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Human Mating and Family Formation Strategies: The Effects of Variability among Males in Quality and the Allocation of Mating Effort and Parental Investment

Jane B. Lancaster and Hillard Kaplan

Department of Anthropology, University of New Mexico, NM, USA

INTRODUCTION

The analysis of the occurrence and frequency of various types of human family formation and kinship patterns as seen in the cross-cultural record has been an honored tradition in anthropological research (Coult and Haberstein, 1965; Murdock, 1967; Murdock and White, 1969). Human family types are conventionally described as monogamous, polygynous (either common or occasional), and polyandrous (Table 1). Using these categories, the cross-cultural record indicates that societies practicing polygyny are the most common. Over 83% of human societies are classified as polygynous with approximately 2/3 practicing occasional (< 20% of adult males) polygyny and the remaining 1/3 in which polygyny is common (≥ 20%). Monogamous societies, where plural marriages are forbidden, nonpreferred or infrequent, constitute 16% of the record and polyandrous societies, in which a marriage between a single woman and several husbands is culturally favored, represent less than 1% of the cross-cultural record.

Table 1. Frequency of Human Marriage Patterns in the Cross-Cultural Record

Monogamy		16.0%
Polygyny		83.5%
occasional	< 20%	(55.7)
common	≥ 20%	(27.8)
Polyandry		0.5%
Single-parenthood, polygynandry		not coded
Total		100%

(Data from Murdock 1967, *n*=849 societies.)

There are three major problems with the use of these traditional categories in attempts to understand the underlying factors in human mating and family formation strategies. 1) The categories as stated cover combinations of widely differing constituents. For example, monogamy is found under two conditions: large, complex state societies and small-scale societies in specific environments. Flinn and Low (1986) have proposed that in the first case monogamy is imposed by social conditions and in the latter by ecological ones. The model we present below suggests an underlying similarity in the conditions for male parental investment in both cases. In contrast, polygyny in humans appears to be associated with two very different patterns of male behavior: in resource-defense polygyny males who maintain control of special resources are differentially chosen as mates by women and their families; and in harem-defense polygyny males vary little in their resource holding capacities but vary more in their ability to acquire mates and defend them against competitors (Flinn and Low, 1986). 2) These classifications tell us very little about what people actually do and under what conditions children are actually raised. In a highly stratified society, 95% of men may be monogamous but the society will be classified as polygynous if the remaining 5% of men practice polygyny because of their greater access to wealth and power. 3) There are a number of truly important categories of mating and family formation left unrecognized and hence unrepresented in the cross-cultural record. Such patterns as male serial monogamy (a form of polygyny but subsumed under monogamy), single-parenthood based on female-headed households and on informal, nonresidential polygynandry are not acknowledged as human family types in spite of their widespread occurrence (Lancaster, 1989; Lockard and Adams, 1981).

In disregard of these basic limitations in the identification of appropriate categories, a number of authors have used differential frequency of these categories to argue species' adaptations in an evolutionary scenario of the origins of the human family. Alexander and his associates (Alexander *et al.*, 1979) pointed to the high frequency of societies that permit polygyny and to the modest degree of sexual dimorphism in human stature as indicators that the human species is adapted to be "mildly" polygynous. Lovejoy (1981) scanned the fossil record of hominid evolution for evidence of ecologically-imposed monogamy based on male provisioning of females and young and pointed to the relatively moderate degree of human sexual dimorphism and to human food-sharing as evidence that monogamy is the core adaptation of the human line. Foley and Lee (1989) studied the adaptational gap between nonhuman primates, the fossil record of the

Plio-Pleistocene, and modern hunter-gatherers and tried to reconstruct the niche in which protohominids must have evolved their biology and social behavior. Others (Alexander and Noonan, 1979; and, for recent reviews see Hrdy, in press; Steklis and Whiteman, 1989) have tried to establish the absence of estrus in humans as evidence for selection favoring monogamous attachment between mates. There is a hidden assumption in these endeavors that a species-specific hominid adaptation exists that is the most fundamental, natural, and original, and that all other forms of human mating and family are derived, less natural, or default behaviors practiced by individuals who are constrained from expressing the pattern most supported by human biology, psychology and behavior.

This paper will pursue a different course suggesting that traditional categories used to describe human systems of mating and raising children obscure our vision of the essential features underlying and predicting the wide diversity found in the cross-cultural record. We follow Irons (1979) and Haldane (1956) who identify behavioral differences between human groups as environmentally-induced variation in the expression of a basically similar genotype and who see facultative responses to environmental differences as the essential human adaptation to socioecological variation.

EVOLUTIONARY BIOLOGY, SOCIOECOLOGY AND LIFE HISTORY STRATEGIES

The past 15 years have witnessed major theoretical advances in the evolutionary biology of behavior as well as a wealth of field studies on animal populations. It is clear that all animals acquire resources from the environment to survive and reproduce and that the ways in which these resources are distributed in space and time are critical to animal systems of mating and rearing offspring (Barlow, 1988; Clutton-Brock and Harvey, 1978; Dunbar, 1988; Emlen and Oring, 1977; Gowaty, 1981; Wittenberger and Tilson, 1980; Wrangham, 1979, 1980). This body of theory and research presents a series of generalizations that can inform an inquiry into human family formation patterns. The first of these is the distinction between mating effort (any investment that increases fertility at the cost of other fitness components) and parental investment (any investment in an offspring that increases the offspring's fitness at a cost to the parent's ability to invest in other offspring) (Trivers, 1972). Each individual approaching reproduction is faced with a series of alternatives for the allocation of resources for which the ultimate payoff will be reproductive fitness. Such life history parameters as the timing of reproduction in the life course, temporal spacing between reproductive acts, the number and quality of offspring produced, and the differential allocation of energy and risk between acquiring mates and raising offspring will be affected by whether resources are scarce or abundant, clumped or distributed, monopolizable or indefensible, and certain or erratically available.

The features of resource distribution in time and space present themselves differently to individual males and females. Most theoreticians begin by analyzing sex differences in access to the resources that members of each sex need to maximize fitness. This basic theory permits comparisons between sexes and between species in mating and reproductive strategies. For the purposes of analyzing human behavioral evolution, the most fundamental contributions were Trivers' (1972) germinal paper on parental investment strategies and sexual selection and the papers by Clutton-Brock and Harvey (1978) and Wrangham (1979) on how individuals map behavioral strategies onto environmental resources. Although both sexes are faced with tradeoffs in the allocation of resources between mating effort and parental investment, there are fundamental differences between male and female mammals in their reproductive strategies with males tending to seek as many fertilizations as possible without paying too high a cost in risk and competition, while females must seek access to resources to raise their fertilized eggs to adulthood. This means that females will map their reproductive strategies onto the distribution of the resources they need to rear offspring, and males will map onto the distribution of females either directly or indirectly by controlling resources that females want. One of the critical modifiers of this basic dichotomy between male and female reproductive strategies is whether or not females require aid from others to rear offspring, and, if so, whether they turn to their mates, to their kin, or to cooperative nonrelatives for such assistance.

Among many species females need assistance to rear young successfully. In nonhuman primates this assistance is usually garnered from the female's kin (Wrangham, 1980). Among humans it is most often, but not always, received from a male sexual partner (Irons, 1983, 1988). In comparing human and nonhuman primates, a striking feature of the human adaptation is the commitment of adults to provision weaned offspring during their juvenile phase of development, a period which is so high in risk in other species that it constitutes a selection funnel into which many enter and few survive (Lancaster, in press; Lancaster and Lancaster, 1987). The riskiness of this period rests on the fact that juveniles are, by definition, small, weak, immature, inexperienced, and poor social competitors. Humans, then, are a species in which the prolonged development of young during the juvenile period and beyond demands a major adaptive commitment to parental investment of such magnitude that males often trade off the value of mating effort for parental investment in offspring.

In the remainder of this paper, three significant factors arising from the tradeoff between mating effort and parental investment and underlying variation in human family formation strategies will be discussed: (1) the significance of male parental investment to the fitness of the male's offspring; (2) the effects of differential allocation of resources toward mating effort or parental investment on male fertility and reproductive success; and (3) the degree of variability in male quality within and between societies and its effects on female mate choice and family formation strategies.

THE TRADEOFF BETWEEN MALE PARENTAL INVESTMENT AND MATING EFFORT AND ITS IMPACT ON MALE-FEMALE RELATIONSHIPS

The value of male parental investment to female fitness varies widely between and within societies. We can predict that this variability in value will affect male decisions about investment. Following Trivers (1972) and Trivers and Willard (1973), parental investment, be it from the male or female parent, will be allocated on the basis of its effect or payoff on offspring survivorship or quality. Since the payoff of parental investment to the male is measured in the survival of his own offspring, male confidence in paternity will be a critical element of a male's willingness to invest. For a male, the value of increases in offspring survival will be reduced in proportion to the male's probability of not being the father of the offspring. If such investment by the male parent makes no difference in male reproductive success, then allocation toward mating effort is predicted. If investment in both mating effort and parental investment pays off in male fitness, then a balance will be struck between the two competing demands for resources. In Figures 1 and 2 we illustrate our conception of the relationship between male parental investment and offspring survival and between male mating effort and male fertility respectively. An assumption underlying these figures is that there will be diminishing returns to investment in both mating and parental effort. For this reason the curves portray the change in offspring survival or in male fertility as a function of increased investment in parenting or mating and show the decreasing marginal effects of increased investment. We imagine that there is a continuum between total investment in parenting to total investment in mating such

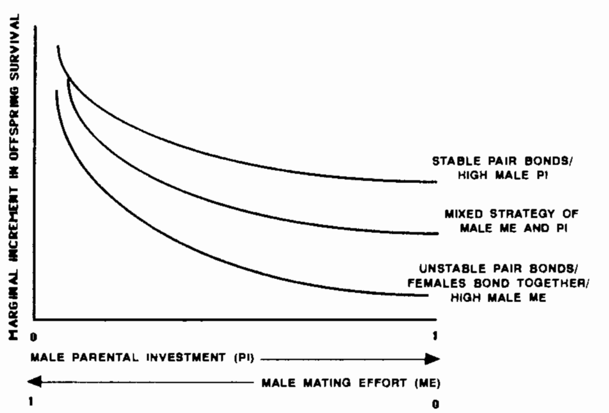

Fig. 1. Male-female relationships as a function of the effects of male parental investment on offspring survival.

that, if (*me*) is investment in mating, investment in parenting is (*1-me*).

Figure 1 illustrates the relationship between male parental investment and offspring survival as it impacts upon male-female relationships. When the significance of a male's parental investment to his offsprings' survival and expected reproductive success is high, he will be motivated to invest parentally to the extent that he can be assured confidence in paternity. From the female perspective, when male parental investment has a great impact on her fitness, she will be motivated to choose a male on the basis of his expected contribution to her offsprings' survival, will exert leverage on him to invest, and be willing to assure paternity (Ember and Ember, 1979; Mock and Fujioka, 1990). When the value of what males can contribute to offspring fitness is low, males will be motivated to invest in increased fertility and females will lack motivation to choose males on the basis of willingness to invest parentally and will be more concerned about indicators of male genetic quality or more immediate, short-term rewards of association. This dynamic is, therefore, likely to affect male-female relationships. When the value of male parental investment is high, we expect more stable bonds between men and women, but those bonds may be in monogamous, polygynous or polyandrous relationships depending on variability in male ability to give and the benefits of male parental investment (see below). When the value of male parental investment is low, females are likely to form female-bonded groupings or ones based on uterine links (maternal kin). Male-female relationships will be brittle or short-term. Family forms can include polygyny, polygynandry, or female-headed households, but in each case the focus of female bonding and resource acquisition is not her sexual partner, and males benefit more by diverting resources toward mating effort. An intermediate condition exists in which males can pursue a mixed strategy of allocating resources to both mating effort and parental investment. Such conditions may lead to a double standard of sexual behavior in which females bond to males whom they have chosen for their parental investment abilities, but males maintain an option for sexual promiscuity and parentally invest only in recognized unions (Hrdy and Williams, 1983). In those cases it is likely that the male will invest parentally in the highest status female he can obtain and to exert mating effort to obtain women of lower status and family power in whose offspring he will invest less. As described by Dickemann (1979), hypergyny (the upward flow of women through marriage and other forms of sexual alliance in stratified social systems) creates a pool of subordinate women and their families willing to make concessions in forms of marriage and inheritance in exchange for upward mobility of children.

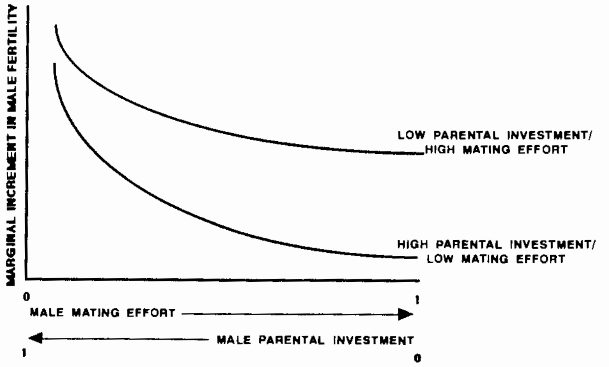

Fig. 2. Male reproductive strategies as a function of the effects of male mating effort on male fertility.

Figure 2 represents the effects of a male's mating effort on his fertility and parental investment strategy. The higher the value of mating effort toward fitness, the more likely he is to trade off investment in mating effort against parental investment. The lower the effect of mating effort, the higher his allocation of resources to parental investment. Again these curves show diminishing returns with each increment of mating effort. The curve of high parental investment and low mating effort might represent typical family patterns of modern, urban, working and middle class families in which parental investment is so significant in raising children that a principal form of mating effort is the advertisement of a male's ability to provide parental investment. In contrast, the tradeoffs for the allocation of resources for women is not so much between mating effort and parental investment. A woman faces investment tradeoffs between her fertility and her offsprings' fitness and among alternative parental investment options (such as between the acquisition of resources for children and direct childcare). The differences in the tradeoffs faced by males and females implies basic conflicts of interest between them as mates. Even in monogamous unions, male and female interests are not identical. A man may wish to divert some mating effort and parental investment toward extramarital relations or a woman may wish to invest more per child and have a smaller family than does her partner. A male participating in a family unit has a very different calculus of costs and benefits than does his mate. The concept of the family as a functionally-integrated, reproductive system ignores and obscures the conflicts of interest among "family members."

HISTORIC AND CROSS-CULTURAL VARIABILITY IN MALE QUALITY

According to this model ecologically-based variability in male quality interacts with the value of male parental investment to a male's offsprings' fitness and with the value of male mating effort to male fitness in relation to systems of mating and family formation strategies. Figure 3 contrasts societies with low variability to those with high variability in male quality in relation to male reproductive strategies. For example, systems in which there is low male parental investment and high male mating effort are found under two very different conditions: one in which, for ecological reasons, there is a relatively small effect of male parental investment on female fertility [e.g. African matrilineal societies (Draper, 1989), Australian aborigines (Irons, 1983)] and the other in which there is high variability between males and an underclass exists in which males have insufficient access to resources for parental investment (Dickemann, 1979, 1981). A wide variety of mating and family formation strategies are linked to these two conditions but all of them express strong links between women and their kin and tenuous bonds between sexual partners. In other words, when males are unable to provide a level of parental investment that makes a difference because investing produces little effect or because they have little to invest, they disproportionately divert resources toward mating effort.

ECOLOGICALLY-BASED VARIABILITY IN ←MALE QUALITY→		Male reproductive strategy	Mating & family formation systems
low variability	high variability		
Small effect of male PI on female RS due to local ecology *Australian aborigines, Afri. matril. belt*	Males who cannot acquire resources for PI *modern and traditional underclasses*	***low male PI high male ME***	female bonded groups polygyny polygynandry single parenthood unstable bonds bride service or no payment
Large effect of male PI on female RS due to local ecology *Eskimo, !Kung*	Large effect of male PI on female RS *Industrial, working & middle classes; peasants*	***high male PI low male ME***	monogamy polyandry stable bonds bride service, dowry or no payment
Moderate effect of male PI on female RS and moderate payoff to Male ME *Ache* *Yanomamo*	Wealthy males are polygynous or apportion PI to major and minor unions *Yomut, Kipsigis* *Nobility, upper classes*	***mixed strategy of PI/ME***	monogamy with mistresses serial monogamy monogamy with dowry resource based polygyny with bride wealth harem defense polygyny with bride capture brittle bonds for low variance

Fig. 3. Human mating and family formation systems as a function of variability among males in quality and in the allocation of parental investment and mating effort.

In contrast to the above, when male parental investment has a large effect on female reproductive success by greatly improving either female fertility or child survivorship as with hunter-gatherers in environments favoring a significant proportion of mobile game in the diet, peasants in stratified social systems, and middle and working classes in industrial societies, we find more stable bonds between male and female and a strong tendency toward monogamy or less often polyandry (more than one male necessary to constitute a functional male parental investment role) (Crook, 1989; Draper, 1989; Hill and Kaplan, 1988; Hurtado and Hill, 1990; Irons, 1983; Lockard and Adams, 1981). Under conditions of low variability marriages are often based on bride service (a demonstration of ability to give male parental investment), and under conditions of high variability marriage alliances may be based on dowry payments in which the families of women compete to gain access to quality grooms with ability to give parental investment (Dickemann, 1979, 1981; Gaulin and Boster 1990).

When individual males pursue a mixed strategy because of favorable returns on both parental investment and mating effort, the degree of variability in quality between males is again highly significant. Under conditions of low variability, we find more brittle bonds between the sexes with serial monogamy and extramarital partners as among Ache foragers (Hill and Kaplan, 1988) or patterns of harem-defense polygyny with bride capture as among Yamomamo horticulturalists (Chagnon, 1988). Under both conditions males pursue extramarital relations at the same time that they give parental investment to their primary mates. Under conditions of greater variability in male quality, relatively better off men can pursue a pattern of resource-based polygyny as among the Kipsigis (Borgerhoff Mulder, 1988, 1990) or the Yomut (Irons, 1980); or, if even wealthier in a stratified social system, they can afford to apportion their parental investment resources unevenly into major unions with secure bonds implying offspring inheritance and to more tenuous unions of various types such as with mistresses, concubines, or secondary marriages (Betzig, 1986; Boone, 1988; Dickemann, 1979, 1981). In stratified societies major unions with wealthy males are likely to involve intense dowry competition between the families of brides (Dickemann 1981; Gaulin and Boster, 1990).

CONCLUSION

Ecologically-imposed variability in male quality in terms of ability to offer or control resources essential to female reproductive success is an essential feature of human mating systems and yet has no relationship to the traditional categories describing human marriage patterns. Traditional classifications do not fit with modern evolutionary biology because they subsume too many categories at the same time that they fail to make essential distinctions between them. To think and talk effectively about human family systems using theory from evolutionary biology, we must discard the old categories of monogamy, polygyny, and polyandry and focus on the underlying matrix composed of the value of male parental investment to offspring survival and female reproductive success, the value of male mating effort to male fertility, tradeoffs by males between parental investment and mating effort, and variability between males in their ability to provide or control resources.

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