



Women's lives there, here, then, now: a review of women's ecological and demographic constraints cross-culturally

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Abstract

Around the world and across time, women's lives and opportunities vary—but this is patterned variation, produced by the interplay of natural selection (life history theory) and ecological and social constraints. Our evolutionary background (e.g., evolution of anisogamy) and phylogenetic constraints (female mammals' specialization for postnatal care) create different costs and benefits for males and females. These interact with environmental conditions to produce patterned variation in mating and marriage systems, degree of male parental investment, for example. Here, I review how, in response to these conditions, women's strategies (reproductive, resource, coalitional, and political) vary.

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1. Introduction

Oh, hard is the fortune of all womankind, She's always controlled, she's always confined. . .

“The Wagoner's Lad,” American Appalachian Folk song.

How do women fare today, as compared with those in past times and traditional societies, in their ability to control resources, wield political power, and choose their life paths? To an

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unprecedented degree, in several western technological societies, including our own, we have societal and legal mechanisms to mandate that women, as well as men, have access to power and control of resources. Yet, although in Western developed nations today, women spend most of the money and outnumber men in professional jobs, they hold relatively few top-level positions. There is a “glass ceiling” to women’s achievements in professional life (Browne, 2002), and women are still rare in some graduate training programs (e.g., business, physics).

Furthermore, as any examination of news articles reveals, women’s options—social, political, and life history—vary today across cultures. Women may be required to be monogamous or polygynous; they may, or may not, choose their husband; they may have to cover their faces and bodies, or not, to submit to clitoridectomy or not, to be stoned for adultery, or to have complete sexual freedom. What are the sources of such variation?

These are difficult questions to tackle: Today’s conditions are both evolutionarily novel and extremely variable. But the comparative evolutionary approach pioneered by Alexander (1971, 1974, 1977, 1979, 1987, 1988, 1990; Alexander & Borgia, 1978; Alexander, Hoogland, Howard, Noonan, & Sherman, 1979) yields important perspectives. We can test hypotheses about the ecological, social, and cultural conditions that favor women’s resource and political control and women’s ability to control their personal lives, looking for patterns in the variations we find. Cross-cultural data exist to explore and test hypotheses about the conditions favoring women’s control of resources and power versus those that tend to suppress them. Here, I examine progress in understanding variation in women’s lives.

2. Theoretical background: our evolutionary history sets limits

Behavioral ecology arises from three simple propositions. First, organisms, including humans, have evolved to strive to acquire resources that enhance their chance for survival and reproduction. Second, the sexes typically differ in how they can best use resources for reproduction because of their distinct routes to reproductive success. Third, members of each sex vary their strategies not only in response to their different modes of reproduction, but also in response to different environments (e.g., Low, 2000b).

The “male–female phenomenon” (Alexander & Borgia, 1978) is old and deep, but putting basic similarities into a theoretical context can help highlight important ecological and cultural complexities. The evolution of anisogamy (large eggs, small sperm; review by Low, 2000b, Chap. 3) sets up biases: *Ceteris paribus*, males in most species are more likely to enhance their reproductive success by expending mating effort, striving in both intra- (male competition) and intersexual (female attraction) arenas, to maximize the number of matings they obtain. Because male reproductive success (RS) is primarily influenced by mating success, small interactions can have a large impact (Smuts, 1995), and risk-taking is often reproductively profitable (e.g., LeBoeuf & Reiter, 1988). A male’s value to females is typically his *resource value* (e.g., territory control). In contrast, females in most species maximize their success by ensuring sufficient resources and safety for their offspring. A female’s value as a mate is her *reproductive value*, the probable number of daughters that she

will have in the rest of her life, based on existing age-specific fertility and survivorship patterns (Fisher, 1958). Female reproductive success is typically most influenced by a female's ability to get sufficient resources throughout periods in which offspring are dependent. Huge amounts of resources ("excess" resources) do not help; and risk taking, because offspring are so dependent, is typically reproductively costly (e.g., Campbell, 1999; Low, 2000b, Chap. 3). These simple facts set up a series of biases that, unless countered, lead to both physical and behavioral sexual dimorphism. In mammals, including the primates, these differences may be exaggerated because female mammals are specialized to provide a dependent offspring's nutritional needs (phylogenetic constraints). The variation, once examined, is patterned in predictable ways by ecological and social factors (e.g., Alexander, 1971, 1974, 1977, 1979, 1987, 1988, 1990; Alexander & Borgia, 1978; Alexander et al., 1979).

Humans, like most other species, show an overwhelmingly positive relationship between resource control (including excess resources) and male reproductive success, which has been reviewed elsewhere (e.g., Low, 2000b). For females, the important relationships are between risk aversion (and other traits, below) and reproductive success (e.g., Campbell, 1999, 2002; Low, 2000b, Chap. 3). Anisogamy and the phylogenetic constraints of being mammals are not the entire story, of course; if they were, all mammals would be polygynous, with females specializing in parental effort.

Humans are rather odd primates, probably because of our intelligence and sociality. Human life history is peculiar: relatively late reproductive maturity, long gestation period, large newborn size (especially brain size), very early weaning (Low, 2000b, Chap. 6). This final evolutionary filigree has led to heightened importance of resources for offspring and a (perhaps resultant) shift in women's mate value from pure reproductive value to a mixture of reproductive and resource value (e.g., Low, 2000a) and an increase in the importance of inheritance (e.g., Mace, 2000). Here, I explore this patterned variation in mating and marriage systems and women's strategic responses in reproduction, resource garnering, coalition formation, and politics.

3. Women's lives in traditional and historical societies

3.1. Resources and women's life histories

In most societies, women's attractiveness to men as mates centers on their health and their reproductive value. Thus, cross-culturally, in societies in which the groom or his family transfers goods to the bride or her family, younger women tend to command a higher bride wealth or service than others do. High reproductive value is desirable, and men with greater economic resources are able to marry women with higher reproductive value in such marriage markets. Among the agricultural and pastoral Kipsigis, for example, the required bride wealth was directly related to a woman's reproductive value. With the introduction of western technology and medicine, differentials have been reduced (Borgerhoff Mulder, 1995, 1998a). Borgerhoff Mulder (personal communication) also notes that, in traditional societies, daugh-

ters of wealthier families may reach menarche, and possibly the mate market, at younger ages than do daughters of poorer families. Because wealthy men could typically marry younger women than poor men can, in some societies (e.g., Irons, 1979, 1983), the relationship between wealth and fertility for women mimicked that for men, but was seldom significant (an exception, in a historical society: Low & Clarke, 1991, 1992).

In historical Germany, younger, higher reproductive value women tended to marry wealthy men, and parents skewed their investment in children along economic cost–benefit lines (e.g., Volland, 1990; Volland & Dunbar, 1995; Volland & Engel, 1989; Volland, Siegelkow, & Engel, 1990). Hughes (1986) found similar patterns in historical England with men's wealth and women's reproductive value. In 19th century Sweden, daughters of wealthy men tended to marry earlier than poorer women do, experience similar interbirth intervals, and have significantly greater fertility (Low & Clarke, 1992). Historical records (Drake, 1969) suggest that poor men sought older women with greater resources when they could, explicitly trading reproductive value for resource value. In 18th and 19th century Scandinavia, daughters of upper–middle class women (who would marry richer men) were considered marriageable at 18 years, while daughters of poorer men, who would marry poorer men, were not considered marriageable until their mid-to-late 20s (Drake, 1969; Low, 1991). Poorer women also were likelier to move from their home parish (Clarke, 1993; Low & Clarke, 1991).

Resources were thus relevant to women's age-specific fertility and mortality, likelihood of migration, and lifetime reproductive success. The direct effects of resource availability on women's fertility tend to be concentrated (above) at the low end of variation: Women with poor nutrition suffer infecundability and loss of fetuses and children. More subtle effects could arise, depending on whether resources were husband's resources, or whether the woman herself garnered them. In the German, English, and Swedish cases above, resources were almost entirely controlled by men. When women obtain their own reproductively important resources, there is a conflict: Effort spent garnering resources cannot be spent allocating the resource in care of offspring. Thus, among the Ache and the Hiwi (Hurtado, Hill, Kaplan, & Hurtado, 1992) and the Ye'kwana (Hames, 1988), for example, women who are nursing cannot gather as much as other women can.

Nonadaptive cultural preferences can affect women's fertility in wealth- or class-specific ways. In 19th century northern Sweden, for example, people adopted the practice of feeding infants cow's milk (a common practice in nearby northern Finland). Refrigeration was lacking, and infant mortality was high. The central Swedish government sent a medical doctor, along with civil servants, to the northern town of Haparanda. He spoke mainly with upper class diplomats and civil servants—but the household staffs in these houses also gained the information. At the upper and lower ends of the class spectrum, health information and resulting infant survivorship were better than for tradespeople and small holders. Similarly, in some parts of 17th century Europe, women who could afford it hired wet-nurses to nurse their children. The reproductive impacts of this practice varied for women of different statuses (see Hrdy, 1999). Wet-nurses fared worst (in terms both of conceptions and loss of infants). Wealthy women had short interbirth intervals and high conception rates, but many children whose care was delegated to other women died. The women whose reproductive lives were least disrupted, and most successful, were lower–middle class women who neither could

afford to delegate their nursing activities nor were forced to take on the care of other women's children for pay.

3.2. *Marriage system and women's options*

A woman's options are constrained by the marriage system. Marriage systems also (below) give rise to further patterns that, in turn, affect women's possible options in life. For humans, as for other mammals, polygyny is the "default" mating system (even when marriage systems are specified as other than polygynous): When some males can dominate mating opportunities, they will. Over 85% of human societies for which data exist are polygynous.

Ecological factors (e.g., availability of large game, making hunting likely; ungulate presence, making animal husbandry likely; e.g., [White & Burton, 1988](#)) correlate with the likelihood of polygyny. There is a less well-known correlate, degree of pathogen stress, which may exacerbate sexual selection, increasing the degree of polygyny ([Hamilton, 1980](#); [Hamilton & Zuk, 1982](#)). Polygyny ([Low, 1988b, 1990a, 1990c](#)) is common in many conditions, but in areas of high pathogen stress, monogamy is absent. Furthermore, although sororal polygyny is preferred cross-culturally, in areas of high polygyny, nonsororal polygyny is more common than expected, as is the capture of women from other groups (both predicted by the polygyny hypothesis and no other; [Low, 1988b, 1990c](#)). Pathogen stress may be a real environmental uncertainty that renders fewer men acceptable as mates and further favors the production of genetically variable offspring.

3.3. *Marriage system, choice, and voice*

Humans are unusual among mammals in that women, in most societies, do not simply exert mate choice, as do most female mammals—although women may informally make their views known. Marriage (within which much reproduction occurs, of course) serves functions of alliance to strengthen a lineage's resource control and power, both within and between groups (cf. [Alexander, 1979](#)).

One anthropological measure that attempts to capture the informal influence of women (e.g., [Whyte, 1978](#)) is women's "voice" or "say" in important alliances, such as marriage arrangements. We might imagine that women would have more informal and formal influence under two conditions: in monogamous societies (because men's and women's interests are likely to converge there more than in many polygynous conditions, and because women may gain more paternal care under monogamy) and when women contribute more than men do to the subsistence base. Neither of these predicted associations is as simple as they might at first seem.

3.4. *Marriage system and conflicts*

In polygynous systems, there is clear potential for sexual conflict of interest: Are women's interests suppressed or in conflict with men's in these systems (e.g., [Davies, 1989](#); [Hrdy, 1979](#); [Irons, 1983](#); [Smuts, 1992, 1995](#))? In many cases, yes. In about 40% (65/157) of traditional societies for which data exist, for example, women are captured as brides or

concubines. Captured women live far from kin and other possible allies, while their husbands remain embedded in a male kin network. [In a few other primates, such as red tail (*Cercopithecus ascanius*) and patas (*Erythrocebus patas*) monkeys, males may form group alliances and capture females; e.g., Cords, 1986.]

Among the Dogon people of Mali (Strassmann, 2000), the more co-wives a woman has, the greater the likelihood that her child/children will die; the nonrandom mortality rate arises from conflicts of interest among those who share both agricultural work and food (“work–eat group members”; Strassmann, 1997, 2000). Dogon men who can be polygynous gain reproductively, but their wives lose. In polygyny, generally, women’s interests do not converge with either their husbands’ or their co-wives’ interests. If the system is sororally polygynous, we do expect the interests of sisters/co-wives to converge more than that of those in nonsororally polygynous systems.

The costs and benefits of polygyny for women are not even, nor necessarily long lasting. For the wives of polygynous men in traditional societies, fertility may be uneven; in a number of societies, second and subsequent wives, for whatever reasons, have fewer children than first wives do (e.g., Daly & Wilson, 1983; Garenne & van de Walle, 1989; Pebley & Mbugua, 1989; Sichona, 1993). The fertility effects are sometimes small (e.g., Timaeus & Reynar, 1988) and sometimes ephemeral in terms of number of grandchildren (Josephson, 1993). There are many covariants of fertility (e.g., women who remain unmarried until their reproductive value is low are unlikely to become first wives and also likely to have few children in their remaining lifetimes); the most detailed and methodologically elegant study so far is Strassmann (2000).

Polygyny is not the only marriage system in which wife–husband conflicts of interest are likely. Because of the socioecological complexities of human systems, women’s interests often do not converge completely with their husbands’ in socially monogamous (Alexander et al., 1979; Reichard, 2004) situations, as they would in genetically monogamous systems (Low, 2004). The reproductive interests of parents converge to a degree—but this does not necessarily protect women’s reproductive interests, as when divorce is common. Human life histories are unusual among mammals; offspring are extremely altricial and require considerable care for extended periods of time (reviews by Kaplan, 1997; Low, 1998). Social monogamy with intense parental investment by both parents does not preclude extra-pair copulations (EPCs; and fertilizations), but any resulting children are likely to command less investment than will children born within socially recognized unions.

While women’s interests converge imperfectly with their husbands in socially monogamous systems, women are likely to see monogamy as serving their interests. It is important that the conditions that favor monogamy can arise from either ecological or social forces. The origins of socially imposed monogamy appear to arise from the pressures of group living, interacting with historical particulars (e.g., Alexander, 1979). As societies increase in size, under many conditions, it becomes more difficult for powerful (and thus polygynous) men to maintain their reproductive advantages openly. Social monogamy typically follows. In these circumstances, EPCs may be reproductively profitable, and husbands’ and wives’ interests often conflict. A number of sociocultural conventions (legitimacy, inheritance rules) arise in most societies to mediate these conflicts, and men and women are likely to use them dif-

ferently; for example, men and women tend to distribute their bequests differently, in ways that reflect these conflicts of interest (Gaulin, McBurney, & Brakeman-Wartell, 1997; Judge, 1995; Judge & Hrdy, 1992).

Polyandrous systems are rare and associated with either resource constraints (as among the Lepcha in northern India, where it appears to take the work of two men to produce enough to support the children of one woman) or conservation of familial resources within some lineages (as among some Tibetan communities). There are too few data to tell whether women's interests thrive in these systems. Thus, with current information, it is not clear that any particular marriage system automatically favors women's resource-accumulation or reproductive interests.

3.5. *Other factors influencing conflicts of interest*

In societies (regardless of marriage system) in which men's sources of power are unpredictable, and women have sufficient resources to be independent, men cannot always control women. Resource distribution, coalitions for mate seeking, inbreeding avoidance, and nepotism (familial coalitions)—all are important in marriage patterns. In such societies, either straightforward polygyny or serial monogamy (really serial polygyny) results. Serial polygyny occurs, for example, among societies as disparate as the Ache of Paraguay and the contemporary United States. Ache men and women have perhaps 10 spouses in a lifetime (most occur early in their reproductive careers; Hill & Hurtado, 1996), U.S. women roughly 1–4.

4. Women's coalitions, resource control, and political power

4.1. *Female coalitions*

Female–female coalitions in primates, including humans, tend to center on parental effort (e.g., Irons, 1983) and on cooperation to protect females from male–female conflicts of interest (e.g., Smuts, 1992). Implicit in the contrast between the “mating effort” emphasis of male coalitions and the “parental effort” emphasis of female coalitions is that the amount of resources under consideration differs—mating effort can turn huge amounts of resources to reproductive profit; typically, parental effort cannot (Low, 2000b, Chap. 3). Female parental effort coalitions tend to be among kin or (in humans) co-wives. Both “positive” (food gathering) and “negative” (e.g., reproductive suppression) parental effort coalitions exist. Reproductive suppression can have bloody outcomes. Marmoset females may kill other females' offspring (Digby, 1995; Lazaro-Perea et al., 2000). In several baboons, females in dominant matrilineal groups harass subordinates (e.g., Wasser, 1983) and sometimes kill their offspring.

In many societies, co-wives gather food together and share information (e.g., Irons, 1983). Women may have considerable informal say not only in family alliance and marriage matters but also behind-the-scenes influence in larger political matters, through their spouses and male relatives; this, however, is difficult to document. Because reproductive return curves

differ for mating and parental efforts, it should be no surprise that the payoffs differ for mating-effort versus parental-effort coalitions. Parental-effort coalitions are more likely to be among related women or co-wives and to be longer term, to be relatively more stable, and to involve lower risk than mating-effort coalitions do (more typical of males).

Despite the inherent potential conflicts of interest in polygyny, women do well reproductively in at least some polygynous systems. In part, this appears to arise from the differential ability of women to find allies and form coalitions in different systems. Sellen, Borgerhoff Mulder, and Seiff (2000) found that among Datoga pastoralists of East Africa, women in marriages with a single co-wife produced fewer surviving offspring than did women with more co-wives; furthermore, their children grew more poorly during their first 3 years. Resources play a part in this pattern; Sellen et al. noted that, among the rich, the number of co-wives is irrelevant, but that in other marriages, women's direct access to critical resources is crucial. Among the swidden agriculturalist Yanomamö of the Orinoco valley in South America, there is little in the way of wealth or heritable resources. Here, a man of high status (who also is likely to have more wives and more children than other men will) received more food gifts from others in the village than poorer men did. His wives thus have more food available (Hames, 1996).

Cross-culturally, women sometimes have significant allies in polygynous systems (Yanca & Low, 2004), in part, depending on whether the polygyny is sororal (wives are sisters) or nonsororal. When co-wives are sisters, female coalitions can exert considerable influence in the kin group; when women live close to their natal families, as well, they have nearby allies. Hence, the relationship between women's interests and polygynous/nonpolygynous systems is not an obvious one; as Borgerhoff Mulder (1992) has noted, women adopt strategies in the face of conflicts of interest and female–female competition, and there is a hierarchy of questions that need to be addressed.

4.2. *When do women control significant resources?*

Cross-culturally, the major influence on women's ability to control resources was the level of female contribution to subsistence; it showed a linear pattern (greater female contribution, greater female resource control; Low, 1990a, 1990d, 1992). Some proposed that broad ecological correlates of female resource control, such as protein deficiency and risk of starvation, show no correlation. Subsistence modes show patterns: that women in fishing and hunting societies were likely to have certain kinds of resource control, and women in irrigation, agricultural, and animal husbandry societies were likely to have little resource control. However, the subsistence mode is related to relative male and female contribution to subsistence (which independently influences women's resource control), residence, and other social phenomena, which renders any proposed causality less clear (cf. Yanca & Low, 2004).

Women compete directly for resources primarily in two conditions, both more prevalent in Africa than elsewhere. In complex matrilineal or dual-inheritance societies, a powerful woman, while not increasing her own number of children, may increase her number of grandchildren by passing wealth and power to her son, as in the Ashanti people of Ghana (Low, 2000b, Chap. 12). Even when such systems are changed by contact with industrialized

societies, traditions of women's independence and power, although they no longer yield reproductive gains, may persist and thrive, as in West Africa today.

Within polygynous societies, the greater the percent of polygynous marriages (degree of polygyny), the more women and their children tended to become independent resource units. Cross-culturally, the more women contributed to the subsistence base, the more say they had over the distribution of the fruits of their own labor (Low, 1990a; cf. Whyte, 1978).

4.3. *When do women hold significant political power?*

We normally think of nation-states and formal political arrangements when we hear the word politics. Yet, of many definitions, the definition of politics of primatologist Frans de Waal (1982) as “social manipulation to secure and maintain influential positions” is a biologically useful one and applicable to women as well as men. The art of politics, defined this inclusively, is older than humanity itself. De Waal commented (p. 19) that “whole passages of Machiavelli seem to be directly applicable to chimpanzee behavior.” But what males, who specialize in mating effort, versus females, who typically invest in offspring-specific maternal effort, stand to gain from political maneuvering differs greatly (above). If coalitions had reproductive ends in our evolutionary history, and if men and women succeeded reproductively through different strategies, then men's and women's coalitions should differ (e.g., Low, 2000a, 2000b, Chap. 11). Not surprisingly, human sex differences, similar to those of other primates, reflect these divergent evolutionary ends.

Cross-culturally, although women's participation varies in many domains, public political power is almost exclusively male (Low, 1990d, 2000b, Chap. 12). About 70% of societies cross-culturally have only male political leaders; just over 7% have both sexes, although men are more numerous and more powerful (Whyte, 1978). In very few societies are women coded as equally powerful as men are (and men are always more numerous). Women are more likely to have influence within their kin groups than in community affairs. Women can hold kin leadership posts and have more say and influence in kinship matters in 6 of 93 societies. Both sexes have roughly equal influence in 3 other societies. In a few, women can attend and participate equally in community gatherings, although they may be segregated from men. While women may widely have an informal voice in community affairs, formal political influence is rare for them, both within the kin group and in the community at large.

The very rarity of women's public political power (9/93 societies; Whyte, 1978) makes statistical analysis difficult. Four of the nine societies are African, suggesting a possible geographic bias, but in a study by Whyte (1978), African societies comprise over a fourth of the odd-numbered societies of the Standard Cross-Cultural Sample (a sample chosen to be representative: stratified by geographic region and within region by language group, and with data from trained ethnographers; Murdock & White, 1969). In fact, the geographic association appears weak (Low, 1992).

Descent rules comprise the one strong pattern with women's large-scale political activity (Low, 1992). Five of the nine societies in which women are said to have such political power are societies with matrilineal or double descent, precisely those societies in which women's power is predicted to enhance their son's (not their own) reproductive success. Over half of

the cases of women having political power occur in one fifth of the (complete) Standard Cross-Cultural Sample: the matrilineal and duolineal societies. Of the 18 matrilineal and double-descent societies, 5 have women in political office (2 expected); of the 56 patrilineal, ambilineal, and bilateral-descent societies, 4 have women in political office (7 expected). Thus, despite the difficulties of recording descent systems in great detail, there does appear to be an association between descent systems and women's ability to hold public office.

5. Women's resource control and power: other factors

Any examination of the influence of cultural factors on women's lives must find covariation. Marriage system is a core cultural phenomenon, and (see above) one with major impacts, but associated with marriage system are other variables that can further affect women's options.

5.1. Inheritance

Hartung (1982) found that inheritance tends to be male biased in polygynous systems because resources influence male reproductive success more than female reproductive success in such systems. In bride wealth systems (above), young, high-reproductive-value women cost more than older women do so that parental gains through sons are more affected by material investment than parental gains through daughters. Cowlshaw and Mace (1996), using a phylogenetic approach, confirmed this pattern, noting that marriage patterns and inheritance "evolve together in a way that is adaptive" that strongly polygynous systems have male-biased inheritance and monogamous ones are more characterized by an absence of sex-biased inheritance.

5.2. Status and the treatment of daughters

Sex-differential investment can take more subtle forms than inheritance biases do and can operate both as physiological and as cultural biases. The evolutionary framework leads us to expect some bias in the treatment of dependent sons and daughters, because in many polygynous mammals, only the best-invested males have much chance of reproducing, but any daughter is likely to have some reproductive success. The guiding selective principle appears to be the following: When parental effort is effective and variance in the reproductive success of one sex exceeds that of the other sex (as in elephant seals), or when resources or parental investment can influence the reproductive success of one sex more than the other, there should be a correlation between parental condition and investment in that sex (Low, 2000b; a restatement of Trivers & Willard, 1973; Clutton-Brock, 1991).

In nonhuman species, and in many preindustrial societies and developing countries, a mother's physiological condition (resources available to rear a successful offspring) typically declines with age. But whenever the nutritional condition of mothers does not decline with age, a *male* bias in sex ratio might be expected in older mothers (e.g., Low, 1991; Mace,

1990). If a female's condition is good as she nears the end of her reproduction, it may pay to invest ever more heavily, with a greater potential reproductive profit if successful; for example, older female gorillas tend to have sons (Mace, 1990). In nutritionally rich 19th century Sweden, mothers over age 35 showed a sex-ratio bias toward sons, and mothers under 25, toward daughters (Low, 1991; also Low, 2000b, p. 105). It is interesting, in light of these physiological patterns, that parents shift their preference for sons versus daughters under different circumstances (Knode, 1988).

5.3. Dowry

Whenever males vary greatly in their status and wealth, women married to wealthy, high-status men (and the women's children) benefit reproductively. Hence, it may pay would-be brides (usually, the brides' fathers) to compete, bargaining for wealthier men as mates. Dowry is 50 times more common in monogamous, stratified societies than in polygynous or nonstratified ones (Gaulin & Boster, 1990). In many of these societies, poorer women's families must pay more dowry than wealthy women's families do; dowry becomes a form of mate competition among women. Insofar as poor families cannot pay well, the stratification is intensified. Such competition can incur costs. Consider dowry in modern rural India. Since about 1950, demographic shifts have resulted in a decline in potential grooms for potential brides of marriageable ages—and dowries have risen steadily. By 1990, a dowry was likely to be over 50% of a household's assets. Wives from poor families, able to pay less dowry, are less likely to marry; if they marry, they have a high risk of being abused by their husbands. Furthermore, domestic violence and spousal abuse have been correlated with increases in dowry worth; "insufficient dowry" is an important recorded cause of spousal abuse (Rao, 1997).

5.4. Training sons versus daughters

We know a little about the genetic bases of behavioral differences, but equally important are sociocultural differences in how sons versus daughters are trained (Low, 1989a, 2000b, Chap. 6). And we know a lot about that. Across cultures, sons and daughters are trained differently in ways that relate to the evolutionary history of each sex's reproductive success. Cross-culturally, sons are more strongly trained than are daughters in behaviors useful in open competition, while daughters are more strongly trained in such values as sexual restraint, obedience, and responsibility—traits widely sought by men in their wives. Put bluntly, boys get more practice than girls do in negotiating their best interests, starting early in life. Furthermore, the greater the degree of polygyny in nonstratified societies (the higher the potential reproductive rewards), the more that boys are taught to strive.

Cross-culturally, the more women actually control important resources or exercise power, the less that daughters are taught to be submissive. For example, the more that women are able to inherit property, the less that daughters are taught to be obedient. The more formal power that women have within the kin group, the more that daughters are taught to be aggressive and the less they are trained to be industrious.

5.5. Sex-preferential infanticide

The extreme of differential parental allocation is sex-biased infanticide. Parents will do best to allocate effort into the reproductively most profitable sex (e.g., Alexander, 1979), thus, infanticide by genetic parents is relatively rare. Infanticide in most species is typically committed by reproductive competitors rather than parents; for example, in lions, langurs, and gorillas (Packer & Pusey, 1983; Watts, 1989; see Hrdy, 1979, for an overview), when a male takes over a harem, he is likely to kill all infants under a certain age. The mother becomes sexually receptive and the male profits both by eliminating an offspring with a competitor's genes and by gaining a mating. In humans, stepparents (whose reproductive interests do not coincide with the child) are more likely to abuse or neglect children than genetic parents do (Daly & Wilson, 1996).

But genetic parents can and do commit infanticide. Among the Inuit, infanticide patterns suggest that parents are attempting to manipulate the sex ratio of their children to maximize mate choice resulting from local sex ratios (keeping daughters when the local ratio is male biased, and vice versa: Smith & Smith, 1994; Smith, 1995). In some caste systems, women, but not men, can “marry up” (hypergyny). High-status men can marry women of all castes; low-status men can only marry low-status women. In these circumstances, sons and daughters differ in reproductive value to high- versus low-status parents. One result is female infanticide by high-status parents (Dickemann, 1979; Parry, 1979).

Cross-culturally, female infants are at risk under predictable socioecological conditions, including plow agriculture and herding, patrilineal inheritance, dowry, and low resource contributions by women (e.g., Bugos & McCarthy, 1984; Dickemann, 1979; Hill & Low, 1991; Low, 1993; Torres & Forrest, 1988; see also Low, 2000b; Whyte, 1978, for the cross-cultural patterns in traditional societies). Broad historical patterns are also consistent with these findings (see review in Low, 2000b), just as sociologists note that infanticide can be biased according to cultural practices.

Today, our best efforts may have unintended negative results. One modern thrust to combat female-preferential infanticide argues that improving women's education and employment will improve the status of women and result in better treatment of daughters. This reasonable argument may be stated too generally; recent demographic reports from India, China, and Korea suggest that when women's status improves, preferential allocation of resources to sons increases—the opposite of the desired outcome (Dasgupta & Visaria, 1996; Premi, 2001). In at least some populations, the education of women correlates positively with female infanticide (Dasgupta & Shuzhuo, 1999; Dasgupta & Visaria, 1996). It is not at all clear that raising women's status will protect female infants; discrimination against daughters may actually *increase* with women's status in these countries (Anderson & Romani, 1997; Dasgupta & Visaria, 1996).

5.6. When are daughters treated preferentially?

The biases arising from our mammalian background mean that successful sons in most circumstances cost more than successful daughters do (cf., e.g., Alexander, 1979). Thus, not

only do we see biases in physiological investment (Trivers & Willard, 1973) but in behavioral care (Borgerhoff Mulder, 1998a; Mace, 1996), inheritance (Hartung, 1982, 1997), and other social investments, even today (Gaulin & Robbins, 1991). Among the Kipsigis (Borgerhoff Mulder, 1998a), poorer families (who have little bride wealth for their sons, but whose daughters bring in bride wealth) invest preferentially in education for their daughters.

Similarly, the Mukogodo in central Kenya are a relatively poor people without power or prestige compared with neighboring groups, such as the Maasai, the Samburu, and the Mumenyot, whom they admire. The Mukogodo are somewhat stigmatized by their neighbors. This fact has had curious consequences. The Mukogodo treat their daughters better than they treat their sons (Cronk, 1991a, 1991b, 1991c, 2000, 2004), and this makes selective sense: Daughters are more able to marry and continue the family lineage.

Mukogodo mothers nurse their daughters longer than they do their sons; Mukogodo caregivers (mothers and others) stay closer to girls than to boys and hold them more. Parents take their daughters more frequently than their sons to the dispensary and clinic for treatment and enroll their daughters more in the local Catholic mission's traveling baby clinic. Because of the biased care, girls show better growth than boys do: better height for age, weight for age, weight for height. The Mukogodo preference for daughters makes good behavioral ecological sense. Yet, the situation is nuanced, and, living among societies that have a strong son preference, the Mukogodo, if you ask them, claim (like the Maasai, whom they try to emulate) to prefer sons to daughters (Cronk, 1991a, 1991b, 2000, 2004).

6. Novel modern environments

6.1. *Variation and scale in modern societies*

Today, of course, the influence of marriage systems on women's ability to gain resources independently and to wield power is even less obvious or direct than in traditional societies. In modern western democracies, serial polygyny (social monogamy with remarriage) is a widespread rule; women once again typically have free mate choice. Arranged marriages do exist in some democracies, although they appear less common than previously (e.g., in India, among some castes). Women in most nations may hold political office and are not restricted from particular jobs. Cultural factors beyond marriage rules may have significant impact. Religious dogma may affect women's lives; in some Muslim societies (particularly the less secular ones), women's dress codes may be severely mandated. They may be subject to clitoridectomy, may not have free mate choice, and may be restrained from daily activities we think of as common, such as voting or driving a car. Although these conditions may not prove conflicts of interest, they are suggestive.

6.2. *Work, resources, and women's reproduction*

Resource control clearly influences individual reproductive success in other mammals and in traditional and historical societies. Today, evolutionarily novel conditions complicate the

picture. What is “wealth”? Men’s earnings? Women’s? Particularly in modern Western societies, women’s tradeoffs are heightened: There are few professional (i.e., high-paying) jobs that women can perform while simultaneously doing childcare. We need appropriate repeatable measures of wealth, information on women’s own wealth, separate from husband’s or household wealth, and individual (rather than aggregate) data on age-specific fertility.

Taşiran (1995) carefully sorted out relevant covariants for Swedish, white U.S., and Black U.S. women. The results indicated that major general patterns remained, but that considerable complexity exists in transitory (and probably nonselective) economic and fertility preferences. Tasiran compared empirical studies and models for Swedish (pre-1935 to 1965 cohorts) and white and non-white U.S. women (pre-1945 to 1966 cohorts), using macro-, micro-, and integrated data (also [Anderson & Low, 2003](#)). For non-white U.S. women, 5–9 years of education made having a first child less likely; 10 or more years made having a first child more likely. For white U.S. women, significant negative effects of education existed for first and second births. For Swedish women, the effects were significant for first and third child (5–9 years; an additional effect was seen on first child for 10+ years of education).

Women’s work has always appeared to present women with a fertility tradeoff harsher than men’s, but today is it money, or time? The analysis of [Taşiran \(1995\)](#) showed how the tradeoffs work for these populations: When women’s work experience was controlled for, women’s wages had several positive effects on aspects of fertility. Women’s work affects the likelihood of a first birth for Swedish and non-white U.S. women and second births for white U.S. women. This contrasts sharply with earlier studies, which confounded the tradeoffs of time and monetary gain for women’s work.

Some differences appear to be simple cultural preferences, others seem to reflect the cultural costs and benefits of having a child. The effect of cohort was significant, reflecting the fact that both economic conditions and cultural preferences may vary over time. In Sweden, whether a woman was married or cohabiting (vs. alone) had no effect on her likelihood of having one or more children; social services for parental benefits had a positive influence only on the probability of having a third child. A man’s wages increased the likelihood of having a first and (independently) a second child. In the study of [Taşiran \(1995\)](#), in the United States, a man’s income had a negative relationship to a woman’s probability of having a first, second, or third child. We have no information (e.g., lineage persistence) to help us understand whether this is a strategy shift (higher per capita investment per child, fewer children), a reproductively costly cultural preference, or simple co-variation with woman’s age, since “husband” includes second or later husbands.

7. Demographic consequences of women’s resource independence

7.1. *Work and family*

The demographic transition, when family sizes fell from, for example, 8–10 to 2–3 children, is something of an evolutionary conundrum (e.g., [Borgerhoff Mulder, 1998b](#)), particularly in the context of women’s resource control. It makes some ecological sense that, as competition

to marrying and getting established increases (as in 19th century Europe and North America and in the developing nations today) and, thus, the cost of each successful child increases, two things might follow: (1) family sizes would fall; and (2) women might shift strategies from pure reproductive value (probable number of children that a woman will have in the remainder of her life, given prevailing age-specific fertility and mortality patterns; Fisher, 1958) to a mixture of resource and reproductive value (Boone & Kessler, 1999; Kaplan & Lancaster, 2000; Low, 2000a; MacArthur & Wilson, 1967). That is, a woman's value might be not only the children that she might have but also the resources that she could contribute to those children's upbringing. Market factors are important in modern societies as diverse as New Mexican Latinos and Thais (Kaplan, Lancaster, Bock, & Johnson, 1995; Knodel, Havanon, & Sittirai, 1990). This represents an important teasing apart of influences; in early biological models, the "cost of getting established" was only influenced by conspecific density, clearly too simple a situation to describe human shifts. Mace (1998, 2000) modeled the evolution of human reproductive rates when wealth is inherited and has shown that that the cost of children has a large effect. Hence, women's shifts, in the face of shifting market competition and increasing per capita costs of children, make selective sense. But have we gone too far, in evolutionary terms (Borgerhoff Mulder, 1998b; Low, 2000a)?

Women today in western developed nations tend to marry later than in traditional and historical societies. Many women who marry relatively late work before (and often after) marriage—increasing their resource base. Family sizes are relatively small, and variance in family size is compressed, compared with traditional and historical societies. In general, women's resources and their reproductive success are positively correlated in studies that examine individual patterns and some census data. Resource effects are primarily at the very low end of the resource spectrum; for example, women on welfare have very low fertility (Acs, 1996; Rank, 1989). One study of census data (Daly & Wilson, 1983, p. 334) also found a positive relationship. Here, household income (not specified, but in that period largely male income) was part of the equation. Tasiran (1995) found that the impact of work, years at work, and income differed for white and Black American and Swedish women. In no case were the impacts of work on fertility wholly negative (above). Yet, it seems clear that today, even as among hunter-gatherers, women face tradeoffs in the expenditure of effort to get resources versus investment of existing resources into children.

7.2. Demographic transition in developing nations

Developing nations today are undergoing demographic transitions to smaller families, as the West did in the 19th century. Once, industrialization was seen (incorrectly: e.g., Schofield & Coleman, 1986) as the proximate cause of fertility decline. It is not a direct major force in modern transitions, but there is a deeper similarity of interest to evolutionary biologists: the degree of per capita investment required to produce highly competitive children, such as market forces (e.g., preferences in the job market; above). And within societies, even when wealthier families have fewer children than poorer families do, the income available for each child remains enormously higher for children in wealthy families (Birdsall, 1980; Birdsall & Griffin, 1988; Clarke & Low, 2001; Low, 2000a). In the past, the number of children was the

best predictor of number of grandchildren; today, it is often not. Are wealth and offspring simply no longer related? This is clearly a question requiring further comparative work.

7.3. *Modern adaptive and nonadaptive responses*

Today, as in the past, individuals respond to both ecological and social challenges, and the major demographic shifts that we see are the accumulated effects of individual responses. Some are adaptive. For example, in life history theory (e.g., Roff, 2001; Stearns, 1992), a primary force influencing the age at first reproduction is the life expectancy of newly matured adults: When life expectancy is short, and adult mortality high, reproduction is early and intense. Early and late reproduction represent life-history tradeoffs that are affected by the environment, in particular, the probability of mortality. Early reproduction means a shorter exposure to mortality before reproduction (seen in dangerous environments); later reproduction (which occurs when adults are safe) means that a mother can have more, or larger, offspring in her first reproductive bout. Daly and Wilson (1997), comparing reproductive patterns in 30 Chicago neighborhoods differing in adult life expectancy, found this general rule to hold. Women in the neighborhoods with the shortest life expectancy had children earlier in life than did women in neighborhoods with the longest life expectancy.

Other shifts in modern patterns appear similarly adaptive; for example, fertility among poor urban Black women and women in ex-Soviet countries is relatively early (e.g., Geronimus, 1996; Geronimus, Bound, Waidmann, Hillmeier, & Burns, 1996). Such women face declines in their health and fecundability and in their support systems.

The least obviously adaptive shifts in Western nations today are seen among women who seek careers such as, CEOs, MDs, lawyers—occupations in which success is associated both with extremely high effort “on the job” and with some risk taking (e.g., Browne, 2002). Fortune magazine reviews the Top 50 women in American business annually. In each survey, these women had very few children of their own, a stark contrast to the Top 50 men in American business. Thus the question: Under what circumstances can a woman’s delay of fertility compensate in increased resources enough to be reproductively profitable? Models by Low, Simon, and Anderson (2002, 2003) suggest that such circumstances are highly constrained. Women who are in the lowest socioeconomic strata in these models suffer very high infant and child mortality. When such women delay fertility enough to complete high school, their job opportunities are better, and they move up into strata with lower childhood mortality; they (or their daughters) then do better reproductively. There are essentially no conditions in these models under which delay of first birth past age 25–28 (except in declining populations: Fisher, 1958) can be reproductively profitable.

Surveys of men’s and women’s attitudes about sexual matters in modern Thailand (Knodel, Saingtienchair, Low, & Lucas, 1997) highlight sexual conflicts of interests (in a society in which resources are primarily male) and potentially adaptive responses under complex conditions. A long tradition exists of men, married as well as single, visiting sex workers in the context of men’s social evenings out. In addition, some men have “minor wives” whom they support at least partially. Thai wives have historically not had the ability to constrain these behaviors and have held a long-standing preference that their husbands, if sexually active

outside marriage, visit sex workers, because the transaction is brief and represents only a minor diversion of resources from the wife and children, in contrast to a minor wife, who can represent a real drain of resources. Interestingly, with the spread of HIV virus, an increasing proportion of women are responding to this sexual conflict of interests by preferring the husband to have a minor wife: The resource conflict is heightened, but the health risks are reduced.

7.4. *Women, status striving, and coalitions*

The very large scale and internal diversity of modern nation-states make generalizations premature. Certainly, women in many families continue, as in traditional societies, to work with female kin in childcare, for example. But both women's options for coalition building and the potential foci of such coalitions are far broader in most modern societies than in traditional and historical societies. Women may seek status and resources directly, not through association with powerful men, and we have probably underestimated the intensity of competitiveness among women (e.g., Campbell, 1999, 2002; Cashdan, 1998). In mobile societies, such coalitions may also become more fluid; one's friends and allies change more over the years than in small-scale societies. In these regard, women's coalitions have perhaps converged toward men's: fluid membership, concerned with resource garnering (not simply allocation of resources to children). However, differences remain. The particular status or resource can vary widely, from money and status as a CEO, to violence to achieve rank in a girl's gang (e.g., Sikes, 1998). In most circumstances, women do not profit (either reproductively or in other currencies), in seeking status through coalitions, from the same sort of behaviors that work for men; they typically maintain more cross-generational ties than men do.

7.5. *Women in politics*

The inherent tradeoffs for women between resource garnering and reproduction have not only demographic but also political ramifications today. In most countries, women are rare in national and international politics (Norway, India, the United States, and England are recent exceptions), even when there are societal and legal mechanisms to mandate that women, as well as men, have access to power and control of resources. We think of men's and women's interests as converging most strongly in monogamous societies (even in socially monogamous societies as modern nation-states and "monogamous/mildly polygynous" traditional societies; Flinn & Low, 1986; Low, 1988a), but women are not more likely to hold political office in monogamous societies, societies in which men are absent, in those with biased sex ratios or in those with particular subsistence bases—women as leaders are too rare to see any pattern, except that of descent, discussed above.

Evolutionarily novel modern conditions mean that women have more direct control of physical resources and potentially more ability to form powerful coalitions than do women in traditional or historical societies. Yet, significant resources, status, and power, once proximate correlates of reproductive success (at least in men), do not appear in modern societies to have clear positive effects on women's lifetime reproductive success.

8. Coda

One would not likely associate Alexander's work with issues of women's status. Nonetheless, his ability to identify crucial issues, to make questions testable, and to combine consideration of both social and ecological influences was paramount in moving the study of human behavior forward from largely anecdotal and specific to more general and testable. As Smith (2000) noted, current evolutionary approaches to the study of human behavior vary in particulars, but all share a theoretical core. This core owes an intellectual debt to Richard Alexander's work. These approaches are eminently useful in dissecting variation in women's roles and lives, among many other issues. There is considerable *patterned variation* in women's lives, both ecologically and socially influenced. This leads to testable hypotheses: why polygyny will be the default mating/marriage system; when women will control relatively more resources and hold relatively more power; when a mother's brother (rather than the putative father) will be the important mentor in a child's life, and so on.

Alexander's work, combined with the less human-focused theory of Dawkins (e.g., 1982, 1989), Hamilton (e.g., 1964, 1966, 1975), Williams (1966, 1975, 1992), and Wilson (1975, 1978), has spawned whole generations of evolutionary minded scholars: in anthropology, psychology, sociology, and economics. Women researchers like Hrdy (e.g., 1999), Gowaty (1997), Zuk (2002), and Smuts (1992, 1995) have bridged the gap between feminist scholarship and behavioral ecology, no mean feat. And now, women philosophers are reaching out (e.g., Vandermassen, 2004). The future holds promise!

References

- Acs, G. (1996). The impact of welfare on young mothers' subsequent childbearing decisions. *Journal of Human Resources*, 31, 898–915.
- Alexander, R. D. (1971). *The search for an evolutionary philosophy of man*. Paper presented at the Proceedings of the Royal Society, Victoria, Melbourne.
- Alexander, R. D. (1974). The evolution of social behavior. *Annual Review of Ecology and Systematics*, 5, 325–383.
- Alexander, R. D. (1977). Natural selection and the analysis of human sociality. In C. E. Goulden (Ed.), *Changing scenes in the natural sciences: 1776–1976. Bicentennial Symposium Monograph, Philosophical Academy of Natural Science, vol. 12* (Special Publication).
- Alexander, R. D. (1979). *Darwinism and human affairs*. Seattle, WA: University of Washington Press.
- Alexander, R. D. (1987). *The biology of moral systems*. New York: Aldine de Gruyter.
- Alexander, R. D. (1988). Evolutionary approaches to human behavior: what does the future hold? In L. Betzig, M. B. Mulder, & P. Turke (Eds.), *Human reproductive behaviour: a Darwinian perspective* (pp. 317–341). New York: Cambridge University Press.
- Alexander, R. D. (1990). How did humans evolve? Reflections on the uniquely unique species. *University of Michigan Museum of Zoology Special Publication 1*, 1–38.
- Alexander, R. D., & Borgia, G. (1978). On the origin and basis of the male–female phenomenon. In M. F. Blum, & N. Blum (Eds.), *Sexual selection and reproductive competition in insects* (pp. 402–435). New York: Academic Press.
- Alexander, R. D., Hoogland, J. L., Howard, R. D., Noonan, K. M., & Sherman, P. W. (1979). Sexual dimorphism and breeding systems in pinnipeds, ungulates, primates, and humans. In N. A. Chagnon, & W. Irons (Eds.),

- Evolutionary biology and human social behavior: an anthropological perspective* (pp. 402–435). North Scituate, MA: Duxbury Press.
- Anderson, B. A., & Romani, J. H. (1997). *Socioeconomic characteristics and excess female infant mortality in Jilin Province, China* (Research Report No. 97). University of Michigan: Population Studies Center.
- Anderson, K. G., & Low, B. (2003). Non-marital first births and women's life histories. In J. Rogers, & H. -P. Kohler (Eds.), *The biodemography of human fertility and reproduction* (pp. 57–86). Boston: Kluwer Press.
- Birdsall, N. (1980). Population growth and poverty in the developing world. *Population Bulletin*, 35, 3–46.
- Birdsall, N., & Griffin, C. (1988). Fertility and poverty in developing countries. *Journal of Policy Modeling*, 10, 29–55.
- Boone, J., & Kessler, K. L. (1999). More status or more children? Social status, fertility reduction, and long-term fitness. *Evolution and Human Behavior*, 20, 257–277.
- Borgerhoff Mulder, M. (1992). Women's strategies in polygynous marriage: Kipsigis, Datoga, and other East African cases. *Human Nature*, 3, 45–70.
- Borgerhoff Mulder, M. (1995). Bride wealth and its correlates. *Current Anthropology*, 36, 573–603.
- Borgerhoff Mulder, M. (1998a). Brothers and sisters: how sibling interactions affect optimal parental allocations. *Human Nature*, 9, 119–162.
- Borgerhoff Mulder, M. (1998b). The demographic transition: are we any closer to an evolutionary explanation? *Trends in Ecology and Evolution*, 13, 266–270.
- Browne, K. (2002). *Biology at work*. Rutgers, NJ: Rutgers University Press.
- Bugos, P. E., & McCarthy, L. M. (1984). Ayoreo infanticide: a case study. In G. Hausfater, & S. B. Hrdy (Eds.), *Infanticide: comparative and evolutionary perspectives* (pp. 503–520). New York: Aldine de Gruyter.
- Campbell, A. (1999). Staying alive: evolution, culture, and women's intrasexual aggression. *Behavioral and Brain Sciences*, 22, 203–252.
- Campbell, A. (2002). *A mind of her own: the evolutionary psychology of women*. Oxford, UK: Oxford University Press.
- Cashdan, E. (1998). Are men more competitive than women. *British Journal of Social Psychology*, 37, 213–229.
- Clarke, A. L. (1993). Women, resources, and dispersal in nineteenth-century Sweden. *Human Nature*, 4, 109–135.
- Clarke, A. L., & Low, B. (2001). Testing evolutionary hypotheses with demographic data. *Population and Development Review*, 27, 633–660.
- Clutton-Brock, T. H. (1991). *The evolution of parental care*. Princeton, NJ: Princeton University Press.
- Cords, M. (1986). Forest guenons and patas monkeys: male–male competition in one-male groups. In B. Smuts, D. L. Cheney, R. M. Seyfarth, R. Wrangham, & T. T. Strushsaker (Eds.), *Primate societies* (pp. 98–110). Chicago: University of Chicago Press.
- Cowlishaw, G., & Mace, R. (1996). Cross-cultural patterns of marriage and inheritance: a phylogenetic approach. *Ethology and Sociobiology*, 17, 87–97.
- Cronk, L. (1991a). Intention versus behavior in parental sex preferences among the Mukogodo of Kenya. *Journal of Biosocial Sciences*, 23, 229–240.
- Cronk, L. (1991b). Preferential parental investment in daughters over sons. *Human Nature*, 2, 387–417.
- Cronk, L. (1991c). Wealth, status, and reproductive success among the Mukogodo of Kenya. *American Anthropologist*, 93, 345–360.
- Cronk, L. (2000). Female-biased parental investment and growth performance among Mukogodo children. In L. Cronk, N. Chagnon, & W. Irons (Eds.), *Adaptation and human behavior: an anthropological perspective*. Hawthorne, NY: Aldine de Gruyter.
- Cronk, L. (2004). *From Mukogodo to Maasai: ethnicity and cultural change in Kenya*. Boulder, CO: Westview Press.
- Daly, M., & Wilson, M. (1983). *Sex, evolution, and behavior* (2nd ed.). Boston: Willard Grant.
- Daly, M., & Wilson, M. (1996). Violence against stepchildren. *Current Directions in Psychological Science*, 5, 77–81.
- Daly, M., & Wilson, M. (1997). Life expectancy, economic inequality, homicide, and reproductive timing in Chicago neighborhoods. *British Journal of Medicine*, 314, 1271–1274.

- Dasgupta, M., & Shuzhuo, L. (1999). Gender bias in China, South Korea and India 1920–1990: effects of war, feminine, fertility decline. *Development and Change*, 30, 619–652.
- Dasgupta, M., & Visaria, L. (1996). Son preference and excess female mortality in India's demographic transition. *Sex preferences for children and gender discrimination in Asia* (pp. 115–138). UNFPA: Korea Institute for Health and Social Affairs.
- Davies, N. (1989). Sexual conflict and the polygamy threshold. *Animal Behaviour*, 38, 226–234.
- Dawkins, R. (1982). *The extended phenotype: the gene as the unit of selection*. Oxford: Oxford University Press.
- Dawkins, R. (1989). *The selfish gene*, (New ed.). Oxford: Oxford University Press.
- de Waal, F. (1982). *Chimpanzee politics*. New York: Harper & Row.
- Dickemann, M. (1979). The reproductive structure of stratified societies: a preliminary model. In N. Chagnon, & W. Irons (Eds.), *Evolutionary biology and human social organization: an anthropological perspective* (pp. 331–367). North Scituate, MA: Duxbury Press.
- Digby, L. J. (1995). Infant care, infanticide, and female reproductive strategies in polygynous groups of common marmosets (*Callithrix jacchus*). *Behavioral Ecology and Sociobiology*, 37, 51–61.
- Drake, M. (1969). *Population and society in Norway: 1735–1865*. Cambridge, UK: Cambridge University Press.
- Fisher, R. A. (1958). *The genetical theory of natural selection*. New York: Dover Books.
- Flinn, M. V., & Low, B. S. (1986). Resource distribution, social competition, and mating patterns in human societies. In D. Rubenstein, & R. Wrangham (Eds.), *Ecological aspects of social evolution*. Princeton, NJ: Princeton University Press.
- Garanne, M., & van de Walle, E. (1989). Polygyny and fertility among the Sereer of Senegal. *Population Studies*, 43, 267–283.
- Gaulin, S. J. C., & Boster, J. S. (1990). Dowry as female competition. *American Anthropologist*, 92, 994–1005.
- Gaulin, S. J. C., & Boster, J. (1997). When are husbands worth fighting for? In L. Betzig (Ed.), *Human nature: a critical reader* (pp. 372–374). Oxford: Oxford University Press.
- Gaulin, S. J. C., McBurney, D. H., & Brakeman-Wartell, S. L. (1997). Matrilineal biases in the investment of aunts and uncles: a consequence and measure of paternal uncertainty. *Human Nature*, 8, 139–151.
- Gaulin, S. J. C., & Robbins, C. J. (1991). Trivers–Willard effect in contemporary North American society. *American Journal of Physical Anthropology*, 85, 61–68.
- Geronimus, A. T. (1996). Black/white differences in the relationship of maternal age to birth weight. *Social Science & Medicine*, 42, 589–597.
- Geronimus, A. T., Bound, J., Waidmann, T. A., Hillmeier, M. M., & Burns, P. B. (1996). Excess mortality among Blacks and Whites in the United States. *New England Journal of Medicine*, 335, 1552–1558.
- Gowaty, P. A. (1997). Darwinian feminists and feminist evolutionists. In P. A. Gowaty (Ed.), *Feminism and evolutionary biology* (pp. 1–7). New York: Chapman.
- Hames, R. B. (1988). The allocation of parental care among the Ye'kwana. In L. Betzig, M. Borgerhoff Mulder, & P. Turke (Eds.), *Human reproductive behavior: a Darwinian perspective* (pp. 192–207). Cambridge, UK: Cambridge University Press.
- Hames, R. B. (1996). Costs and benefits of monogamy and polygyny for Yanomamö women. *Ethology and Sociobiology*, 17, 181–199.
- Hamilton, W. D. (1964). The genetical evolution of social behaviour: I, II. *Journal of Theoretical Biology*, 7, 1–52.
- Hamilton, W. D. (1966). The moulding of senescence by natural selection. *Journal of Theoretical Biology*, 12, 12–45.
- Hamilton, W. D. (1975). Innate social aptitudes of man: an approach from evolutionary genetics. In R. Fox (Ed.), *ASA studies 4: biosocial anthropology* (pp. 133–153). London: Malaby Press.
- Hamilton, W. D. (1980). Sex versus non-sex versus parasite. *Oikos*, 35, 282–290.
- Hamilton, W. D., & Zuk, M. (1982). Heritable true fitness and bright birds: a role for parasites? *Science*, 218, 384–387.
- Hartung, J. (1982). Polygyny and the inheritance of wealth. *Current Anthropology*, 23, 1–12.
- Hartung, J. (1997). If I had it to do over. In L. Betzig (Ed.), *Human nature: a critical reader* (pp. 344–348). Oxford: Oxford University Press.

- Hill, E., & Low, B. (1991). Contemporary abortion patterns: a life-history approach. *Ethology and Sociobiology*, *13*, 35–48.
- Hill, K., & Hurtado, A. M. (1996). *Ache life history: the ecology and demography of a foraging people*. New York: Aldine de Gruyter.
- Hrdy, S. B. (1979). Infanticide among animals: a review, classification and implications for the reproductive strategies of females. *Ethology and Sociobiology*, *1*, 13–40.
- Hrdy, S. B. (1999). *Mother nature*. New York: Pantheon Books.
- Hughes, A. L. (1986). Reproductive success and occupational class in eighteenth-century Lancashire, England. *Social Biology*, *33*, 109–115.
- Hurtado, M., Hill, K., Kaplan, H., & Hurtado, J. (1992). Tradeoffs between food acquisition and child care among Hiwi and Ache women. *Human Nature*, *3*, 185–216.
- Irons, W. (1979). Cultural and biological success. In N. A. Chagnon, & W. Irons (Eds.), *Evolutionary biology and human social behavior: an anthropological perspective* (pp. 257–272). North Scituate, MA: Duxbury Press.
- Irons, W. (1983). Human female reproductive strategies. In S. K. Wasser (Ed.), *Social behavior of female vertebrates* (pp. 169–213). New York: Academic Press.
- Josephson, S. C. (1993). Status, reproductive success, and marrying polygynously. *Ethology and Sociobiology*, *14*, 391–396.
- Judge, D. S. (1995). American legacies and the variable life histories of women and men. *Human Nature*, *6*, 291–323.
- Judge, D. S., & Hrdy, S. B. (1992). Allocation of accumulated resources among close kin: inheritance in Sacramento, California, 1890–1984. *Ethology and Sociobiology*, *13*, 495–522.
- Kaplan, H. (1997). The evolution of the human life course. In K. W. Wachter, & C. E. Finch (Eds.), *Between Zeus and the Salmon: the biodemography of longevity* (pp. 175–210). Washington, DC: National Academy Press.
- Kaplan, H., & Lancaster, J. (2000). The evolutionary economics and psychology of the demographic transition to low fertility. In L. Cronk, N. Chagnon, & W. Irons (Eds.), *Adaptation and human behavior: an anthropological perspective* (pp. 283–322). Hawthorne, NY: Aldine de Gruyter.
- Kaplan, H., & Lancaster, J. B. (1999). The life histories of men in Albuquerque: an evolutionary-economic analysis of parental investment and fertility in modern society. In L. Cronk, N. Chagnon, & W. Irons (Eds.), *Adaptation and human behavior: an anthropological perspective* (pp. 283–322). Hawthorne, NY: Aldine de Gruyter.
- Kaplan, H., Lancaster, J. B., Bock, J. A., & Johnson, S. E. (1995). Fertility and fitness among Albuquerque men: a competitive labour market theory. In R. I. M. Dunbar (Ed.), *Human reproductive decisions* (pp. 96–136). London: St. Martin's Press (in association with the Galton Institute).
- Knodel, J. (1988). *Demographic behavior in the past: German village populations in the 18th and 19th centuries* (pp. 96–136). Cambridge, UK: Cambridge University Press.
- Knodel, J., Havanon, N., & Sittitriai, W. (1990). Family size and the education of children in the context of rapid fertility decline. *Population and Development Review*, *16*, 31–62.
- Knodel, J., Saengtienchair, C., Low, B., & Lucas, R. (1997). An evolutionary perspective on Thai sexual attitudes. *Journal of Sex Research*, *34*, 292–303.
- Lazaro-Perea, C., Castro, C. S., Harrison, R., Araujo, A., Arruda, M. F., & Snowdon, C. T. (2000). Behavioral and demographic changes following the loss of the breeding female in cooperatively breeding marmosets. *Behavioral Ecology and Sociobiology*, *48*, 137–146.
- LeBoeuf, B., & Reiter, J. (1988). Lifetime reproductive success in Northern elephant seals. In T. H. Clutton-Brock (Ed.), *Reproductive success: studies of individual variation in contrasting breeding systems* (pp. 344–383). Chicago: University of Chicago Press.
- Low, B. (1988a). Measures of polygyny in humans. *Current Anthropology*, *29*, 189–194.
- Low, B. (1988b). Pathogen stress and polygyny in humans. In L. Betzig, M. Borgerhoff Mulder, & P. Turke (Eds.), *Human reproductive behaviour: a Darwinian perspective* (pp. 115–128). Cambridge, UK: Cambridge University Press.

- Low, B. (1989). Cross-cultural patterns in the training of children: an evolutionary perspective. *Journal of Comparative Psychology*, *103*, 311–319.
- Low, B. (1990a). Human responses to environmental extremeness and uncertainty: a cross-cultural perspective. In E. Cashdan (Ed.), *Risk and uncertainty in tribal and peasant economies* (pp. 229–255). Boulder, CO: Westview Press.
- Low, B. (1990b). Land ownership, occupational status, and reproductive behavior in 19th-century Sweden: Tuna parish. *American Anthropologist*, *92*, 457–468.
- Low, B. (1990c). Marriage systems and pathogen stress in human societies. *American Zoologist*, *30*, 325–339.
- Low, B. (1990d). Sex, power, and resources: ecological and social correlates of sex differences. *Journal of Comparative Psychology*, *27*, 45–71.
- Low, B. (1991). Reproductive life in nineteenth century Sweden: an evolutionary perspective on demographic phenomena. *Ethology and Sociobiology*, *12*, 411–448.
- Low, B. (1992). Sex, coalitions, and politics in preindustrial societies. *Politics and the Life Sciences*, *11*, 63–80.
- Low, B. (1993). Ecological demography: a synthetic focus in evolutionary anthropology. *Evolutionary Anthropology*, *1993*, 106–112.
- Low, B. (1994). Men in the demographic transition. *Human Nature*, *5*, 223–253.
- Low, B. (1998). The evolution of human life histories. In C. Crawford, & D. L. Krebs (Eds.), *Handbook of evolutionary psychology* (pp. 131–161). Mahwah, NJ: Lawrence Erlbaum Assoc.
- Low, B. (2000a). Sex, wealth, and fertility: old rules, new environments. In L. Cronk, N. Chagnon, & W. Irons (Eds.), *Adaptation and human behavior: an anthropological perspective* (pp. 323–344). Hawthorne, NY: Aldine de Gruyter.
- Low, B. (2000b). *Why sex matters* (pp. 323–344). Princeton, NJ: Princeton University Press.
- Low, B. (2004). Ecological and social complexities in human monogamy. In C. Boesch, & U. Reichart (Eds.), *The evolution of monogamy* (pp. 161–176). Cambridge: Cambridge University Press.
- Low, B., & Clarke, A. L. (1991). Occupational status, land ownership, migration, and family patterns in 19th-century Sweden. *Journal of Family History*, *16*, 117–138.
- Low, B., & Clarke, A. L. (1992). Resources and the life course: patterns in the demographic transition. *Ethology and Sociobiology*, *13*, 463–494.
- Low, B., Clarke, A. L., & Lockridge, K. (1992). Toward an ecological demography. *Population and Development Review*, *18*, 1–31.
- Low, B., Simon, C. P., & Anderson, K. G. (2002). An evolutionary ecological perspective on demographic transitions: modeling multiple currencies. *American Journal of Human Biology*, *14*, 149–167.
- Low, B., Simon, C. P., & Anderson, K. G. (2003). The biodemography of modern women: tradeoffs when resources become limiting. In J. Rogers, & H. -P. Kohler (Eds.), *The biodemography of human fertility and reproduction* (pp. 105–134). Boston, MA: Kluwer Press.
- MacArthur, R. H., & Wilson, E. O. (1967). *The theory of island biogeography*. Princeton, NJ: Princeton University Press.
- Mace, G. M. (1990). Birth, sex ratio, and infant mortality rates in captive western lowland gorillas. *Folia Primatologica*, *55*, 156–165.
- Mace, R. (1996). Biased parental investment and reproductive success in *Gabbara pastoralists*. *Behavioral Ecology and Sociobiology*, *38*, 75–81.
- Mace, R. (1998). The coevolution of human fertility and wealth inheritance strategies. *Philosophical Transactions of the Royal Society of London. Series B*, *353*, 389–397.
- Mace, R. (2000). An adaptive model of human reproductive rate where wealth is inherited. In L. Cronk, N. Chagnon, & W. Irons (Eds.), *Adaptation and human behavior: an anthropological perspective* (pp. 261–281). Hawthorne, NY: Aldine de Gruyter.
- Murdock, G. P. (1981). *Atlas of world cultures*. Pittsburgh, PA: University of Pittsburgh Press.
- Murdock, G. P., & White, D. (1969). Standard cross-cultural sample. *Ethnology*, *8*, 329–369.

- Packer, C., & Pusey, A. (1983). Adaptation of female lions to infanticide by incoming males. *American Naturalist*, *121*, 716–728.
- Parry, J. P. (1979). *Caste and kinship in Kangara*. London: Routledge & Paul.
- Pebbley, A., & Mbugua, W. (1989). Polygyny and fertility in sub-Saharan Africa. In R. Lesthaeghe (Ed.), *Reproductive and social organization in sub-Saharan Africa*. Berkeley, CA: University of California Press.
- Premi, M. (2001). The missing girl child. *Economic and Political Weekly*, *36*, 1875–1880.
- Rank, M. (1989). Fertility among women on welfare. *American Sociological Review*, *54*, 296–304.
- Rao, V. (1997). Wife-beating in rural south India: a qualitative and econometric analysis. *Social Science & Medicine*, *44*, 1169–1180.
- Reichard, U. (2004). Monogamy: past and present. In U. Reichard, & C. Boesch (Eds.), *Monogamy: mating strategies and partnerships in birds, humans, and other mammals* (pp. 3–25). Cambridge, UK: Cambridge University Press.
- Roff, D. A. (2001). *The evolution of life histories: theory and analysis* (pp. 3–25). New York: Chapman & Hall.
- Schofield, R. S., & Coleman, D. (1986). Introduction: the state of population theory. In D. Coleman, & R. Schofield (Eds.), *The state of population theory: forward from Malthus* (pp. 1–13). London: Blackwell.
- Sellen, D., Borgerhoff Mulder, M., & Seiff, D. F. (2000). Fertility, offspring quality, and wealth in Datoga pastoralists: testing evolutionary models of intersexual selection. In L. Cronk, N. Chagnon, & W. Irons (Eds.), *Adaptation and human behavior: an anthropological perspective* (pp. 91–114). Hawthorne, NY: Aldine de Gruyter.
- Sichona, F. J. (1993). The polygyny-fertility hypothesis revisited: the situation in Ghana. *Journal of Biosocial Sciences*, *25*, 473–482.
- Sikes, G. (1998). *Eight-ball chicks*. Anchor: New York.
- Smith, E. A. (1995). Inuit sex ratio: a correction and an addendum. *Current Anthropology*, *36*, 658–659.
- Smith, E. A. (2000). Three styles in the evolutionary analysis of human behavior. In L. Cronk, N. Chagnon, & W. Irons (Eds.), *Adaptation and human behavior: an anthropological perspective* (pp. 27–46). Hawthorne, NY: Aldine de Gruyter.
- Smith, E. A., & Smith, S. A. (1994). Inuit sex-ratio variation. *Current Anthropology*, *45*, 595–624.
- Smuts, B. (1992). Male aggression against women: an evolutionary perspective. *Human Nature*, *3*, 1–44.
- Smuts, B. (1995). The evolutionary origins of patriarchy. *Human Nature*, *6*, 1–32.
- Stearns, S. C. (1992). *The evolution of life histories*. Oxford: Oxford University Press.
- Strassmann, B. I. (1997). Polygyny as a risk factor for child mortality among the Dogon. *Current Anthropology*, *38*, 688–695.
- Strassmann, B. I. (2000). Polygyny, family structure, and child mortality: a prospective study among the Dogon of Mali. In L. Cronk, W. Irons, & N. Chagnon (Eds.), *Adaptation and human behavior: an anthropological perspective* (pp. 49–67). New York: Aldine de Gruyter.
- Taşiran, A. C. (1995). *Fertility dynamics: spacing and timing of births in Sweden and the United States* (pp. 49–67). Amsterdam: Elsevier.
- Timaeus, I. M., & Reynar, A. (1988). Polygynists and their wives in sub-Saharan Africa: an analysis of five demographic and health surveys. *Population Studies*, *52*, 145–162.
- Torres, A., & Forrest, J. D. (1988). Why do women have abortions? *Family Planning Perspectives*, *20*, 169–176.
- Trivers, R. L., & Willard, D. E. (1973). Natural selection of parental ability to vary the sex ratio. *Science*, *179*, 90–92.
- Vandermassen, G. (2004). Sexual selection: a tale of male bias and feminist denial. *European Journal of Women's Studies*, *11*, 9–26.
- Voland, E. (1990). Differential reproductive success within the Krummhörn population (Germany, 18th and 19th centuries). *Behavioral Ecology and Sociobiology*, *26*, 65–72.
- Voland, E., & Dunbar, R. (1995). Resource competition and reproduction: the relationship between economic and parental strategies in the Krummhörn population. *Human Nature*, *6*, 33–49.
- Voland, E., & Engel, C. (1989). Female choice in humans: a conditional mate selection strategy of the Krummhörn women (Germany 1720–1874). *Ethology*, *84*, 144–154.

- Voland, E., Siegelkow, E., & Engel, C. (1990). Cost/benefit oriented parental investment by high status families: the Krummhörn case. *Ethology and Sociobiology*, *12*, 105–118.
- Wasser, S. (1983). Reproductive competition and cooperation among female yellow baboons. In S. Wasser (Ed.), *Social Behavior of Female Vertebrates*. New York: Academic Press.
- Watts, D. P. (1989). Infanticide in mountain gorillas: new cases and a reconsideration of the evidence. *Ethology*, *81*, 1–18.
- White, D., & Burton, M. (1988). Causes of polygyny: ecology, economy, kinship, and warfare. *American Anthropologist*, *90*, 871–887.
- Whyte, M. K. (1978). Cross-cultural codes dealing with the relative status of women. *Ethology*, *17*, 211–237.
- Williams, G. C. (1966). *Adaptation and natural selection*. Princeton, NJ: Princeton University Press.
- Williams, G. C. (1975). *Sex and evolution*. Princeton, NJ: Princeton University Press.
- Williams, G. C. (1992). *Natural selection: domains, levels, and challenges*. Oxford: Oxford University Press.
- Wilson, E. O. (1975). *Sociobiology: the new synthesis*. Cambridge, MA: Harvard University Press.
- Wilson, E. O. (1978). *On human nature*. Cambridge, MA: Harvard University Press.
- Yanca, C., & Low, B. (2004). Female allies and female power: a cross-cultural analysis. *Evolution and Human Behavior*, *25*, 9–23.
- Zuk, M. (2002). *Sexual selections: what we can and can't learn about sex from animals*. Berkeley, CA: University of California Press.