Index" (sect. 6.7.2).

It is perfectly plausible that there would be statistically significant correlations between all these measures and sociosexuality scores. And Schmitt adds to the usefulness of these theories by documenting support for them. However, these are mostly second-order effects, the primary factors being more closely related to biology. For example, if women were not freed from unplanned and often frequent child bearing they would be unlikely to be members of parliament, let alone hold ministerial positions. They would be much less likely to contribute to GDP, nor would they be deferring marriage and pregnancy at least until their early thirties, and sometimes indefinitely.

Thus Schmitt underestimates the arguably overwhelming effect of modern contraception; availability of safe, early abortion; advances in reproductive healthcare; and medical protection against sexually transmitted diseases (STDs). This means he may be underestimating the extent to which high sociosexuality or promiscuity in premodern or third-world cultures was or still is a high-risk, life-threatening strategy, especially, but not solely, for women.