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Abstract

Alexander (1987; Alexander et al. 1979), Betzig (1986), and MacDonald (1990) variously argue that monogamy is the result of a compromise among men after the advent of democracy whereby wealthy, powerful men receive political support from poor men in exchange for giving up their multiple wives. We advance an alternative theory and aver that the institution of marriage spontaneously emerges out of women's individual choices to marry polygynously or monogamously. If resource inequality among men is great, women choose to marry polygynously and the polygynous institution of marriage emerges. If resource inequality among men is small, women choose to marry monogamously and the monogamous institution of marriage emerges. The theory explains the historical shift from polygyny to monogamy as a result of the gradual decline of inequality among men. Computer simulations uphold the internal logical consistency of the theory, and the analysis of cross-cultural data from a large number of countries strongly supports our female choice theory and offers no support for the male compromise theory.

Why are marriages in some societies monogamous while those in others are polygynous? What accounts for the gradual historical shift from polygyny to monogamy in the course of human civilization? What explains the particular form the institution of marriage takes in a given society or a given time in history?[1]

Despite the central importance of marriage and the family in sociology, there has been no sociological theory of the institution of marriage that addresses these questions. The 915-page tome *Handbook of Marriage and the Family* (Sussman & Steinmetz 1987) contains very little discussion of monogamy versus polygyny, and none of its 30 chapters (nor any of their sections) is devoted to the cross-cultural or historical variations in the mating system. One must therefore look to neighboring disciplines for a theory of the institution of marriage.

In economics, Becker (1991) has pioneered the application of microeconomic models to the study of marriage and the family. In his discussion of monogamy and polygyny (1991), he makes an explicit analogy between the household and the firm. As in the firm, household members receive "incomes" according to their marginal contributions toward the "output." Children are the primary output of the household. Since women make greater marginal contribution than men toward the production and care of children, households with more women would have higher "productivity" than those with only one woman, thereby encouraging polygynous marriages. In the course of history, however, with industrialization and urbanization, households have greatly reduced their demand for *quantity* of children and correspondingly increased their demand for *quality* of children. Becker (1991) notes that "since the marginal contribution of men to quality is much greater than to quantity, our analysis predicts correctly that the incidence of polygyny has declined substantially over time" (95).

In anthropology, Melotti (1981) notes that there has been a gradual shift over human evolutionary history from promiscuity to polygyny to monogamy. He points out that the average coefficient of relatedness (r: the proportion of genes that two individuals share) among children of promiscuous unions ($0 \leq r \leq .5$) is smaller than that among children of polygynous unions ($.25 \leq r \leq .5$), which in turn is smaller than that among children of monogamous unions ($r = .5$). Altruism among children within the monogamous family is therefore evolutionarily more beneficial than altruism among children within the polygynous family (because it benefits others who are more closely related to the altruist), which in turn is evolutionarily more beneficial than altruism among children of promiscuous unions. Melotti contends that this is why the monogamous family was evolutionarily selected over time. However, Melotti's theory of the origin of the family runs into logical problems on its own evolutionary grounds. Since humans (and their primate ancestors) have always been altruistic toward their kin through millions of years of their evolutionary history, Melotti's theory cannot explain why polygyny was widespread until a few thousand years ago or why many peoples still practice polygyny today. Evolutionary theory and evidence also suggests that humans have always had pair bonds (a man and a woman raising their children together), whether monogamously or polygynously (Ridley 1993). They were therefore never completely promiscuous (Murdock 1949).

In evolutionary biology and anthropology, Alexander (1987; Alexander et al. 1979), Betzig (1986), and MacDonald (1990) argue that monogamy is a compromise or concession that upper-class men make to lower-class men in exchange for their political support under democracy. In the next section, we will discuss this male compromise theory (our appellation) of monogamy and point out some of its problems. We will then present an alternative female choice theory, which begins with some of the same assumptions as the male compromise theory but argues that marrying monogamously or polygynously is a choice that women (and their families or clans) make in the face of varying degrees of resource inequalities among men.[2] We will then conduct a series of computer simulations to test the internal logical consistency of our theory. Finally, we will test the competing hypotheses derived from these two theories of marriage institution with international data from a large number of countries.

The Male Compromise Theory of Monogamy

For the purpose of illustration, Wright (1994) asks us to imagine a society composed of 1,000 men and 1,000 women. Further, these men and women are rank-ordered in terms of their desirability as potential mates. England and Farkas (1986) propose the D scale (for Desirability) as a singular dimension on which men and women can be ranked and evaluated as potential mates and suggest that the D scale for women measures their physical attractiveness and that for men measures their earning capacity. There is by now evolutionary theory and evidence that men indeed value youth and physical attractiveness in women and women value wealth and status in men, and that this is largely invariant both historically (Buss & Barnes 1986; Hill 1945; Hudson & Henze 1969; McGinnis 1958) and cross-culturally (Buss 1989, 1994).[3] However, Wright's illustration works regardless of the nature of the underlying dimension as long as the men and women are uniquely and unambiguously ranked.

Assume strict monogamy. If the marriage market functions efficiently, then Man #1 (the most desirable man in this society) marries Woman #1 (the most desirable woman in this society), Man #2 marries Woman #2, and so on down to Man #1,000 (the least desirable man) marrying Woman #1,000 (the least desirable woman). Even if there are minor glitches in the marriage market and the matching is not perfect, Wright's point is that, as long as the institution of marriage prescribes monogamy, each man (even the least desirable) is guaranteed a wife.

Now introduce polygyny. Then, assume that Woman #400 decides to leave Man #400 and chooses to become the second wife of Man #40. If one-half share of Man #40 is better than a whole of Man #400 (for instance, if Man #40 is more than twice as wealthy as Man #400), then Woman #400 would be better off as the

second wife of Man #40 than being the first and sole wife of Man #400. So she decides to marry polygynously.

Now there is a vacancy in the wife market, and Women #401-1,000 move up one notch each: Woman #401 marries Man #400, Woman #402 marries Man #401, and Woman #1,000 marries Man #999. Man #1,000 now remains wifeless. Thus, after the introduction of polygyny,

> one woman (#400) is greatly better off,
> 600 women (#401-1,000) are slightly better off,
> one woman (#40) is greatly worse off, because she now has to share
>   her husband with Woman #400,
> one man (#40) is somewhat better off, for having an additional wife,
> 600 men (#400-999) are slightly worse off, and
> one man (#1,000) is greatly worse off.

Wright (1994) therefore reaches a somewhat counterintuitive conclusion: *Most women are materially better off, and most men are reproductively worse off, under polygyny.* Economists (Becker 1974; Grossbard 1978, 1980) have earlier reached the same conclusion. The value of any commodity in microeconomics is a function of supply and demand. Polygyny allows some men to monopolize women and makes women scarce. It therefore decreases the supply of women relative to the demand for them and increases their value. The reverse holds true for men under polygyny.

Now what explains the gradual historical shift from polygyny to monogamy? Alexander (1987; Alexander et al. 1979), Betzig (1986) and MacDonald (1990) variously argue that wealthy men have abolished polygyny and instituted monogamy in order to placate poor men, who would be wifeless under polygyny. While all three of these evolutionary scientists point to a link between democracy and monogamy, their theories are subtly different in their details. We will briefly discuss their theories of monogamy in turn.

ALEXANDER

Alexander (1987; Alexander et al. 1979) makes a distinction between ecologically imposed and socially imposed monogamy. *Ecologically imposed monogamy* occurs when the environmental conditions are such that "individual men are typically unable to gain by attempting to provide for offspring of more than one wife" (Alexander et al. 1979:418-19). (Note the assumption of male choice inherent in this definition.) *Socially imposed monogamy,* which is unique to humans, occurs when laws and rules prohibit polygyny and prescribe monogamy. Alexander argues that these laws are designed "to regulate the reproductive striving of individuals and subgroups within societies, in the interest of preserving unity in the larger group. Because of the importance of mate competition, socially imposed monogamy

exemplifies the essence of societal laws — the restricting of the ability of societal members to exercise fully their different capacities for reproductive competition and success, and enhancing the security and potential reproductive success of the individuals who collaborate to conceive and enforce the laws" (Alexander et al. 1979:423). These laws therefore "(1) guarantee to every individual the right to produce and rear its own offspring and (2) restrict the amount and likelihood of variation in reproduction among families" (Alexander 1987:72). These laws and hence socially imposed monogamy are therefore more likely under "the rule of law" (characteristic of modern democracy) than under "the rule of men" (despotism) (Betzig 1986). Alexander (1987) notes that socially imposed monogamy tends to coincide with "the vote, representative government, elected (not hereditarily succeeding) officials, and universal education" (72).

BETZIG

In her comprehensive study of polygyny among despotic political leaders, Betzig (1986) convincingly demonstrates that the extent and complexity of political hierarchy increase the despotic power of political leaders, which in turn increases their reproductive success through access to multiple mates. In her concluding chapter, however, Betzig (1986) notes: "At some point in social evolution, however, a watershed is crossed; both despotism and differential reproduction apparently fall off as hierarchical organization continues to grow more complex. Only one condition favors the adaptive sacrifice of an immediate reproductive advantage at any level of selection, and that is one which yields a long-term reproductive gain" (103). Betzig speculates that the division of labor and economic specialization make the political leaders dependent on the specialists; the survival and continuation of their regimes, especially in times of war, depend on the subjects' cooperation. Under such circumstances, the political leaders might choose to reward the heroic cooperation of the subjects by giving up some of their sexual privileges and sharing some of their wives and concubines with the subjects. In essence, the political leaders sacrifice their short-term reproductive gains (the exclusive access to the most desirable women) in order to increase their long-term reproductive gains (the continuation of their political dynasty). Betzig speculates that this might be why monogamy increases with economic development under democracy. It is important to note that, while Betzig presents her thesis in a chapter titled "Democracy," and democracy does correlate with economic development and specialization (Lipset 1959), what necessitates the compromise between powerful and powerless men in Betzig's view is economic specialization and division of labor (characterized by the Durkheimian organic solidarity), rather than democracy per se.

MACDONALD

Unlike Alexander and Betzig, MacDonald (1990) eschews a general evolutionary theory of socially imposed monogamy. His "nondeterministic, contextual perspective" instead posits that the environmental and ecological factors cannot entirely explain whether the monogamous institution of marriage emerges in a given society. The outcome crucially depends on a large number of internal political processes. Chief among these are egalitarian ideologies and social controls. "The social controls and their supporting ideology are . . . the result of the institutionalization of egalitarian ideology and social controls as a result of internal pro-egalitarian political processes serving the interests of unwealthy males, as apparently occurred during the development of Christianity in Rome" (MacDonald 1990:221). In MacDonald's view, the ideologies and social controls that are conducive to the emergence and maintenance of socially imposed monogamy often occur under democracy. For instance, in ancient Sparta, where the institution of marriage was predominantly monogamous,

> although the state was a monarchy, there were a number of institutional controls on the kings, such as the institution of the ephorate, which dispersed political power so that despotism by one individual was not characteristic of Sparta. The legal system attributed to Lycurgus diminished the power of the kings and increased the power of the assembly of citizens, so that the kings became ordinary members of the Council except for their commanding role during war. In the *agoge* and in the Assembly all Spartans were equal before the state, regardless of family lineage and material wealth; and in the constitution, however strong the powers of the *Gerousia* [Council] might be, their voice was decisive in the cardinal issues of election and ratification. (207)

MacDonald argues that political egalitarianism (democracy) is one of the ideologies and social controls that foster the maintenance of sexual egalitarianism (monogamy).

Thus, while Alexander, Betzig, and MacDonald posit different mechanisms for the emergence and the maintenance of socially imposed monogamy, they all argue that democracy plays a crucial role.[4] Under democracy and with the male universal suffrage, the wealthy political leaders (who were most likely polygynous) had to give up their privilege of having multiple wives in exchange for the votes of poor men, who would not vote for the wealthy polygynists when they themselves would be wifeless as a result (Ridley 1993). Thus, in this theory, monogamy is the compromise struck (if implicitly) between wealthy (more desirable) and poor (less desirable) men in the face of democracy and male universal suffrage. However, the male compromise theory "remains only a thesis" (Wright 1994:98) and has not been tested empirically.[5]

If monogamy replaces polygyny as a compromise among men in the face of democracy, then one can deduce the following hypothesis from the male compromise theory:

> *Democracy hypothesis*: The level of democracy has a negative effect on the level of polygyny in society.

It is interesting that, in 1903, decades before the birth of modern evolutionary biology, George Bernard Shaw succinctly captured its essence in his "Maxims for Revolutionists."

> Any marriage system which condemns a majority of the population to celibacy will be violently wrecked on the pretext that it outrages morality.
>
> Polygamy, when tried under modern democratic conditions, as by the Mormons, is wrecked by the revolt of the mass of inferior men who are condemned to celibacy by it; for the maternal instinct leads a woman to prefer a tenth share in a first rate man to the exclusive possession of a third rate one.[6] (Shaw 1957:254)

The male compromise theory, however, encounters a minor logical problem: What about women? Mating is an instance of intersexual selection, in which a male and a female choose each other. In every species in which the female makes greater parental investment in the offspring than the male (such as human beings), however, the female is more choosy about mating (because she has more to lose by making a mistake) and therefore all mating decisions are essentially left up to the female (Trivers 1972). Mating becomes a female choice among these species; it happens when the female consents to it. It therefore stands to reason that, among humans, women (or their families and clans) exercise greater control than men over whether a given marriage takes place. In her analysis of 133 societies from the Human Relations Area Files, Small (1992) notes: "Often marriages are arranged, but there is no reason to assume that the interests of the females in an arranged marriage are necessarily different from the interests of the families involved. . . . Thus, 'arranged' does not necessarily mean the woman is forced or coerced" (146, 148). In his comparative study of human mating, Buss (1994) maintains: "Even where matings are arranged by parents and kin, however, women often exert considerable influence over their sexual and marital decisions by manipulating their parents, carrying on clandestine affairs, defying their parents' wishes, and sometimes eloping" (91). Further, the genetic interest of the woman's male kin (her father and brothers) is largely (although not entirely) coincident with the woman's own genetic interest.

There is another problem with the male compromise theory. While polygyny favors women and hurts men in general, sons of wealthy political leaders are the few men who would benefit from polygyny (because they would inherit their fathers' wealth and power and be more likely to be polygynous). It therefore

seems unlikely, given the principles of evolutionary biology, for the wealthy political leaders to diminish their own and their sons' evolutionary prospects by substituting monogamy for polygyny, especially since wealthy political leaders are more likely to have sons than daughters.[7]

An Alternative Theory: Monogamy as a Female Choice

We concur with Becker (1974), Grossbard (1978), Ridley (1993), and Wright (1994) that most women are materially better off under polygyny than under monogamy. However, there is one very important scope condition for this statement, which remains implicit in the male compromise theory: resource inequality among men. Women benefit from polygyny only when there is extreme resource inequality among men. To use Shaw's colorful language, women should prefer to marry polygynously *only if* a tenth share in a first-rate man is greater than the exclusive possession of the third-rate one; in other words, only if the first-rate man is more than 10 times as desirable or wealthy as the third-rate one. If not, then a woman is better off marrying the third-rate man monogamously than marrying the first-rate one polygynously.[8]

Assume that there is no institution of marriage in society in the form of a socially prescribed system of mating and a woman is contemplating marriage. She can choose to marry polygynously and become the second or third wife of a wealthy man, or she can choose to marry monogamously and become the first and sole wife of a less wealthy man. Most women should choose to marry polygynously if there is great resource inequality among men, and they should choose to marry monogamously if there is less resource inequality among men. If most women in society choose to marry polygynously, then the society would have de facto polygyny as its institution of marriage. If most women in society choose to marry monogamously, then the society would have de facto monogamy as its institution of marriage. We therefore propose our first hypothesis.

> *Inequality hypothesis:* The extent of resource inequality among men has a positive effect on the level of polygyny in society. (Grossbard 1980, proposition 5)

In essence, our inequality hypothesis is an extension to human society of the polygyny threshold model (PTM) in biology, originally formulated to explain the breeding systems of avian species (Davies 1989; Orians 1969; Searcy & Yasukawa 1989; Verner 1964; Verner & Wilson 1966). The PTM predicts that polygynous breeding systems are more likely to occur when males are heterogeneous in the quality of their territories. The difference between the territorial quality of a polygynous male and that of a monogamous male — a "premium" that allows a

male bird to become polygynous — is called the polygyny threshold. The PTM has previously been applied to a human society (Borgerhoff Mulder 1990).

Further, if a society's level of polygyny is the outcome of a large number of women making their own marriage decisions, then it should also be a function of how much power women have over their own marriage. Specifically, increasing women's power should result in more polygynous marriages if men's resource inequality is great, but it should result in more monogamous marriages if men's resource inequality is small. In the face of extreme resource inequality among men, more powerful women should choose to marry polygynously; in the face of less resource inequality among men, the same women should choose to marry monogamously. We thus propose our second hypothesis.

> *Female power hypothesis*: The extent of resource inequality among men and the level of women's power have a *positive* interaction effect on the level of polygyny in society.

Unlike the proponents of the male compromise theory, who believe that institutions are imposed on society top-down by its political leaders, we believe that institutions emerge spontaneously bottom-up as an aggregation of individual choices among a large number of people in society. Figure 1 represents our theory of the marriage institution in a micro-macro model ("the Coleman boat") (Coleman 1990; Hechter & Kanazawa 1997). At the macro level, the society has given levels of resource inequality among men and of women's power, both of which are exogenous to the model. These macro structural factors set constraints within which women must make their decisions. Women have the (evolutionarily given) desire to maximize their children's welfare and choose to marry either monogamously or polygynously according to the societal conditions (set by the two exogenous macro factors). Separate and independent individual decisions of thousands or millions of women to marry either monogamously or polygynously will aggregate at the societal level to a particular type of institution of marriage (monogamy or polygyny). Of course, once the institution is in place, it will independently affect the future marriage choices of women. Our theory explains only the original emergence of the marriage institution.

Our theory therefore explains the historical shift from polygyny to monogamy as a function of resource inequality among men (which remains exogenous to our theory). As men have become more equal in their wealth and status over time, more women have chosen to marry monogamously because it was more beneficial for them to do so. The separate and independent decisions of a large number of women to marry monogamously rather than polygynously have brought about the institutional change from polygyny to monogamy.

FIGURE 1: Micro-Macro Model of Marriage Institution
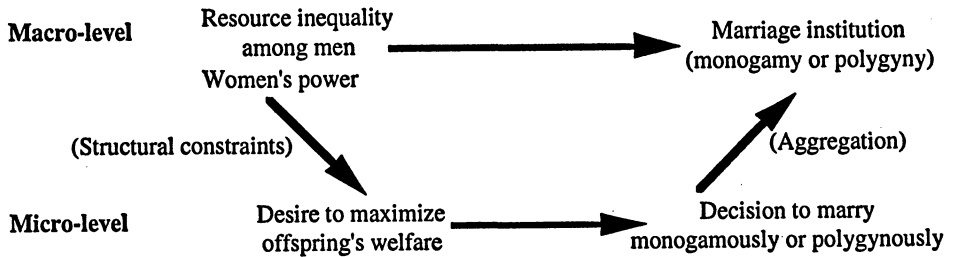
Computer Simulations

We have first conducted computer simulations to test the logical consistency of our theory of marriage institution. The initial assumptions for the simulations are as follows:

1. The society consists of m men and f women. (Always $m = f$.)
2. There are r resources distributed among m men. The society has a level of resource inequality measured by the Gini coefficient

   $$G = \frac{1}{2*m*(m-1)*\bar{x}} \sum_{i=1}^{m} \sum_{j=1}^{m} |x_i - x_j|,$$ where x_i is the number of resources

   i possesses ($\sum x_i = r$) (Foster 1985). $G = 0.0$ indicates perfect equality (each man possesses the same number of resources r/m), and $G = 1.0$ indicates maximum inequality (one man possesses all r resources in society).
3. A woman randomly meets k men and marries the one who has the largest number of resources. A man i's resources are x_i if he is not

   already married, and $\frac{x_i}{w+1}$ if he is already married and has w wives. (In

   other words, a woman decides whom to marry regardless of whether the man is already married; she does so strictly on the basis of how many resources he has available to her subsequent to her marriage to him.)
4. The simulation ends when all women are married.

   Figure 2 shows the relationship between resource inequality (measured by the Gini coefficient) and the proportion of all marriages that are polygynous. (The

simulation results presented here assume $m = f = 500$ and $r = 10,000$, but the basic results are robust across all levels of $m = f$ and r.) As Figures 2a-2d show, there is a clear positive relationship between resource inequality and the extent of polygyny in society. The greater the resource inequality among men, the more polygynous the society. This relationship confirms the internal logical consistency of our inequality hypothesis.

In addition, Figure 2e shows what happens to the marriage institution when women do not make their marriage decisions on the basis of how many resources men have. As might be expected, the graph shows that the proportion of marriages that are polygynous remains around 37% regardless of the extent of resource inequality among men if women choose men randomly. Figure 2e therefore demonstrates that the behavioral assumption of resource maximization that we posit for women in our computer simulations is integral to the relationship between resource inequality and polygyny.[9]

Further, the positive relationship between inequality and polygyny is stronger as k (the number of men a woman meets) becomes larger. When $k = 2$ (women randomly meet two men to choose from), the proportion of marriages that are polygynous goes roughly from 24% when $G = 0.0$ to 42% when $G = 1.0$. However, when $k = 25$ (women randomly meet 25 men to choose from), the same proportion increases roughly from 3% when $G = 0.0$ to 85% when $G = 1.0$. There is therefore a clear positive interaction effect between G and k on polygyny. If we assume that the number of marriage opportunities a woman has generally increases with women's power in society, then our simulations also confirm the logical consistency of our female power hypothesis.

Our computer simulations therefore demonstrate that our alternative theory of marriage institution has internal logical consistency. We have yet to see, however, whether the empirical data actually support our theory.

Empirical Tests

We will test the two competing theories of the marriage institution (the male compromise theory and our alternative female choice theory) with international data. Since all evolutionary psychological theories invoke species-typical psychological mechanisms as part of their explanations (Buss 1995; Tooby & Cosmides 1990), they are best tested with cross-cultural data to see whether the hypotheses hold in all human societies. We have compiled the data from various published sources, and they contain 127 countries (even though, due to missing data and listwise deletion, all hypotheses are tested with smaller samples).

FIGURE 2: Relationship between Inequality and Polygyny
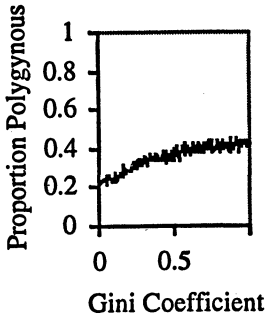
(a) Mating opportunities = 2
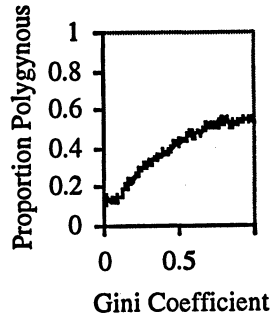
(b) Mating opportunities = 4

(c) Mating opportunities = 10

(d) Mating opportunities = 25

(e) Random mating

DEPENDENT VARIABLE

Polygyny

In order to measure the level of polygyny for each *country*, we first determine the level of polygyny for each *ethnic and cultural group* within the country. The *Encyclopedia of World Cultures* (Levinson 1991-95) contains detailed descriptions of social and cult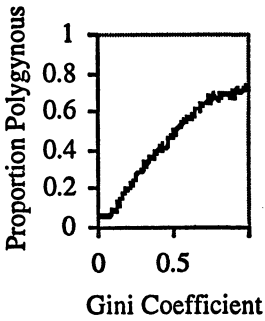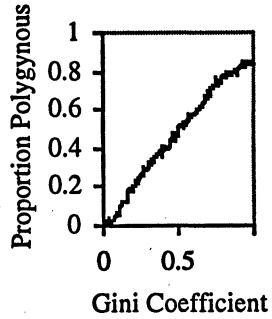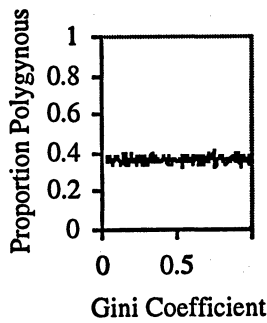ural practices of all known cultural groups in the world. Their marriage systems are coded on the following four-point scale:

> 0 = monogamy is the rule and is widespread
> 1 = monogamy is the rule but some polygyny occurs
> 2 = polygyny is the rule or cultural ideal but is limited in practice
> 3 = polygyny is the rule and is widespread

This scale is very similar to the five-point scale that White (1988) proposes and that is commonly used in cultural anthropology (White & Burton 1988). Unlike Betzig's (1982) four-point scale, which measures the extent of polygyny among political leaders, our scale (like White's) measures the practice of polygyny among the general population.

We then multiply the score for each cultural group by its relative size within the population of the country. The weighted sum of such scores is the polygyny score for the country. For instance, in Turkey, there are two ethnic groups: the Turks and the Kurds. According to the *Encyclopedia of World Cultures*, the Turks are strictly monogamous (polygyny score = 0), whereas among the Kurds polygyny is the rule even though its practice is limited (polygyny score = 2) (vol. 9:375,176). The Turks represent 80% of the population in Turkey, and the Kurds the remaining 20% (World Almanac 1996). Thus we compute the polygyny score for the country of Turkey as follows: $0*.80 + 2*.20 = .40$ (on the scale of 0 to 3).[10]

INDEPENDENT VARIABLES

Democracy

We use Bollen's (1980, 1993) index of political democracy as the measure of the level of democracy in a country. Bollen performs a confirmatory factor analysis to derive the index from many empirical indicators for a large number of countries at three time periods: 1960, 1965, and 1980. We use all three indices to test the democracy hypothesis from the male compromise theory. Bollen's index of political democracy is widely used in political science and sociology as a valid and reliable measure of democracy (Muller 1995; Simpson 1990). The index varies from 0 (complete authoritarianism) to 100 (complete democracy).

Resource Inequality

We use four measures of resource inequality:

1. Personal Gini: Gini coefficient of income inequality among individuals or households (World Bank 1997a)
2. Sectoral Gini: Gini coefficient that measures the inequality of economic productivity across three large economic sectors (agricultural, industrial, and service) (Taylor & Jodice 1983). The sectoral Gini is a far cruder measure of resource inequality among men than the personal Gini, but it has the advantage of being available for a larger number of countries. Its use therefore allows us to include many more countries in our analysis.
3. The percentage share of income or consumption by the top 10% (World Bank 1997b)
4. The percentage share of income or consumption by the top 20% (World Bank 1997b)

Women's Power

We use two indicators of women's power in society:

1. The percentage of female pupils in secondary schools (World Bank 1997a). Education, especially in less developed countries, enhances women's ability to exercise their rights and responsibilities (King & Hill 1993) and thereby increases their power. Abdelrahman's (1991) study suggests that more-educated women in Sudan exert greater control over the timing of their marriage, the choice of their spouse, and the location of their postnuptial residence. Niraula and Morgan (1994) show that women's education increases their autonomy in one village in Nepal.
2. The percentage of women who marry after the age of 20 (United Nations 1997). We assume that women who marry at an older age exercise greater control over their marriage decisions than child or teenage brides. Thus the proportion of women in society who postpone their marriage until after their childhood and adolescence measures women's power over their decisions regarding their spouse, the timing, and other circumstances surrounding their marriage.

Results

Table 1 presents the results of regression analysis to determine the relative effects of democracy and resource inequality on polygyny. Since there are three measures

TABLE 1: The Effects of Democracy and Inequality on Polygyny

	A. Democracy 1960 Measures of Inequality			
	Personal Gini (1)	Sectoral Gini (2)	Top 10% (3)	Top 20% (4)
Constant	−.1402	.3932	−.8278	−1.5437
Democracy	.0099*	−.0023	−.0019	−.0024
	(.0048)	(.0034)	(.0028)	(.0029)
Inequality	.0156	.0266****	.0565****	.0539****
	(.0124)	(.0056)	(.0101)	(.0100)
R^2	.1903	.2886	.2829	.2689
N	56	84	83	83

	B. Democracy 1965 Measures of Inequality			
	Personal Gini (1)	Sectoral Gini (2)	Top 10% (3)	Top 20% (4)
Constant	−.0954	.8185	−.5878	−1.2793
Democracy	.0048	−.0062+	−.0036	−.0041
	(.0050)	(.0033)	(.0028)	(.0028)
Inequality	.0231+	.0216***	.0539****	.0515****
	(.0123)	(.0056)	(.0106)	(.0104)
R^2	.1252	.2733	.2444	.2364
N	60	91	89	89

	C. Democracy 1980 Measures of Inequality			
	Personal Gini (1)	Sectoral Gini (2)	Top 10% (3)	Top 20% (4)
Constant	−.0165	.5318	−.6427	−1.3308
Democracy	6.9734^{-4}	−.0031	−.0019	−.0024
	(.0041)	(.0027)	(.0025)	(.0025)
Inequality	.0273*	.0261****	.0537****	.0511****
	(.0108)	(.0057)	(.0107)	(.0103)
R^2	.1051	.2994	.2307	.2271
N	64	102	95	95

Note: Standard errors are in parentheses.

+ $p < .10$ * $p < .05$ ** $p < .01$ *** $p < .001$ **** $p < .0001$

of democracy and four measures of resource inequality, we estimate 12 equations to test the democracy and inequality hypotheses.

The democracy hypothesis is supported in only one of the 12 tests. The level of democracy has a significant ($p < .10$) negative effect (predicted by the male compromise theory) only when the measure of democracy is taken in 1965 and the measure of inequality is sectoral Gini (panel B, column 2). It is interesting that, in one case, the effect of democracy on polygyny is more highly significant ($p < .05$) *in the opposite direction* from that predicted by the male compromise theory. When the measure of democracy is taken in 1960 and the measure of resource inequality is personal Gini, democracy significantly *increases* the level of polygyny (panel A, column 1)! The effect of democracy on polygyny is nonsignificant in the other 10 tests.

The alternative inequality hypothesis derived from the female choice theory is supported in 11 of the 12 tests. When the measure of democracy is taken in 1960 and the measure of inequality is personal Gini, the effect of inequality has the right sign but is nonsignificant (panel A, column 1). In all other cases, however, the level of resource inequality significantly (often $p < .0001$) increases the level of polygyny. As our theory predicts, the greater the resource inequality among men, the more polygynous the society.

Our critics might argue, however, that the positive relationship between resource inequality and polygyny that we find in Table 1 is spurious. It is well known, for instance, that the level of economic development has a curvilinear (inverted-U) relationship with the extent of income inequality (Kuznets 1955). The critics might contend that economic development might account for the relationship, simultaneously decreasing the level of inequality (among societies higher on economic development) and the practice of polygyny (as the more developed societies move toward monogamy). We therefore estimate the same equations again, controlling for the level of economic development (measured by GDP per capita) (World Almanac 1996). In order to capture the curvilinear relationship between economic development and income inequality, we enter both GDP per capita and GDP per capita squared.

Further, Guttentag and Secord (1983) observe that the society's sex ratio has profound effects on numerous aspects of interaction between men and women, and South and Trent's (1988) empirical test in a cross-national analysis confirms the Guttentag-Secord theory. We therefore include a measure of a country's sex ratio in the equations as well. Following South and Trent (1988), we use the ratio of men aged 15-49 to women aged 15-49 for the measure of sex ratio. Table 2 presents the results.

The basic conclusions from Table 1 remain unchanged in Table 2. Once again, the inequality hypothesis is supported in 11 of the 12 tests. When the measure of democracy is taken in 1980 and the measure of inequality is personal Gini, the effect of inequality has the right sign but is nonsignificant ($p = .1334$) (panel C,

column 1). The level of inequality significantly increases the extent of polygyny in the other 11 equations.

The democracy hypothesis is now supported in none of the 12 tests; in no equation is the effect of democracy on polygyny significantly negative. Once again, in two of the 12 tests, the effect of democracy is significantly *positive*, contrary to the prediction of the male compromise theory (panel C, columns 3 and 4). Incidentally, the significantly negative effects of economic development on polygyny in many of the equations give empirical support to Betzig's (1986) theory that the economic division of labor (which highly correlates with economic development) reduces polygyny and increases monogamy. The measure of sex ratio also has a significant negative effect on polygyny. However, Table 2 demonstrates that the positive effect of resource inequality on polygyny remains significant even with controls for economic development and sex ratio.

Table 3 presents the results of our test of the female power hypothesis. While both inequality and women's power are in the equations as main terms (along with controls for economic development and sex ratio), the crucial test of the hypothesis is in the coefficient for the *interaction* term; the hypothesis predicts a significantly positive interaction effect of inequality and women's power on polygyny. The results presented in Table 3 indicate that the female power hypothesis is supported in seven out of the eight tests. When the measure of women's power is the proportion of women who marry after the age of 20 and the measure of inequality is personal Gini, the coefficient for the interaction term is positive but nonsignificant ($p = .1045$) (panel B, column 1). However, in all other cases, the interaction effects are significantly positive, as predicted by our female power hypothesis. It appears that, regardless of the measure of female power or resource inequality among men, increasing women's power increases polygyny in the face of greater resource inequality (when it benefits women to marry polygynously). However, increasing women's power decreases polygyny (and increases monogamy) in the face of relative resource equality (when it benefits women to marry monogamously). These findings are consistent with our prediction that women choose to marry polygynously or monogamously according to which choice benefits them and their offspring.

Conclusion

Why do some societies have a monogamous institution of marriage while others have a polygynous one? Alexander (1987; Alexander et al. 1979), Betzig (1986), and MacDonald (1990) variously argue that monogamy emerges as a compromise between powerful, wealthy men and powerless, poor men, whereby the former give up their multiple wives in exchange for the votes from the latter, and the latter give political support for the former in exchange for the guaranteed

TABLE 2: The Effects of Democracy and Inequality on Polygyny, Controlling for Economic Development

| | A. Democracy 1960 | | | |
| | Measures of Inequality | | | |
	Personal Gini (1)	Sectoral Gini (2)	Top 10% (3)	Top 20% (4)
Constant	9.2404	3.4334	7.5806	7.2214
Democracy	.0021	4.6360^{-4}	.0023	.0022
	(.0048)	(.0036)	(.0031)	(.0031)
Inequality	.0210+	.0211***	.0372***	.0353***
	(.0116)	(.0060)	(.0100)	(.0098)
Economic development	-4.6283^{-4}*	-4.4274^{-5}	-1.4793^{-4}**	-1.4729^{-4}**
	(1.9693^{-4})	(4.4500^{-5})	(4.4222^{-5})	(4.4451^{-5})
(Economic development)^2	4.4931^{-8}+	3.6591^{-10}	4.9871^{-9}*	4.8969^{-9}*
	(2.4767^{-8})	(2.0222^{-9})	(2.0891^{-9})	(2.0975^{-9})
Sex ratio	-8.3888*	-2.7968	-7.4828**	-7.5935**
	(3.1623)	(1.9407)	(2.6540)	(2.6647)
R^2	.4143	.3871	.5021	.4971
N	54	84	81	81

| | B. Democracy 1965 | | | |
| | Measures of Inequality | | | |
	Personal Gini (1)	Sectoral Gini (2)	Top 10% (3)	Top 20% (4)
Constant	9.1862	3.7054	7.0836	6.7060
Democracy	$-.0028$	$-.0022$	.0019	.0017
	(.0047)	(.0036)	(.0033)	(.0033)
Inequality	.0252*	.0169**	.0354**	.0333**
	(.0109)	(.0060)	(.0109)	(.0107)
Economic development	-5.4182^{-4}**	-3.2313^{-5}	-1.2248^{-4}*	-1.2034^{-4}*
	(1.8525^{-4})	(4.6992^{-5})	(4.7431^{-5})	(4.7704^{-5})
(Economic development)^2	5.3895^{-8}*	-2.7632^{-10}	3.7395^{-9}+	3.5926^{-9}
	(2.3855^{-8})	(2.1237^{-9})	(2.2252^{-9})	(2.2325^{-9})
Sex ratio	-8.1495*	-2.7540	-6.9108*	-6.9712*
	(3.0796)	(2.0093)	(2.8524)	(2.8656)
R^2	.4150	.3539	.4151	.4094
N	58	91	87	87

TABLE 2: The Effects of Democracy and Inequality on Polygyny, Controlling for Economic Development (Continued)

| | C. Democracy 1980 | | | |
| | Measures of Inequality | | | |
	Personal Gini (1)	Sectoral Gini (2)	Top 10% (3)	Top 20% (4)
Constant	9.5525	2.5713	7.9681	7.5315
Democracy	-5.8191^{-4}	.0014	.0057+	.0055+
	(.0035)	(.0029)	(.0029)	(.0029)
Inequality	.0145	.0214***	.0316**	.0299**
	(.0095)	(.0057)	(.0107)	(.0104)
Economic development	-5.6017^{-4}**	-5.7035^{-5}	-1.1645^{-4}*	-1.1578^{-4}*
	(1.6389^{-4})	(4.4588^{-5})	(4.6925^{-5})	(4.7050^{-5})
(Economic development)^2	5.4908^{-8}*	4.7286^{-10}	2.5943^{-9}	2.5313^{-9}
	(2.1582^{-8})	(2.0249^{-9})	(2.2047^{-9})	(2.2086^{-9})
Sex ratio	-8.1207**	-1.8199	-7.7169**	-7.6775**
	(3.0247)	(1.6861)	(2.8536)	(2.8665)
R^2	.4247	.3848	.4153	.4128
N	62	102	93	93

Note: Standard errors are in parentheses.

+ $p < .10$ * $p < .05$ ** $p < .01$ *** $p < .001$ **** $p < .0001$

opportunity for marriage. Our analysis of cross-cultural data from 127 countries contradicts their theory. The level of democracy has no effect at all on the level of polygyny in society.

It is important to note, however, that economic development, which we include in our equations as a control variable, has a negative effect on polygyny in most of our analyses. To the extent that economic development highly correlates with the division of labor and specialization, our results lend empirical support to Betzig's (1986) contention that economic division of labor increases monogamy. Betzig argues that economic division of labor and specialization make political leaders dependent on the specialists and that the former must therefore make concessions to the latter in the form of greater access to women. While our empirical analyses strongly suggest that democracy per se (as measured by Bollen's index of political democracy) has no effect on polygyny, it might be the case that economic division of labor significantly reduces polygyny (as Betzig speculates).

While concurring with the proponents of the male compromise theory that polygyny is beneficial to most women, we point out that this is true only if there is extreme resource inequality among men. We posit that, consistent with the pattern observed among other species in which the female makes a greater

TABLE 3: The Interactive Effect of Women's Power and Inequality on Polygyny

| | A. Percentage of Females among Secondary School Pupils | | | |
| | Measures of Inequality | | | |
	Personal Gini (1)	Sectoral Gini (2)	Top 10% (3)	Top 20% (4)
Constant	11.0792	3.2743	8.1607	8.8873
Inequality	−.0796+	−.0539*	−.0484	−.0473
	(.0455)	(.0268)	(.0524)	(.0497)
Women's power	−.0782+	−.0466*	−.0691+	−.0930+
	(.0390)	(.0225)	(.0361)	(.0493)
Interaction	*.0021**	*.0018***	*.0018+*	*.0017+*
	(9.1162^{-4})	(5.9518^{-4})	*(.0011)*	*(.0010)*
Economic development	-5.2429^{-4**}	-6.2755^{-5}	-1.3216^{-4*}	-1.3185^{-4*}
	(1.8114^{-4})	(4.7623^{-5})	(5.0193^{-5})	(5.0330^{-5})
(Economic development)²	5.0464^{-8*}	1.5645^{-9}	4.6587^{-9*}	4.5391^{-9*}
	(2.2683^{-8})	(2.1724^{-9})	(2.2612^{-9})	(2.2667^{-9})
Sex ratio	−6.1628*	−.4985	−4.7231*	−4.7631*
	(2.3326)	(.8522)	(1.9263)	(1.9353)
R^2	.4577	.4603	.5003	.4973
N	60	91	88	88

| | B. Percentage of Females Who Marry after Age 20 | | | |
| | Measures of Inequality | | | |
	Personal Gini (1)	Sectoral Gini (2)	Top 10% (3)	Top 20% (4)
Constant	7.0393	5.1586	4.3293	5.2825
Inequality	−.1078	−.1103*	−.1000	−.0930
	(.0802)	(.0461)	(.0803)	(.0762)
Women's power	−.0632	−.0642*	−.0605+	−.0802+
	(.0371)	(.0256)	(.0311)	(.0424)
Interaction	*.0016*	*.0015***	*.0016+*	*.0015+*
	(9.2928^{-4})	(5.3219^{-4})	(9.2655^{-4})	(8.7794^{-4})
Economic development	-6.2661^{-4**}	-6.7296^{-5}	-1.6172^{-4**}	-1.6354^{-4**}
	(2.0255^{-4})	(5.9123^{-5})	(5.3749^{-5})	(5.3440^{-5})
(Economic development)²	5.7774^{-8*}	2.6694^{-9}	6.1065^{-9**}	6.0657^{-9**}
	(2.4974^{-8})	(2.2434^{-9})	(2.2370^{-9})	(2.2290^{-9})
Sex ratio	−.5273	1.1206	1.0302	1.2759
	(2.9215)	(1.1614)	(2.2859)	(2.2775)
R^2	.6823	.5743	.6045	.6078
N	31	56	55	55

Note: Standard errors are in parentheses.

+ p < .10   * p < .05   ** p < .01   *** p < .001   **** p < .0001

parental investment in the offspring than the male, women should be able to choose how they marry, whether polygynously or monogamously. Further, given their interest in their children's welfare, women should choose to marry polygynously if there is extreme resource inequality among men but choose to marry monogamously if men's resources are distributed more or less equally. The institution of marriage at the societal level should emerge spontaneously as the aggregate phenomenon out of the millions of individual decisions that women make at the individual level (Figure 1). Our theory explains the institutional change from polygyny to monogamy as a function of resource inequality among men. As men became more equal in the course of history, more women chose to marry monogamously, and monogamy emerged as the institution of marriage. Our analysis supports the two hypotheses from our female choice theory of the marriage institution.

While our computer simulations provide strong support for the logical consistency of the theory, our empirical tests of the hypotheses are at best approximate. The hypothesized mechanism behind the emergence of the institution is at the individual level, while the data we use to test the hypotheses are at the macro level. Our data analysis merely shows that more women marry polygynously when there is more resource inequality among men, but it does not conclusively demonstrate that it is indeed the resourceful men who take multiple wives in societies characterized by greater inequality. However, Grossbard's (1976) study of marriage in Nigeria, which shows that wealthier men of higher status have more wives than less wealthy men of lower status, and Borgerhoff Mulder's (1990) similar study of Kipsigis women in Kenya provide empirical support for the micro foundation of our theory. Our aggregate data are consistent with the macro-level implications of our micro-level mechanism. Still, an empirical test of our theory at the micro level in cross-cultural settings, with data that hitherto are nonexistent, is certainly necessary.

Our female choice theory of marriage institution can potentially solve one empirical puzzle: Why is it that there appears to be a negative correlation between polygyny and women's status across societies? Why is it that polygyny seems to occur in societies (mostly in Africa and Middle East) where women's status is low? We speculate that the negative correlation between polygyny and women's status might be spurious, created by an antecedent variable that might be called "Western egalitarianism." Western egalitarianism simultaneously posits that all men are and ought to be equal *and* that men and women are and ought to be equal. The former tenet should function to reduce extreme resource inequalities among men, and the latter should function to elevate the status of women in society. If our female choice theory of marriage institution is correct, as our initial data analyses seem to indicate, then the former should reduce the extent of polygyny

among societies with such Western egalitarianism and therefore create a spurious negative correlation between polygyny and women's status in society.

Notes

1. *Monogamy* is the marriage of one man to one woman. *Polygyny* is the marriage of one man to more than one woman, while *polyandry* is the marriage of one woman to more than one man. *Polygamy* (although it is often used synonymously with polygyny) comprises polygyny *and* polyandry. Evolutionary hypotheses predict that polyandry will be rare unless the cohusbands are brothers (because men would not invest in children when paternal uncertainty is very high as in the case of polyandry), and cross-cultural evidence indeed shows that nonleviratic polyandry is virtually nonexistent. We therefore treat monogamy and polygyny as the two possible forms of the marriage institution.

2. While our theory seeks to explain the institution of marriage, there is some question whether individuals in modern society with the monogamous institution of marriage are truly monogamous in their individual mating behavior. Liberal divorce laws allow wealthy men to practice *serial polygyny*, where they leave their wives beyond their reproductive prime and marry younger women in their reproductive prime. By allowing the same men to monopolize women (not simultaneously, but sequentially), liberal divorce laws hurt the reproductive interests of both poor men (who cannot marry women in their age cohort) and older women (who must raise their children alone after the divorce).

   Further complicating the matter, the monogamous institution of *marriage* can coexist with polygynous *mating* through adultery, concubinage, and other extrainstitutional forms of mating. For instance, Betzig (1986) notes that even despotic rulers with hundreds of concubines in their harems often had only one legitimate wife and were therefore married monogamously. However, it is the contention of our "bottom-up" theory of institutional emergence and change that, if a sufficient number of women choose to mate polygynously within the monogamous institution of marriage, then the institution of marriage will gradually shift to reflect and accommodate the individual behavior.

3. Evolutionary considerations (such as resources and physical attractiveness) serve as the ultimate causes, whose effects on behavior (mate selection) are mediated by proximate causes (love, desire, and other emotions). Human actors believe that they are choosing to mate with the ones they love and desire, not the ones with characteristics that increase their reproductive success (measured by the number of grandchildren). Human actors are not usually conscious of the evolutionary logic behind their emotions. The strength of evolutionary psychology is that it can predict from the ultimate causes whom human actors are likely to love and find desirable.

4. The synthesis of the individual theories by Alexander, Betzig, and MacDonald, as well as the collective appellation "male compromise theory," is ours. The hypothesis drawn from the theory and the choice of the empirical indicator to test it are also ours.

It is therefore possible that the original theorists themselves would not have chosen our measure of democracy to test their theories.

5. One anonymous reviewer notes that men's use of "brute force" upon each other essentially functions to create de facto reproductive democracy. Poor men do not need democracy as a political institution to express their dissatisfaction with the rich polygynists; they can just kill them and steal their wives. While this is true, the use of violence to achieve such illicit ends was probably always condemned in the human evolutionary history, as surmised from the fact that such use of violence is also negatively sanctioned among primates (de Waal 1996). Thus any male who attempts to democratize mating through violence risks not only retaliation from the victim but also the condemnation of fellow members of the society.

6. Or, as the comedian Bill Maher asked his panel on his television show *Politically Incorrect* on 7 January 1998: "Would you rather be the second or third wife of Mel Gibson or the only wife of Willard Scott?" to which one of the panelists, the conservative commentator and activist Susan Carpenter McMillan, responded: "If it comes to Mel Gibson, I wouldn't care if I was one, two or three" (http://www.abc.com/pi/word/980107.html).

7. Trivers and Willard (1973) were the first to propose that wealthy families prefer sons over daughters and poor families prefer daughters over sons in their parental investment. This is because sons from wealthy families are expected to have greater reproductive success than their sisters (because the sons' reproductive success is largely determined by their wealth and status, which they normally inherit from their families) and because daughters from poor families are similarly expected to have greater reproductive success than their brothers (because the daughters' reproductive success is largely determined by their youth and physical attractiveness, which are distributed more or less orthogonally to class). The Trivers-Willard hypothesis has been supported by a large number of empirical studies on societies across history and throughout the world, including the contemporary U.S. (Betzig & Weber 1995; Gaulin & Robbins 1991). See Cronk (1991) for a comprehensive review of the empirical support for the Trivers-Willard hypothesis.

8. Low (1988) proposes another theory of marriage also based on the logic that women are better off marrying polygynously when the inequality among men is great. However, she measures inequality among men not by the amount of resources they possess, but by their health: "Females are expected to convert monogamy to polygyny precisely when there are special advantages to mating with 'best' males, as will be the case . . . when pathogen stress is severe" (116). However, Low points out that polygynous mating can emerge as a result of both male and female choice: "When resources and customs permit, men tend toward polygyny, and when any factor (e.g., health, resources) makes some men much better mates than others, women too, can profit reproductively from polygyny" (122).

9. The condition of random mating on the part of women with $k > 2$ (when women have multiple choices of mates) is logically equivalent to the condition of women pursuing men with the largest number of resources when $k = 1$ (when women only have one man to "choose" from).

10. We fully realize that this weighting procedure inadvertently transforms the original four-point ordinal scale into an interval scale. However, given that all our independent variables are available only for countries, not for ethnic or cultural groups, we have to use countries, not ethnic or cultural groups, as statistical cases, and therefore we need a means to compute the polygyny score for each country. We believe our weighting procedure represents the best compromise, since using the unweighted scores for the ethnic and cultural groups is not an option.

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