Where Do Cultures Come From?

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This article seeks to make three separate contributions to the anthropological study of culture. Metatheoretically, it presents an evolutionary psychological perspective within which to study culture and generate specific theories of the origins, constancy, and variations in human culture. Theoretically, it provides a concrete evolutionary psychological theory of son-daughter preference: why people in some societies prefer sons to daughters and practice female infanticide whereas those in others prefer daughters to sons and practice male infanticide (killing of boys). Empirically, it tests and supports an evolutionary psychological theory of son-daughter preference with large, international quantitative data both at the micro (individual) and macro (societal) levels. The empirical analyses show that wealthier individuals from 46 nations prefer sons to daughters, whereas poorer individuals prefer daughters to sons. They also suggest that wealthier societies have cultural preference for sons, whereas poorer societies have cultural preference for daughters.

Keywords: *evolutionary psychology; Trivers-Willard hypothesis; offspring sex ratios*

Culture is a central concept, if not *the* central concept, in anthropology. Yet there have been very few general and systematic theoretical perspectives on the origins, constancy, and variance in culture: Where do cultures come from? Why are there cultural universals? Why, at the same time, are there such wide variations in culture?

Apart from the evolutionary perspective adopted in this article, possibly the only other general theoretical perspective that offers systematic answers to these questions is cultural materialism (Harris, 1974, 1977). Relying as it does on infrastructural determinism (how ecological and environmental conditions determine social structure and ideational superstructure), cultural materialism tends to overemphasize cultural variations and has difficulty explaining cultural universals beyond the tripartite sectors of infrastructure, structure, and superstructure. For instance, although cultural materialism can explain why people in some cultures consume beef and those in others consume pork (Harris, 1974), it cannot explain why people in all cultures consume animal meat. Although it can explain why people in some cultures worship cows and those in others worship pigs, it cannot explain why people in all cultures worship animate objects.

Barkow (1980, 1989), Cronk (1999), Fessler (2004), Low (1989), and others have successfully employed the evolutionary perspective before to explain culture, but perhaps the most significant contribution in this area has been made by Boyd and Richerson (1985, 2005; Richerson & Boyd, 2005). Their dual-inheritance model of gene-culture coevolution explains how individuals with given genetic and behavioral predispositions are more likely to develop certain cultures yet how culture, once in existence, can shape the future distribution of genes in a population by allowing some individuals to attain greater reproductive success than others. Their main contention is well captured in the phrase "nothing about
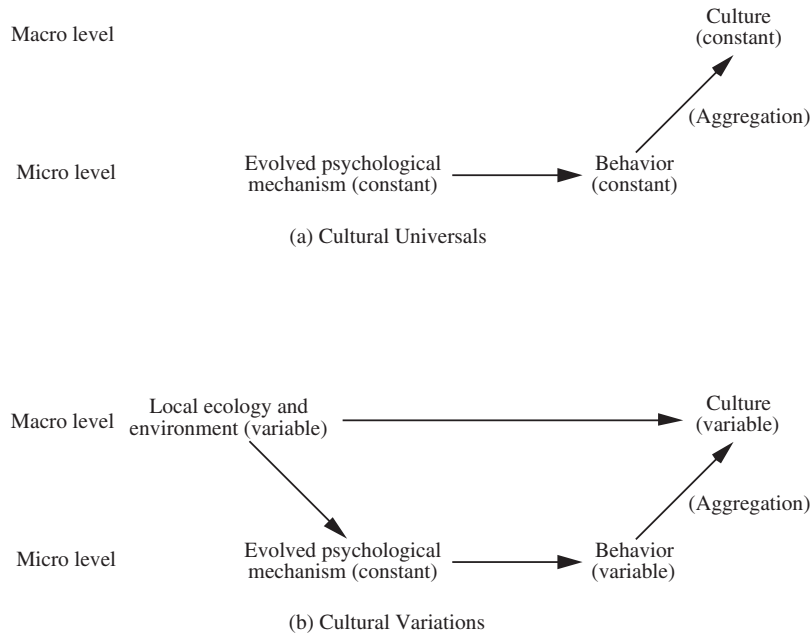
culture makes sense except in the light of evolution" (Richerson & Boyd, 2005, pp. 237-257), which of course is a play on Dobzhansky's (1973) earlier claim, "nothing in biology makes sense except in the light of evolution."

This article attempts to make three separate contributions to the anthropological study of culture. Metatheoretically, it presents evolutionary psychology as a general theoretical perspective to explain the origins, constancy, and variance in culture. Theoretically, it provides a concrete evolutionary psychological theory of one specific aspect of human culture, whether parents value sons or daughters more. Empirically, it tests an evolutionary psychological theory of son-daughter preference with large, international statistical data both at the micro (individual) and macro (societal) levels. The empirical analyses show that wealthier individuals from 46 nations prefer sons to daughters, whereas poorer individuals prefer daughters to sons. They also suggest that wealthier societies have cultural preference for sons, whereas poorer societies have cultural preference for daughters.

AN EVOLUTIONARY
PSYCHOLOGICAL PERSPECTIVE ON CULTURE

Evolutionary psychology seeks to discover universal human nature, which consists of domain-specific evolved psychological mechanisms. A psychological mechanism is an information-processing procedure or "decision rule" that evolution, by natural and sexual selection, has equipped humans to possess to solve an adaptive problem (a problem of survival or reproduction). Unlike decision rules in decision theory or game theory, however, psychological mechanisms mostly operate behind our conscious thinking. Evolved psychological mechanisms produce preferences and values, which rational actors then pursue within their constraints, and they also engender emotions (Ben-Ner & Putterman, 2000; Kanazawa 2001a). Comprehensive introductions to evolutionary psychology include Barkow, Cosmides, and Tooby (1992); Buss (2004); Cartwright (2000); Daly and Wilson (1988); and Low (2000).

Relying heavily as it does on the concept of evolved psychological mechanisms, which compose universal human nature, it is straightforward to explain cultural universals from the evolutionary psychological perspective once one makes the micro-macro

Macro level

Culture
(constant)

(Aggregation)

Micro level

Evolved psychological
mechanism (constant) → Behavior
(constant)

(a) Cultural Universals

Macro level

Local ecology and
environment (variable) → Culture
(variable)

(Aggregation)

Micro level

Evolved psychological
mechanism (constant) → Behavior
(variable)

(b) Cultural Variations

**Figure 1: Evolutionary Psychological Perspective on Cultural Universals
and Variations**

link, which explains culture at the macro level as an aggregation of individual behavior at the micro level (Kanazawa & Still, 2001); cultural values and norms at the societal level are correspondent to the behavior of majority of individuals. (See Figure 1a.) Individuals in different societies share the same evolved psychological mechanisms because they are species-typical. Thus, to the extent that evolved psychological mechanisms alone produce behavior by expressing themselves identically in a wide range of circumstances and environments, then behavior in different societies will also be constant; people in different societies behave similarly. Then the cultural values and norms with respect to this particular behavior will also be constant across societies, and we would have a cultural universal.

An example of a cultural universal is the cultural norm that the husband be older than the wife in a married couple. In his study of mating preferences in 38 cultures, Buss (1989, p. 8, Table 4) shows

that in every one of the cultures for which he has data ($N = 30$), the husband is, on average, older than the wife. My more comprehensive international data ($N = 83$) show exactly the same pattern. In none of the 83 nations is the husband, on average, younger than the wife.

What explains this cultural universal? I contend that it stems directly from men's and women's evolved psychological mechanisms. Men in every society prefer to marry women younger than them, and women in every society prefer to marry men older than them (Buss, 1989, p. 8, Table 4). Men prefer to marry younger women because they have greater reproductive value (younger women have more years left to reproduce before menopause) and higher fertility (younger women actually bear more children than older women, even before menopause). Women prefer to marry older men because women need men's resources to invest into their children and the privileges and protection their status confers, and older men tend to have greater resources and higher status than younger men because all primate societies (including all human societies) are gerontocratic.

In this case, men's and women's preferences are perfectly complementary. Most men seek to marry (and do marry) younger women, and most women seek to marry (and do marry) older men. The cultural norm at the macro level prescribing the husband to be older than the wife emerges as an aggregation of thousands and millions of men's and women's choices of their spouses. Because men's and women's evolved psychological mechanisms, and their actual behavior emanating from them, are the same in every society, we have a cultural universal.

Now although the pattern where the husband is older than the wife is a cultural universal observed in every human society, the actual age difference between the spouses varies slightly from society to society. In my data, it varies from the mean of 1.2 years in Ireland to that of 9.2 years in Mali. Why is the age difference between the husband and the wife greater in some societies than in others? What explains these cultural variations?

It turns out that the mean age difference between the spouses is a function of the marriage institution. The age difference is significantly ($p < .001$) greater in polygynous societies than in monogamous ones (Kanazawa, 2001b). This is because in polygynous societies, already-married older men of higher status and greater resources can continue to marry more younger women, whereas in monogamous societies, only unmarried, and therefore relatively

younger, men can marry young women. However, this simply begs the question: Why are some societies monogamous whereas others are polygynous? What explains these cultural variations?

As Figure 1b shows, the evolutionary psychological perspective explains cultural variations as an interaction of variable ecological and environmental conditions and the constant evolved psychological mechanisms. Cosmides and Tooby (1992) call such cultural variations "evoked culture." The key ecological condition in the case of marriage institution is the level of resource inequality among men (Kanazawa & Still, 1999). For every species in which the female makes greater parental investment into the offspring than the male, including humans, sex and mating is a female choice (Trivers, 1972). Thus, the key evolved psychological mechanism here is women's desire to maximize the welfare of their offspring.

In societies where there is greater resource inequality among men, women and their children are better off if many of them share a single wealthy man because in such societies, even a half, a quarter, or one tenth of a wealthy man (and his resources) is still greater than a whole of a poor man. Thus, women tend to marry polygynously in societies characterized by greater resource inequality (Kanazawa & Still, 1999). In contrast, in societies where there is lesser resource inequality among men, women and their children are better off monopolizing a poor man (and his resources) than sharing a rich man. In such societies, a quarter of a wealthy man is not as great as a whole of a poor man. Thus, women tend to marry monogamously in societies characterized by lesser resource inequality. Then the cultural variations between monogamy and polygyny at the societal level emerge as an aggregation of thousands or millions of women making independent decisions to marry monogamously and polygynously at the individual level (Kanazawa & Still, 1999, 2001). Because their decisions and behavior vary between societies characterized by different levels of resource inequality among men, we have cultural variations.

The evolutionary psychological perspective on culture, therefore, provides a general theoretical framework that simultaneously explains cultural universals and variations. I will now use this framework to construct a concrete evolutionary psychological theory of one particular aspect of culture: whether parents, in general, prefer sons or daughters.

AN EVOLUTIONARY PSYCHOLOGICAL THEORY
## OF SON-DAUGHTER PREFERENCE

TOWARD A MORE BALANCED
STUDY OF INFANTICIDE

It is widely known that people in some cultures, such as Korea (Park & Cho, 1995), China (Tuljapurkar, Li, & Feldman, 1995), and India (Das Gupta, 1987; Rosenzweig & Schultz, 1982) prefer sons to daughters. In the absence of more medically sophisticated techniques, such as selective abortion of female fetuses, parents in these cultures are suspected of achieving their goal of having more sons than daughters through female infanticide and other, less blatant means of neglect, abuse, and abandonment of girls.

Female infanticide and other means of eliminating girls, however, are seldom directly observed and recorded by Western anthropologists and other outside observers. Widespread female infanticide, therefore, must necessarily be indirectly inferred from a significantly high sex ratio (Sen, 1992, pp. 122-125). The "natural" or "normal" sex ratio at birth for humans is 1.05: 105 boys born for every 100 girls (Grant, 1998). According to the United Nations (1995) statistics, the sex ratio among infants ages 0 to 4 in 1994 is 1.1202 in South Korea and 1.1032 in mainland China. These nations indeed have the two highest sex ratios in this age group in the world. These figures are very unlikely to result from random fluctuations from the mean of 1.05 in the absence of female infanticide and other means of systematically eliminating girls.

Scientists usually assume that all infanticides among humans involve the killing of girls and that no parents would systematically kill boys. Their standard assumption is reflected in the asymmetrical language in the scientific literature on infanticide. Whereas *female infanticide* means killing of girls, *male infanticide* means killing by fathers or other adult males (of infants of either sex; Rodman, 1999). The possibility that parents might selectively kill or otherwise eliminate boys rather than girls is often absent from the scientific literature on infanticide.

Statistics compiled by the United Nations (1995) belie this standard assumption. Figure 2 demonstrates that nations vary widely in the sex ratio of infants ages 0 to 4. It reveals two new findings hitherto unremarked on in the anthropological discussion of human infanticide. First, the cultural value of son preference, and thus the practice of female infanticide, is usually assumed to be
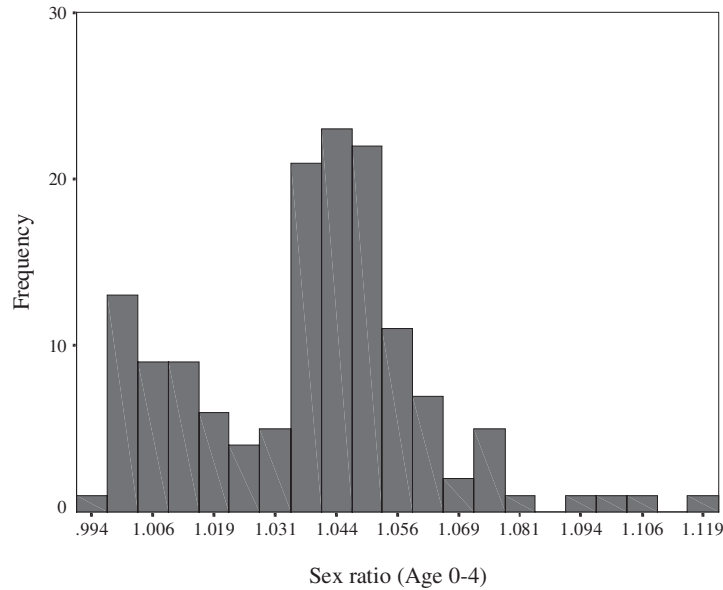
**Figure 2:   Distribution of Cultural Values for Sons or Daughters Through-
                out the World (*N* = 143)**
SOURCE: United Nations (1995).

limited to Asian nations, such as Korea, China, and India (Edlund, 1999), and as I mention above, the data do suggest that female infanticide might be widespread in these nations. However, Figure 2 also shows that the sex ratio is unusually high among such Western nations as Iceland (1.1000), Luxembourg (1.0909), and Spain (1.0735). In fact, all of these nations have higher infant sex ratios than India (1.0603). If scientists are willing to infer widespread practice of female infanticide in South Korea, China, and India from their unusually high sex ratios, as well they should, then in the absence of plausible alternative explanations, they must equally be willing to infer it in Iceland, Luxembourg, and Spain.

Second, Figure 2 also demonstrates that although many nations have unusually high sex ratios, even more have unusually low ones. Most of these nations are in Africa: Central African Republic (.9954), Congo, Djibouti, Gambia, Guinea-Bissau, Niger, and Swaziland (all of which have the infant sex ratio of 1.0000). If scientists are willing to infer widespread female infanticide in nations with

unusually high infant sex ratios, then in the absence of plausible alternative explanations, they must equally be willing to infer widespread male infanticide (killing of boys, hitherto assumed nonexistent) in nations with unusually low infant sex ratios.

One possible alternative explanation for the unusually low sex ratios in these African nations is that in these poor nations, boys, who are physically weaker and more fragile, die from diseases in greater numbers than girls do. This explanation is not likely to account for most of the "missing boys," however. Millions of years of evolution have carefully calibrated the human sex ratio at birth to be around 1.05, so that, even though more boys die in infancy than girls, the sex ratio will be about 1.00 for efficient mating by the time the cohort reaches puberty. That means that in the harsh material environment of the Pleistocene (the ice age), about five more boys than girls died in infancy. However poor these African nations might be today (in 1994), their environments are probably not much worse for infant survival than they were during the ice age (although it is impossible to make a precise comparison in the absence of data on infant survival during the Pleistocene). I therefore suspect that the unusually low sex ratios in these African nations at least partially result from male infanticide (killing of boys) and other, less blatant forms of neglect and abuse of boys (Cronk, 2000, 2004, pp. 111-129), just as I suspect that the unusually high sex ratio in Asian and European nations results from female infanticide and other forms of neglect and abuse of girls.[1]

THE TRIVERS-WILLARD HYPOTHESIS

What can explain the cross-cultural variations in son-daughter preference? How can we account for the fact that people in some cultures prefer sons and practice female infanticide, whereas those in others prefer daughters and practice male infanticide? Although female infanticide is often thought to result from extreme poverty in such nations as South Korea, China, and India, Edlund (1999) demonstrates with supportive empirical data that it is actually the wealthier families in China and India that seem to practice female infanticide and thus have higher infant sex ratios, whereas poor Chinese and Indian families seem to practice male infanticide and have lower infant sex ratios. Why would wealthy families in poor countries favor sons whereas their poor counterparts favor daughters?

It turns out that evolutionary biologists and psychologists have known the answer to this question for more than 30 years. The Trivers-Willard hypothesis (Trivers & Willard, 1973) is unique within evolutionary psychology, which mostly studies universal human nature, in that it makes class-based predictions of parental investment behavior. It begins with the observation that men's reproductive success largely depends on their wealth and status (because women prefer to mate with wealthy, powerful men) and women's reproductive success largely depends on their youth and physical attractiveness (because men prefer to mate with young, physically attractive women). In other words, men's reproductive success hinges on factors that are closely associated with class, whereas women's reproductive success hinges on factors that are largely orthogonal to class. For this reason, daughters from poor families are expected to attain higher reproductive success than their brothers, whereas sons from wealthy families are expected to attain higher reproductive success than their sisters. Parents should thus be selected to favor (albeit unconsciously) daughters to sons in poor families, and sons to daughters in wealthy families.
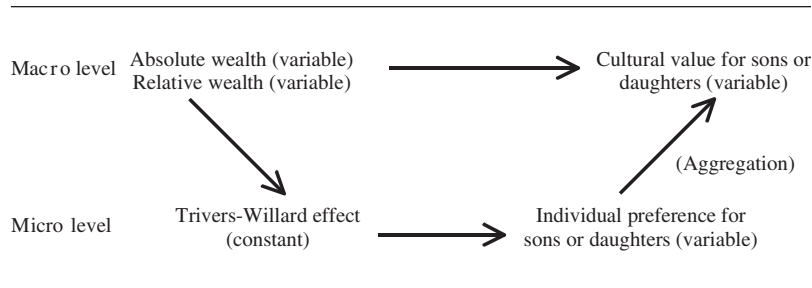
For example, Cronk (2000, 2004) reports that the Mukogodo in north-central Kenya, who occupy the lowest status in the Maasai pastoralist society, largely favor their daughters to sons. When their daughters get sick, they are very quick to take them to clinics for immediate medical attention, whereas when their sons are sick, they tend to be neglected, despite the fact that government-run clinics are free of charge and those run by the Catholic mission charge only nominal fees (Cronk, 2004, p. 118, Table 5.1). As a result, Mukogodo girls are healthier, heavier, and taller for their age than Mukogodo boys (Cronk, 2004, p. 120, Figure 5.1). Although the Mukogodo themselves seem largely unaware of their female-biased parental investment, Cronk explains it in terms of the Trivers-Willard (1973) hypothesis and the possibility of hypergyny of Mukogodo girls to the dominant Maasai men.

Although the Trivers-Willard (1973) hypothesis is one of the most celebrated principles in evolutionary biology, its empirical status is ambiguous. On one hand, the empirical support for the original formulation of the Trivers-Willard hypothesis among humans is partial. Although there is a large number of empirical studies on human societies throughout history and across the world that confirm the hypothesis (Cronk, 1989; Moore, 1990, pp. 326-327, Figures 1 and 2; Voland, 1984), including the contemporary United States (Betzig & Weber, 1995; Gaulin & Robbins, 1991;

Kanazawa, 2001c; Mueller, 1993), there are also some studies that do not find support for it (Freese & Powell, 1999; Keller, Nesse, & Hofferth, 2001; Koziel & Ulijaszek, 2001). On the other hand, there has been recent theoretical extension and generalization of the Trivers-Willard hypothesis. The generalized Trivers-Willard hypothesis maintains that parents with any heritable trait that affects the reproductive success of sons or daughters can manipulate their offspring sex ratio to maximize their inclusive fitness. So parents who have typically male brains are more likely to have sons and those with typically female brains are more likely to have daughters (Kanazawa & Vandermassen, 2005); tall and big parents are more likely to have sons (Kanazawa, 2005b); beautiful women are more likely to have daughters (Kanazawa, 2005a); and violent men are more likely to have sons (Kanazawa, in press).

The psychological mechanism posited by the Trivers-Willard (1973) hypothesis forms the microfoundation of my evolutionary psychological theory of son-daughter preference. (See Figure 3.) The local ecological and environmental factors to which this psychological mechanism responds and with which it interacts are both the absolute and relative levels of wealth in society. The human brain and its evolved psychological mechanism are adapted to the ancestral environment and are thus strongly biased to view and respond to the environment as if it were still the ancestral environment (Kanazawa, 2004). One possible implication of this observation is that when the psychological mechanism posited by the Trivers-Willard hypothesis unconsciously evaluates our social class or how well off we are, the standard against which we implicitly compare our current situation is the material conditions of the ancestral environment. In other words, the Trivers-Willard mechanism may respond to the absolute, not relative, level of wealth. If the absolute level of wealth of the society is high, then most of its citizens may feel as though they are in the upper class, regardless of their actual class within their society, and thus favor sons; if its absolute level of wealth is low, then most of its citizens may feel as though they are in the lower class, regardless of their actual class within the society, and thus favor daughters.

Even in the ancestral environment, however, there was some limited resource inequality among families; there were relatively richer and poorer families even in the hunter-gatherer societies during the Pleistocene. This is probably why women today can still select men on the basis of their wealth and status (Buss, 1994), which they would have difficulty doing today if there had been no

Macro level	Absolute wealth (variable) Relative wealth (variable)	→	Cultural value for sons or daughters (variable)
			(Aggregation)
Micro level	Trivers-Willard effect (constant)	→	Individual preference for sons or daughters (variable)

Figure 3: An Evolutionary Psychological Theory of Son-Daughter Preference

resource inequality in the ancestral environment to which their brains are adapted. So I suggest the Trivers-Willard (1973) mechanism may also respond to the relative level of wealth, whether we are better or worse off than others in our own society. If we are relatively better off within our own society, then we may feel like we are in the upper class, regardless of our society's absolute level of wealth, and thus favor sons; if we are relatively worse off within our own society, then we may feel like we are in the lower class, regardless of our society's absolute level of wealth, and thus favor daughters. I therefore suggest that the Trivers-Willard hypothesis simultaneously predicts the main effects of both absolute and relative levels of wealth on son-daughter preference.

I suggest that cultural values and norms at the societal level can emerge from behavioral regularity among individuals (Kanazawa & Still, 2001). If many or most people do *X* rather than *Y*, then cultural values and norms for *X* will emerge at the societal level, purely as a matter of statistical expectation; if many or most people do *Y* rather than *X*, then cultural values and norms for *Y* will emerge instead (Homans, 1950, pp. 265-268; Knight, 1992). Thus, in my evolutionary psychological theory of son-daughter preference, individual preferences for sons or daughters at the micro level (and accompanied behavior such as infanticide of one sex or the other) aggregate to the correspondent cultural values and norms at the macro level. If most or all people in society prefer sons to daughters, then the cultural values and norms should also favor sons over daughters. If most or all people in society prefer daughters to sons, then the cultural values and norms should also favor daughters over sons.

AN EMPIRICAL TEST OF THE
EVOLUTIONARY PSYCHOLOGICAL THEORY
OF SON-DAUGHTER PREFERENCE

I test my evolutionary psychological theory of son-daughter preference at two different levels of aggregation. I first test it at the micro level to see if the psychological mechanism posited by the Trivers-Willard (1973) hypothesis is operative and wealthier people, both by the absolute and relative standards, indeed prefer sons to daughters. I then test it at the macro level to ascertain whether the correspondent cultural values and norms about son-daughter preference truly emerge as the aggregation of individual preferences for sons or daughters.

THE MICRO LEVEL

Data. I use the third (1995 to 1997) wave of the World Values Survey (WVS; Inglehart, Basañez, & Moreno, 1998). The WVS is a multiwave international survey of values and norms that includes large samples from numerous nations and regions. The appendix presents the definitions, means, standard deviations, and number of cases for all variables used in the empirical analyses both at the micro and macro levels.

Dependent variable. In the third (and no other) wave of the WVS, the researchers asked the question, "If you were to have only one child, would you rather have it be a boy or a girl?" The respondents chose from two alternative, forced choices (0 = girl, 1 = boy). I use this binary variable as an indicator of individuals' preference for sons or daughters in my logistic regression equation. Some respondents volunteered a third option, such as "it makes no difference." I exclude all respondents who did not choose one or the other of forced options.[2] The final sample for estimation include 38,969 respondents from 46 different nations and regions.

Independent variables. For the measure of individuals' absolute level of wealth, I use their nation's per capita income (World Bank, 2002, pp. 18-21, Table 1.1). I impose the same level of absolute wealth on all respondents in the same nation. For the measure of relative wealth, I use the individuals' income decile from the WVS.

The deciles are constructed separately for each nation to take account of a different level and distribution of income in it.

Control variables. To make sure that my measure of relative wealth capture the individuals' material resources, rather than being confounded with correlates of income (such as education), I control for individuals' level of education. Because married and unmarried respondents might have different desires and plans for children, especially in societies where being married is an absolute prerequisite for parenthood, I control for respondents' marital status (1 = currently married, 0 = otherwise). Finally, to control for all the unmeasured heterogeneity between nations apart from their absolute and relative levels of wealth, especially for important social structural factors, such as the social welfare system for the elderly, laws regarding primogeniture and inheritance, and pro- or antinatal government policies (such as China's one-child policy), I enter the nation variable as a categorical variable in my logistic regression equation. Entering a variable with k values as a categorical variable in a logistic regression equation is equivalent to entering $k - 1$ dummies in an ordinary least squares (OLS) regression equation.

Results. Table 1 (left column) shows the results of my logistic regression analysis. Controlling for relative wealth, education, and marital status of the respondents, the absolute level of wealth (measured by per capita income) has a very strong and significant ($p < .0001$) effect on son-daughter preference. Individuals who live in wealthier nations are far more likely to prefer a son to a daughter if they can have only one child. This is consistent with the evolved psychological mechanism posited by the Trivers-Willard (1973) hypothesis and the assumption that the human brain is adapted to the ancestral environment (Kanazawa, 2004).

In addition, the individuals' relative level of wealth (measured by their income decile within their own society) also has a significantly ($p = .0111$) positive effect on their son-daughter preference. In a given society, those with greater incomes are more likely to prefer sons to daughters, and those with less income are more likely to prefer daughters to sons, precisely as predicted by the Trivers-Willard (1973) hypothesis.

My analysis of the WVS data therefore seems to support the microfoundation of my evolutionary psychological theory of son-daughter preference, which is based on the psychological mecha-

TABLE 1
Determinants of Son-Daughter Preference

	Micro Level	Macro Level
Determinant	b SE Wald	b SE β
Absolute wealth	.0002**** (2.030^{-5}) 105.4938	1.0693^{-6}*** 3.1018^{-7} .3202
Relative wealth (inequality)	.0132* (.0052) 6.4522	-6.9291^{-4}*** 1.9544^{-4} −.3293
Constant	−1.6769 .1570	1.0606 .0088
–2 log likelihood	48,359.49	—
χ^2 (df = 49)	5,343.00****	—
% correctly classified	64.49	—
R^2	—	.3110
n	38,969	106

NOTE: The microlevel equation contains additional controls for education, marital status, and country.
*$p < .05$. **$p < .01$. ***$p < .001$. ****$p < .0001$.

nism originally posited by the Trivers-Willard (1973) hypothesis. Individuals who are better off, both absolutely and relatively, are more likely to prefer sons to daughters, and those who are worse off, both absolutely and relatively, are more likely to prefer daughters to sons. My next question is, do these individual preferences aggregate to correspondent cultural values and norms at the societal level?

THE MACRO LEVEL

Data and variables. I compile my own macrolevel data on nations from various published sources. My dependent variable is the sex ratio among infants ages 0 to 4 (United Nations, 1995). As I discuss above, I infer cultural values and norms of son preference from high infant sex ratios (as others have done before) and infer cultural values and norms of daughter preference from low infant

sex ratios (although no social scientists have done so before). I use gross domestic product (GDP) per capita as a national measure of absolute wealth (World Almanac, various years).

For my measure of relative wealth, I use the Gini coefficient (World Bank, 2001, pp. 70-73, Table 2.8). The Gini coefficient is a measure of inequality, not of relative wealth, and it varies from 0 (absolute equality) to 1.0 (maximum inequality). Given the mathematical formula for its computation, it is possible to have an equally high Gini coefficient by having either a few wealthy individuals and many poor individuals or many wealthy individuals and a few poor individuals. The mathematical formula is completely symmetrical and would produce the same coefficient for the two types of unequal society. However, in empirical reality, a high Gini coefficient always indicates a society in which there is a large number of poor people. Even though it is mathematically possible, there are no real societies in which there are many wealthy individuals and a few poor individuals. Thus, for all practical purposes, the Gini coefficient can be used as a measure of relative wealth in society: The higher the Gini coefficient, the more relatively poor individuals there are in society. Conversely, the lower the Gini coefficient, the fewer relatively poor individuals and, as a consequence, the more relatively wealthy individuals there are in the society.[3]

Results. Table 1 (right column) shows the results of my OLS regression analysis with nations as cases. It shows that the absolute level of wealth (measured by GDP per capita) has a significant ($p <$ .001, β = .3202) effect on cultural values and norms for sons or daughters at the societal level. It also shows that relative wealth (measured inversely by the Gini coefficient) also has a significant ($p < .001$, $\beta = -.3293$) effect on them. The more wealthy a nation is, both absolutely and relatively, the more the cultural values and norms favor sons. The less wealthy a nation is, both absolutely and relatively, the more the cultural values and norms favor daughters. This is the straightforward macrolevel implication of the Trivers-Willard (1973) hypothesis at the micro level.

Figures 4 and 5 depict the partial relationships between absolute wealth and son-daughter preference (Figure 4) and between relative wealth (inequality) and son-daughter preference (Figure 5). Figure 4 shows that controlling for relative wealth (inequality), more wealthy nations have higher infant sex ratios and preference for sons to daughters. Figure 5 shows that controlling for absolute wealth, nations with more poor individuals have lower infant sex
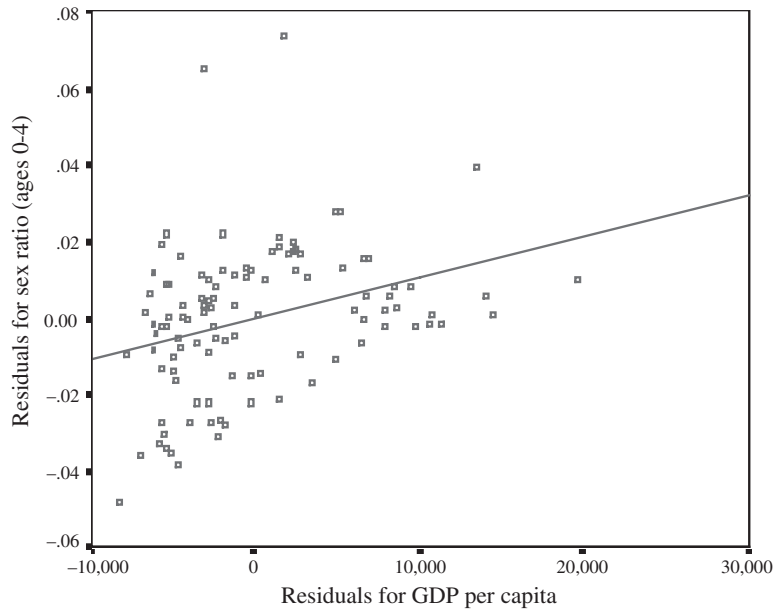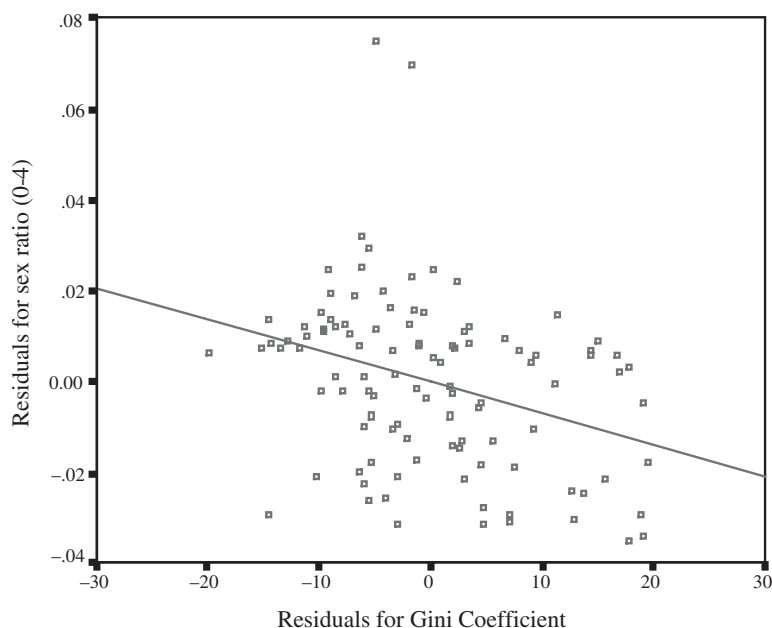
**Figure 4: Partial Correlation Between Wealth and Son-Daughter Prefer-
ence, Controlling for Inequality**
NOTE: The two extreme outliners on top are China (left) and South Korea (right).

ratios and preference for daughters to sons. The partial correla-
tions are both statistically significant ($p < .001$) and substantively
large ($\beta = .3202$ and $-.3293$), although China and South Korea
remain extreme outliers. Thus, although the coefficients are statis-
tically significant, even with these extreme outliers included in the
sample, my evolutionary psychological theory cannot claim to ex-
plain all the variance in the cultural values for sons and daughters.
(With China and South Korea excluded from the sample, all the
substantive conclusions remain the same, but R^2 increases from
.3110 to .3732.)

CONCLUSION

This article has attempted to make three separate contribu-
tions to the anthropological study of culture. Metatheoretically,

Figure 5: Partial Correlation Between Inequality and Son-Daughter Preference, Controlling for Wealth
NOTE: The two extreme outliers on top are South Korea (left) and China (right).

it has presented the evolutionary psychological perspective as the general theoretical framework within which to study culture, which can generate different deductive theories to explain the origins, constancy, and variations of cultures. Theoretically, it has constructed one specific evolutionary psychological theory of culture to explain why people in some societies prefer sons to daughters, whereas those in others prefer daughters to sons.

Social scientists have neglected to consider the possibility of systematic elimination of boys (so much so that whereas *female infanticide* means killing of girls, *male infanticide* means killing by fathers). I have pointed out that cross-culturally, male infanticide (killing of boys) is probably more widespread than female infanticide. Because there are always more poor people than rich people in every society (as I argue above), an evolutionary psychological theory of son-daughter preference would predict that male infanticide should be more commonplace than female infanticide, as the

data presented in Figure 2 seem to corroborate. I have explained both types of infanticide with the microfoundation of the Trivers-Willard (1973) hypothesis. This hypothesis predicts that wealthy families favor sons to daughters because sons from wealthy families are expected to have greater reproductive success than their sisters, whereas poor families favor daughters to sons because daughters from poor families are expected to have greater reproductive success than their brothers. This article has provided a micro-macro evolutionary psychological theory of son-daughter preference that explains cultural values and norms for sons or daughters in terms of the absolute and relative wealth of nations.

Empirically, this article has tested an evolutionary psychological theory of son-daughter preference both at the micro and macro levels. Consistent with the Trivers-Willard (1973) hypothesis, individuals throughout the world prefer sons to daughters as their absolute and relative levels of wealth increase. Consistent with the evolutionary psychological theory of son-daughter preference, the analysis shows that nations with higher levels of absolute wealth and smaller proportions of relatively poor families have higher infant sex ratios, indicating their citizens' preference for sons to daughters.

Appendix
Descriptive Statistics

Microlevel Analysis

Variable	Description	M	SD	n
Desired sex of child	"If you were to have only one child, would you rather have it be a boy or a girl?" 0 = girl, 1 = boy	.44	.50	47,085
Absolute wealth	Per capita income in U.S. dollars	8,789.66	10,973.50	47,085
Relative wealth	Household income decile, from 1 = lowest decile to 10 = highest decile	4.49	2.59	39,939
Education	Highest level of education, from 1 = no formal education to 9 = university-level education with degree	5.34	2.35	45,955
Marital status	1 = currently married, 0 = otherwise	.60	.49	47,020
Valid *n* (listwise)				38,969

Macrolevel Analysis

Variable	Description	M	SD	n
Sex ratio ages 0 to 4	Number of boys ages 0 to 4 divided by the number of girls ages 0 to 4	1.0387	.0234	143
Absolute wealth	GDP per capita in U.S. dollars	5,748.6194	6,428.0473	155
Relative wealth	Gini coefficient, from 0 = perfect equality to 1 = perfect inequality	.3941	.1041	108
Valid *n* (listwise)				106

NOTE: GDP = gross domestic product.

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Notes

1. Mace, Jordan, and Holden (2003) study worldwide variations in offspring sex ratio at birth and explain it in terms of genetic adaptation of local populations rather than the Trivers-Willard (1973) hypothesis. There are some problems with their phylogenetic comparative analysis, however. First, they arbitrarily exclude China and Korea from their analysis, arguing that their extremely high sex ratio must be because of artificial means of sex selection (p. 89), while including some European nations with nearly equally high sex ratios. Second, and more important, their own explanation is internally logically contradictory. They first rely on Fisher's principle of sex ratio selection—that the sex that imposes greater costs to parents will be produced in fewer numbers—to explain why humans produce slightly more boys than girls; because boys have greater infant mortality rates than girls, parents are expected to end up investing more into girls, and girls are thus more costly to parents than boys (p. 89). Then, on the next page (p. 90), Mace et al. argue that African parents have fewer sons than daughters because sons impose greater reproductive costs to African parents because of their larger size; they argue that lower sex ratios in Africa is an adaptive response to higher fertility rates. Thus, greater parental costs are invoked simultaneously to explain low sex ratios in sub-Saharan Africa and high sex ratios everywhere else.

2. Retaining the respondents who volunteered a third option ("it makes no difference") and performing an ordinal regression analysis with the dependent variable measured as 1 = girl, 2 = no difference, and 3 = boy produces virtually identical results to those reported from logistic regression. The coefficients are roughly the same size, but their significance levels are slightly lower because of a larger sample size.

3. There is a large number of individual variables that have been identified in prior research to affect the likelihood of conception of a boy or a girl, such as the timing and frequency of copulation, levels of testosterone and other hormones, parents' ages and their age difference, and recent experience of war, among others. (See James, 1987, and Grant, 1998, for comprehensive reviews.) However, these individual-level variables are quite difficult to measure in a macrolevel analysis of nations such as this one, and many individual-level variables, such as the timing of copulation, can safely be assumed to be distributed randomly across societies and thus cancel out each other in a macrolevel analysis. At any rate, the present analysis does not attempt to be comprehensive or exhaustive; it is instead meant to assess the partial effect of the Trivers-Willard (1973) effect on the offspring sex ratio.

References

Barkow, J. H. (1980). Biological evolution of culturally patterned behavior. In J. S. Lockard (Ed.), *The evolution of human social behavior* (pp. 277-296). New York: Elsevier.

Barkow, J. H. (1989). *Darwin, sex, and status: Biological approaches to mind and culture*. Toronto, Canada: University of Toronto Press.

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

Ben-Ner, A., & Putterman, L. (2000). On some implications of evolutionary psychology for the study of preferences and institutions. *Journal of Economic Behavior and Organization*, *43*, 91-99.

Betzig, L., & Weber, S. (1995). Presidents preferred sons. *Politics and the Life Sciences*, *14*, 61-64.

Boyd, R., & Richerson, P. J. (1985). *Culture and the evolutionary process*. Chicago: University of Chicago Press.

Boyd, R., & Richerson, P. J. (2005). *The origin and evolution of cultures*. Oxford, UK: Oxford University Press.

Buss, D. M. (1989). Sex differences in human mate preferences: Evolutionary hypotheses tested in 37 cultures. *Behavioral and Brain Sciences*, *12*, 1-49.

Buss, D. M. (1994). *The evolution of desire: Strategies of human mating*. New York: Basic Books.

Buss, D. M. (2004). *Evolutionary psychology: The new science of the mind* (2nd ed.). Boston: Allyn & Bacon.

Cartwright, J. (2000). *Evolution and human behavior: Darwinian perspectives on human nature*. Cambridge, MA: MIT Press.

Cosmides, L., & Tooby, J. (1992). Cognitive adaptations for social exchange. In J. H. Barkow, L. Cosmides, & J. Tooby (Eds.), *The adapted mind: Evolutionary psychology and the generation of culture* (pp. 163-228). New York: Oxford University Press.

Cronk, L. (1989). Low socioeconomic status and female-based parental investment: The Mukogodo example. *American Anthropologist*, *91*, 414-429.

Cronk, L. (1999). *That complex whole: Culture and the evolution of human behavior*. Boulder, CO: Westview.

Cronk, L. (2000). Female-biased parental investment and growth performance among the Mukogodo. In L. Cronk et al. (Eds.), *Adaptation and human behavior: An anthropological perspective* (pp. 203-221). Hawthorne, NY: Aldine.

Cronk, L. (2004). *From Mukogodo to Maasai: Ethnicity and cultural change in Kenya*. Boulder, CO: Westview.

Daly, M., & Wilson, M. (1988). *Homicide*. New York: De Gruyter.

Das Gupta, M. (1987). Selective discrimination against female children in rural Punjab, India. *Population and Development Review*, *13*, 77-100.

Dobzhansky, T. (1973). Nothing in biology makes sense except in the light of evolution. *American Biology Teacher*, *35*, 125-129.

Edlund, L. (1999). Son preference, sex ratios, and marriage patterns. *Journal of Political Economy*, *107*, 1275-1304.

Fessler, D. M. T. (2004). Shame in two cultures: Implications for evolutionary approaches. *Journal of Cognition and Culture*, *4*, 207-262.

Freese, J., & Powell, B. (1999). Sociobiology, status, and parental investment in sons and daughters: Testing the Trivers-Willard hypothesis. *American Journal of Sociology*, *106*, 1704-1743.

Gaulin, S. J. C., & Robbins, C. J. (1991). Trivers-Willard effect in contemporary north American society. *American Journal of Physical Anthropology*, *85*, 61-69.

Grant, V. J. (1998). *Maternal personality, evolution, and the sex ratio: Do mothers control the sex of the infant?* London: Routledge.

Harris, M. (1974). *Cows, pigs, wars, and witches: The riddles of culture*. New York: Random House.

Harris, M. (1977). *Cannibals and kings: The origins of cultures*. New York: Random House.

Homans, G. C. (1950). *The human group*. New York: Harcourt Brace.

Inglehart, R., Basañez, M., & Moreno, A. (1998). *Human values and beliefs: A cross-cultural sourcebook*. Ann Arbor: University of Michigan Press.

James, W. H. (1987). The human sex ratio. Part 1: A review of the literature. *Human Biology*, *59*, 721-752.

Kanazawa, S. (2001a). De gustibus *est* disputandum. *Social Forces*, *79*, 1131-1163.

Kanazawa, S. (2001b). Why father absence might precipitate early menarche: The role of polygyny. *Evolution and Human Behavior*, *22*, 329-334.

Kanazawa, S. (2001c). Why we love our children. *American Journal of Sociology*, *106*, 1761-1776.

Kanazawa, S. (2004). The Savanna Principle. *Managerial and Decision Economics*, *25*, 41-54.

Kanazawa, S. (2005a). *Beautiful women have more daughters: A further implication of the generalized Trivers-Willard hypothesis (gTWH)*. Unpublished manuscript, London School of Economics and Political Science. Interdisciplinary Institute of Management.

Kanazawa, S. (2005b). Big and tall parents have more sons: Further generalizations of the Trivers-Willard hypothesis. *Journal of Theoretical Biology*, *235*, 583-590.

Kanazawa, S. (in press). Violent men have more sons: Further evidence for the generalized Trivers-Willard hypothesis (gTWH). *Journal of Theoretical Biology*.

Kanazawa, S., & Still, M. C. (1999). Why monogamy? *Social Forces*, *78*, 25-50.

Kanazawa, S., & Still, M. C. (2001). The emergence of marriage norms: An evolutionary psychological perspective. In M. Hechter & K.-D. Opp (Eds.), *Social norms* (pp. 274-304). New York: Russell Sage.

Kanazawa, S., & Vandermassen, G. (2005). Engineers have more sons, nurses have more daughters: An evolutionary psychological extension of Baron-Cohen's extreme male brain theory of autism and its empirical implications. *Journal of Theoretical Biology*, *233*, 589-599.

Keller, M. C., Nesse, R. M., & Hofferth, S. (2001). The Trivers-Willard hypothesis of parental investment: No effect in the contemporary United States. *Evolution and Human Behavior*, *22*, 343-360.

Knight, J. (1992). *Institutions and social conflict*. Cambridge, UK: Cambridge University Press.

Koziel, S., & Ulijaszek, S. J. (2001). Waiting for Trivers and Willard: Do the rich really favor sons? *American Journal of Physical Anthropology*, *115*, 71-79.

Low, B. S. (1989). Cross-cultural patterns in the training of children: An evolutionary perspective. *Journal of Comparative Psychology*, *103*, 311-319.

Low, B. S. (2000). *Why sex matters: A Darwinian look at human behavior*. Princeton, NJ: Princeton University Press.

Mace, R., Jordan, F., & Holden, C. (2003). Testing evolutionary hypotheses about human biological adaptation using cross-cultural comparison. *Comparative Biochemistry and Physiology: Part A*, *136*, 85-94.

Moore, J. H. (1990). The reproductive success of Cheyenne war chiefs: A contrary case to Chagnon's Yanomamo. *Current Anthropology*, *31*, 322-330.

Mueller, U. (1993). Social status and sex. *Nature*, *363*, 490.

Park, C.-B., & Cho, N.-H. (1995). Consequences of son preference in a low-fertility society: Imbalance of the sex ratio at birth in Korea. *Population and Development Review*, *21*, 59-84.

Richerson, P. J., & Boyd, R. (2005). *Not by genes alone: How culture transformed human evolution*. Chicago: University of Chicago Press.

Rodman, P. S. (1999). Whither primatology? The place of primates in contemporary anthropology. *Annual Review of Anthropology*, *28*, 311-339.

Rosenzweig, M. R., & Schultz, T. P. (1982). Market opportunities, genetic endowments, and intrafamily resource distribution: Child survival in rural India. *American Economic Review*, *72*, 803-815.

Sen, A. (1992). *Inequality reexamined*. Cambridge, MA: Harvard University Press.

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

Trivers, R. L., & Willard, D. E. (1973). Natural selection of parental ability to vary the sex ratio of offspring. *Science*, *179*, 90-92.

Tuljapurkar, S., Li, N., & Feldman, M. W. (1995). High sex ratios in China's future. *Science*, *267*, 874-876.

United Nations. (1995). *The sex and age distribution of the world populations: The 1994 revision*. New York: Author.

Voland, E. (1984). Human sex-ratio manipulation: Historical data from a German parish. *Journal of Human Evolution*, *13*, 99-107.

World Almanac. (Various years). *The world almanac and book of facts*. Mahwah, NJ: Author.

World Bank. (2001). *World development indicators 2001*. Washington, DC: Author.

World Bank. (2002). *World development indicators 2002*. Washington, DC: Author.

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