

An Evolutionary Perspective on Human Fertility

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This paper illustrates evolutionary approaches to population issues. Life history theory is a general theoretical framework that incorporates environmental influences, contextual influences, and heritable variation. In general, physically or psychologically stressful environments delay maturation and the onset of reproductive competence. Perceptions of scarcity also result in lower fertility by delaying reproduction or having fewer children—a phenomenon viewed as an adaptation to ancestral environments. The desire for upward social mobility is viewed as an evolved motive disposition affecting fertility decisions. The opportunity for upward social mobility typically results in delaying reproduction and lowering fertility in the interest of increasing investment in children. Variation in life history strategies is also influenced by genetic variation, but genetic variation interacts with cultural shifts in the social control of sexual behavior. Finally, I discuss the effects of between-group competition for resources on population issues. Immigration policy and group differences in fertility influence political power within and between societies, often with explosive results. Demographic expansion has often been an instrument of ethnic competition and is an important source of conflict in the contemporary world.

INTRODUCTION

This paper illustrates the types of contribution that an evolutionary perspective can make to thinking about fertility and its relation to the environment. In a very real sense fertility and especially differences in fertility

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and how these differences are elicited by environmental cues should be the \$64,000 question in evolutionary science. In evolutionary terms, differences in fertility are differences in biological fitness, and they therefore are fundamental in understanding how gene frequencies in human populations continue to change.

LIFE HISTORY THEORY AND HUMAN FERTILITY

One area where evolutionary biology can contribute is at the level of basic theory. In biology, life history theory attempts to understand patterns of longevity, pair bonding, age of first reproduction, period of pre-adult dependency, and levels of paternal and maternal investment. A reproductive strategy involves a response to a central external ecological contingency that selects for optimum levels of partitioning mating effort (i.e., the effort expended in attracting mates) and parenting effort (i.e., effort expended in rearing offspring).

Paternal investment in offspring—a critical component of life-history strategy—typically involves provisioning and protecting the young and is associated with ecological situations where paternal care is linked with offspring survival (Clutton-Brock, 1991; Krebs & Davis, 1993; Geary, 1998). Paternal investment is associated with adaptation to ecologically adverse or highly competitive environments where high levels of parental investment are critical to rearing successful offspring (Diamond, 1986; Kleiman, 1977, 1981; Miller, 1994b; Wilson, 1975; Southwood, 1981). This makes intuitive sense because in ecologically adverse or highly competitive situations, male provisioning of food or other resources might tip the balance in favor of offspring compared to the offspring of males who do not provision their young. Geary (1998) summarizes evidence indicating that paternal investment does indeed increase the survival rate among humans and was likely an important factor in human evolution.

Nevertheless, the extent to which paternal investment is necessary varies widely within and between cultures. Regarding the latter, several theorists have proposed that the adverse, ecologically very marginal environments created by the Ice Age had an important role in shaping the intelligence and high-investment reproductive behavior of northern populations (Jensen, 1998; Lenz, 1931; Lynn, 1987; MacDonald, 1994; Miller, 1994a,b; Rushton, 1988, 1995). Within this framework, natural selection resulted in a tendency toward high-investment parenting as a result of chronic environmental adversity: Raising children required more investment in such environments, including, I would suppose, paternal investment.

In addition to adverse environments, highly competitive environments

may also lead to high-investment parenting. Here the theoretical focus has been on the *r/K* continuum of reproductive strategies. *r*-selected species evolve in response to highly unstable environments where there is little predictability of resource availability. These species adopt a low-investment/high-fertility reproductive strategy to take advantage of temporary situations where there are abundant resources and little competition.

On the other hand, *K*-selected species evolve in response to a highly stable, predictable resource environment. These species adopt a high-investment/low-fertility strategy in order to compete with conspecifics and with other species (Southwood, 1981). While *r*-selected species respond to temporary periods of resource abundance with a low-investment reproductive style, *K*-selected species adapt to a highly predictable resource environment in which parents are forced to forego additional matings in order to invest their time and energy in producing highly competitive offspring. Geary (1998) reviews evidence indicating that paternal investment is associated with social competence. For example, divorce leads to increases in aggressive and noncompliant behaviors (Belsky, Steinberg, & Draper, 1991), while father-child play is associated with social popularity of children (MacDonald & Parke, 1984; Carson, Burks, & Parke, 1993).

Within either the adversity selection or the *r/K* framework, then, high fertility and low-investment parenting are not expected responses to resource scarcity or environmental stress for humans. Moreover, while *r*-selected species tend to overshoot their resource base, adversity-selected and *K*-selected species remain within the carrying capacity of the environment. The expected response, therefore, of a *K*-selected or adversity-selected species to resource scarcity would be to delay reproduction until reproduction was viable, but not to respond to adversity and stress with low-investment reproduction. The expectation would be that cues to environmental adversity would result in a delay of maturation and reproductive viability and lowered fertility. On the other hand, cues of environmental abundance and richness are predicted to result in earlier maturation, earlier reproduction, and higher fertility.

In conformity with these predictions, there is a very consistent pattern indicating that stressors of all kinds uniformly result in a lowered tempo of maturation, including age of menarche.

Some of the more interesting data gathered by Tanner (unless otherwise referenced) include the following:

- There is a pronounced secular trend (beginning at least 150 years ago in England) of lowered age of menarche associated with better nutrition coincident with modernization. It is unlikely that these changes are the result of increasing stress in the modern world, since this rise is associ-

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ated with increases in the birth weights of babies (e.g., Gruenwald et al., 1967) and increases in brain size (e.g., Miller & Corsellis, 1977), and increases in height (Tanner, 1990). More likely, the changes are the result of better nutrition consequent to increasing living standards. Real standards of living have approximately doubled between the 1930's and the 1980's (Coleman & Salt, 1992).

- Malnutrition (e.g., in times of war) or disease slows down growth and onset of menarche.
- Psychosocial stressors (e.g., abusive family relationships, sadistic teachers) have similar effects on physical maturation (e.g., failure to thrive) as do nutritional deficits or deficits due to disease, i.e., a slowing of developmental tempo. Children at some boarding schools grew less during school term than when at home during vacations. Recently Surbey (1999) found that delayed pubertal development was associated with a measure of stressful life events. Results were mixed, however, since Surbey also found that a measure of daily stressful events was associated with earlier menarche.
- In Britain, upper SES children continue to mature more rapidly than lower SES children. Additional children of manual workers show more of a growth decrement in comparison to their older siblings than children of non-manual workers. These findings are compatible with the proposal that the greater nutritional and psychological stresses occurring in the lower classes delay maturation.
- Social class differences in growth rates have been obliterated in Sweden and Norway, a result that Tanner suggests is due to the success of social welfare programs in those countries.
- The stress of high levels of physical exercise, as among dancers and athletes, is known to delay the onset of puberty (Calabrese et al., 1983; Warren et al., 1991; Warren et al., 1986).
- Zajonc's (1976; see also Zajonc, Markus, & Markus, 1979) confluence model indicates that intelligence declines as a function of birth order and less spacing between births.

These data cannot be interpreted as indicating developmental delays only in extreme circumstances (see Rowe, 1999). For example, the secular trend in age of menarche and the deficits occurring in lower SES groups are not the result of extreme deprivation, but indicate a gradual cline from markedly poor environments in earlier eras and among the poorer classes to superior environments characteristic of contemporary affluent people.

Also supporting the present perspective are historical examples where populations have responded to perceptions of environmental adversity by delaying reproduction or continuing a high-investment style of reproduction. Virginia Abernethy (this issue) has emphasized such findings in her

pioneering work on fertility regulation. Reviewing worldwide data, she has provided many examples indicating that in general perceptions of economic prosperity leads to increased fertility, and economic downturns lead to declines in fertility. For example, the Great Depression and the depression of the 1890's were associated with later marriage and delays in having children. On the other hand, the prosperity during and after World War II resulted in a decline in age of marriage and earlier child bearing (Coleman, 1990; Moss, 1964).

This pattern is typical of Western societies over historical time (Hajnal 1965; 1983; Laslett 1983; MacFarlane 1980, 1986; Wall 1983; Wrigley & Schofield, 1981). There is good evidence that the prime mechanism for the regulation of population in pre-industrial Western Europe centered around a flexible age of marriage, pre-conjugal chastity, and varying the percentage of females marrying rather than through the Malthusian positive constraint of mortality.

From an evolutionary perspective, therefore, the argument is that humans have been selected to respond to perceptions of environmental adversity by delaying or lowering reproduction and to respond to perceptions of environmental optimism and prosperity in the opposite manner. Because this seems to be a universal pattern in humans, the suggestion is that during human evolution there were recurrent periods of scarcity and that successful individuals responded to cues of scarcity by delaying or lowering reproduction, resulting in a very important human psychological adaptation.

EVOLVED MOTIVE DISPOSITIONS AND HUMAN FERTILITY

A second area where evolutionary thinking may make a contribution involves what I term Evolved Motive Dispositions (MacDonald, 1991, 1995a). Evolutionists conceptualize humans as having oftentimes conflicting drives and motives. It is common among evolutionists to argue that social status seeking is an evolved motive disposition (Barkow, 1989; Buss, 1994). People in all human societies monitor their position relative to others in the society and are highly motivated to increase or maintain their social status. The proposal is that the evolved desire to increase or maintain one's social status may conflict with the desire to have large numbers of children and therefore influence fertility decisions.

People's desire for the trappings of social status sometimes results in behavior that conflicts with principles of economic rationality—a good indicator that social status seeking has deep psychological roots and indeed constitutes a psychological adaptation. For example, Paul Johnson (1985)

found that 19th-century British working class people would commonly pawn their Sunday best suit for six days in the week and then redeem it on Sunday, thereby incurring an interest rate up to 100% per year. The Sunday Suit acted as the visible public guarantee of a family's continuing respectability. It demonstrated the family's financial sufficiency and therefore maintained its social status and credit-worthiness.

I suppose that the default mechanism is to adopt a high-fertility, early-marriage strategy (Turke, 1989). However, in the event that people perceive that such a strategy will result in poverty while delaying marriage and having fewer children would result in relative economic ease and an increase or maintenance of one's social status, there is a shift to a later-marriage, low-fertility strategy. This shift is conceptualized as a result of a conflict between two universal human motivational systems. Conflicts between evolved motivational systems are undoubtedly quite common, as indicated by evolutionary analysis of human personality systems (MacDonald, 1995a). For example, men may have conflicts between evolved desires for intimate social relationships and evolved desires for the excitement and pleasure of sexual promiscuity. These goals may be incompatible in particular situations, but both motivational systems are adaptations.

In the case of reproductive strategies, there may be a similar conflict between evolved motivational systems. Paul Turke (1989) has shown that humans universally view children as costly but desirable items. However, the motive to maximize the number of surviving offspring may conflict with the evolved motive to increase or maintain social status. If it does, as in the period following economic modernization for Western European populations, then for many people the desire for higher social status results in delayed marriage, low fertility and high investment in children. However, people who do not perceive themselves as able to take advantage of opportunities for upward social mobility by delaying marriage and restricting fertility are much less inclined to do so than those who perceive the status advantages of adopting a low-fertility strategy.

The critical role of the possibility for upward social mobility is implicit in Macunovich's (this issue) emphasis on relative cohort size (RCS) as the critical variable influencing fertility transitions. Macunovich proposes that young men develop their perception of acceptable living standards and social class status during childhood. Increasing RCS results in downward pressure on young men's wages and a trade-off in which they accept lower levels of fertility in return for higher levels of material well-being more in keeping with expectations developed during childhood.

A somewhat different influence of social class can be seen in the be-

havior of historic Jewish populations. Whereas Macunovich's males adjust their fertility in an attempt to match the social class of their parents, these populations responded to increased opportunity for upward social mobility by sharply curtailing their fertility. Ashkenazi Jews are prone to developing a high-investment reproductive strategy (MacDonald, 1994). Ashkenazi Jews as a group have a very high average IQ. The average full scale IQ is approximately 117, with large differences between performance and verbal IQ compatible with an average verbal IQ of 125 and a performance IQ in the average range. There is good historical evidence for eugenic pressures as a result of marriage practices which produced a large overlap among intelligence, resource acquisition and reproductive success in traditional Ashkenazi Jewish society.

Despite the finding that Ashkenazi Jews are highly prone to develop a high-investment reproductive strategy, perceptions of the possibility of upward social mobility had a profound effect on the life-history strategy of European Jewish populations. Western-European Jews were relatively quick to adopt a low-fertility/high-investment strategy in response to possibilities for upward social mobility. Jews in Germany and other Western societies entered the demographic transition considerably earlier than gentiles in the same society and achieved a remarkable level of social and economic success (e.g., Goldstein, 1981; Knodel, 1974). Moreover, Jewish fertility changed from being higher than gentile fertility to being lower than gentile fertility in the aggregate (e.g., A. Goldstein 1981; Knodel 1974; Ritterband 1981). This shift to a higher-investment style of childrearing was accompanied by theoretically expected demographic markers of high-investment parenting, including low rates of infant and adult mortality compared to gentiles even after controlling for SES, as well as lower levels of illegitimacy, premarital conception, and divorce rates (Cohen 1986; Goldstein 1981; Guttmacher & Secord, 1981).

However, Jewish populations in Eastern Europe behaved quite differently during the same period but under quite different circumstances. Throughout the 19th century, Jewish populations in Eastern Europe had the highest rate of natural increase of any European population, e.g., rising from one to six million in the Russian Empire (Alderman 1992, 112; Frankel 1981, 103; Lindemann 1991, 28–29, 133–135). This population explosion was accompanied by high rates of poverty within the Jewish population in the context of official state-sponsored quotas on Jewish enrollment in universities and limitations on Jewish economic activities. In addition, in Russia, the home of the majority of the region's Jews, the vast majority of the Jewish population was forced to live in a geographically

limited area, the Pale of Settlement. Despite the emigration of close to two million Jews to America and elsewhere, many Eastern European Jews remained in very difficult economic straits.

The response of the Eastern European Jewish communities to this inability to improve their social status was to adopt a high-fertility style of reproduction. At the same time as their counterparts in Western Europe were delaying marriage, having fewer children and rapidly advancing socially and economically (Efron, 1994, 77), poor Jews in Eastern Europe with no hope of upward mobility married earlier and had relatively large numbers of children. When these Eastern European Jews emigrated to America and were able to achieve upward mobility, they quickly developed a high-investment, low-fertility strategy, with the result that American Jews—the vast majority the descendants of Eastern European Jews—have the lowest fertility rate of any American ethnic group (e.g., Lieberman & Weinfeld 1978, 16).

In Darwinian terms satisfaction of social status goals in the absence of actual reproductive success is quite probably maladaptive—that is, there is no long term fitness benefit in modern populations for having fewer children (Borgerhoff-Mulder, 1999). On the other hand, there may well be political benefits for a minority group to adopt a low fertility/high social status strategy. Lieberman and Weinfeld (1978) point out that low fertility among the most assimilated sectors of the Jewish community in contemporary Western societies is highly adaptive because it is associated with high-investment parenting, upward social mobility, and wealth. Because Jews constitute only a small percentage of the United States population (approximately 2.4 percent), the pursuit of Jewish interests “requires a sophisticated, competent population with essentially middle class characteristics: the community as it is. Jewish political influence, which seems in excess of community numbers, is based on the human and material resources which the Jewish community can mobilize. . . . Low fertility helps perpetuate middle class status for Jews, with attendant high levels of education and political involvement” (p. 17).

Another intriguing way in which evolved systems may influence fertility is via interaction with social learning mechanisms. I have already noted that Macunovich proposes that people’s fertility decisions are influenced by their perceptions of acceptable living standards and social class status during childhood. From an evolutionary perspective, this suggests a mechanism in which there are learning biases that are activated during a “sensitive period” of development. Similarly, Surbey (1990) has proposed that the presence of an unrelated male, typically a step-father, during a develop-

mentally sensitive period triggers a low-investment style of reproduction in children. The evidence for such a mechanism is inconclusive at this time because of the difficulty of disentangling genetic proclivities to low-investment parenting from a mechanism in which low-investment parenting is induced by an environmental trigger. Nevertheless, there is little doubt that step-father presence is associated with earlier puberty and a low-investment reproductive style in girls (Ellis & Garber, 1999), while positive family interactions are associated with later puberty (Ellis et al., 1999).

Evolutionary biases in social learning may also affect fertility decisions in situations where high-status models adopt low fertility behavior. Boyd and Richerson (1985) have developed an evolutionary model of cultural diffusion in which adaptive or maladaptive cultural practices may spread via modeling processes (see Bock [this issue] for a summary). Macunovich (this issue) posits a role for fertility norms that develop after the original fertility transition (originally triggered by increasing RCS) and which maintain lowered levels of fertility, and Bock (this issue) describes a body of theory that emphasizes the cultural diffusion of lowered fertility emanating from elites and centers of power. An evolutionary hypothesis would propose that social norms of low fertility would result from evolved social learning biases toward imitating the behavior of elites or socially conventional behavior (MacDonald, 1988). Such a theory is necessarily incomplete because it does not provide a mechanism for the original transformation of the fertility behavior of elites.

GENETIC VARIATION AND ENVIRONMENTAL INFLUENCES ON HUMAN REPRODUCTIVE STRATEGIES

Evolution has thus shaped the overall life history strategy that is characteristic of humans as a species. However there are important individual differences within species as well. The data reviewed by Belsky et al. (1991) are highly compatible with this perspective. They especially note the large intercorrelations among spousal harmony, parent-child relationship quality, children's interpersonal style, timing of puberty, sexual behavior, and level of parental investment. It is also clear that IQ is part of this mix: Besides variables directly related to mental testing, such as school performance, IQ is associated with proneness to illegitimacy, child abuse, low birth weight, sexual behavior, divorce (*unstable pair bonding*), rates of physical maturation, parent-child relationships, poverty, welfare dependency, and crime (Herrnstein & Murray, 1994).

Heritability

There is agreement among all theorists that some of the variation in life history variables is the result of genetic variation. Within this perspective, individual differences in parental investment patterns result partly from heritable variation remaining in the population because natural selection did not remove all of the genetic variation related to parental investment. This perspective implies that genetic variation continues to underlie a range of more or less viable strategies within contemporary populations, as may well be the case with personality variation and intelligence. And, in addition to within-group genetic variation, there may also be between-group differences resulting from different selection pressures affecting human groups that evolved in somewhat different ancestral environments. Thus an evolutionary perspective is highly compatible with average differences in life history strategy between human groups. Rushton (1995) has noted life history differences between Asian, Caucasian, and African populations, and I have mentioned Ashkenazi Jews as an example of a group with a high-investment reproductive strategy.

There is indeed evidence that variables related to reproductive strategies are heritable. The critical variable of pubertal timing is substantially heritable ($h^2 = 0.4\text{--}0.5$), and environmental influences are unshared within families (Martin & Bailey, 1999; Rowe, 1999). There are moderate heritabilities for age of first sexual intercourse (Martin, Eaves, & Eysenck, 1977), warmth/nurturance and impulsivity/extraversion as personality traits (e.g., Digman, 1990), parental warmth toward children (Rowe, 1994), parenting styles (Plomin, et al., 1989), and likelihood of divorce (Rowe, 1994). Also, the reproductive strategy perspective developed here includes intelligence as a critical, highly heritable variable. Estimates of the heritability of intelligence range from 0.4 to 0.8.

Interactions Between Genetic Proclivities and Cultural Context

Nevertheless, estimates of heritability do not exist in a vacuum. Evolutionary perspectives are highly compatible with interactions between genetic predispositions and changes in culture, and here I examine changes in the cultural supports for high-investment parenting. Cultural supports for high-investment parenting act as external forces of social control which act to maximize high-investment parenting among all segments of the population, even those who are relatively disinclined for genetic and/or environmental reasons to engage in such practices. One may view cultural supports for high-investment parenting as a form of external social control that

is formally analogous to laws or customs that regulate behavior in other areas of life.

Western cultures have traditionally erected a variety of cultural controls on sexual behavior that have effectively supported high-investment parenting. The historical data on marriage in Western societies indicate that traditionally there have been very low levels of divorce and illegitimacy (MacDonald, 1995b). This pattern was maintained by powerful social controls embedded in the religious and legal framework of Western societies. For example, during the medieval period the Church successfully opposed divorce, concubinage, and illegitimate birth for all classes of society, including the wealthy; engaging in these behaviors resulted in social opprobrium. And in later periods women and lower- and middle-status males were important interest groups that maintained these cultural supports for high-investment parenting. The illegitimacy rate was usually far less than 3% until after 1750 (Laslett, 1977) and there was no tendency for the rate to increase during times of resource scarcity.

However, since approximately 1965 there has been a massive cultural shift away from these traditional patterns toward a dramatically increasing prevalence of a low-investment reproductive style in the United States and other Western societies. The interesting point from the present perspective is that there has been a powerful interaction between this cultural shift and the heritability of life history strategy.

Since 1970 the rate of single parenting has increased from 1/10 families to 1/3 families (Norton & Miller, 1992), and there have been dramatic increases in teenage sexual activity and teenage childbearing without marriage (Furstenberg, 1991). There is excellent evidence for an association among teenage single parenting, poverty, lack of education, and poor developmental outcomes for children (e.g., Dornbusch & Gray, 1988; Furstenberg & Brooks-Gunn, 1989; McLanahan & Booth, 1989; Wilson 1993).

Indeed, all of the trends related to the family show very large shifts which developed in the mid-1960's (Herrnstein & Murray 1994, 168ff), including increases in trends toward lower levels of marriage, increases in divorce rates (p. 172), and higher rates of illegitimacy. In the case of divorce and illegitimacy rates, the data indicate a sharp shift upward during the 1960's from previously existing trends, with the trend lines established during that period continuing into the present. Clearly the 1960's was a watershed period in American social and cultural history.

Whatever the cause of these cultural shifts, Herrnstein and Murray (1994) show that these changes in social functioning have not fallen evenly across the continuum of parental investment. For example, only 2% of the white women in Herrnstein and Murray's top category of cognitive ability

(IQ minimum of 125) and 4% of the white women in the second category of cognitive ability (IQ between 110 and 125) gave birth to illegitimate children, while the corresponding rates for the bottom two categories of cognitive ability are 17% (IQ between 75 and 90) and 32% (IQ below 75) respectively. Thus the cultural shift in which the traditional social controls characteristic of historical Western societies have been severely attenuated has had little effect on individuals predisposed toward high-investment parenting. However, the attenuation of these controls has resulted in a massive alteration of behavior among individuals who are not so inclined.

There is evidence that an important contributor to this cultural shift in reproductive behavior is low paternal investment in children. Marriage, far more than mother's IQ, is the most important variable in predicting poverty among children and its correlative negative developmental outcomes (Herrnstein & Murray, 1994, 138). Moreover, the adolescent girls who are most likely to become pregnant are least under the control or influence of adults, especially fathers. For example, Herrnstein and Murray (1994) found that father-absence at age 14 was a strong predictor that the woman's first birth would be illegitimate. Given the general association between precocious adolescent sexual behavior and a variety of deviant behaviors (see above), it is relevant that Dornbusch et al. (1985) found that single parenting is associated with lower levels of parental control of adolescents and higher levels of deviant behavior by adolescents.

These results are consistent with supposing that the decline of social controls on reproductive behavior tends to result in low-investment parenting among those so inclined. In this scenario, the effects of social controls interact with individual tendencies toward parental investment which are in turn influenced by genetically-influenced individual differences in life history strategy.

These results are highly compatible with the findings of Dunne et al. (1997) that the heritability of age of first sexual intercourse has increased since the 1960s. In their younger cohort (born between 1952 and 1965) genetic factors accounted for 49 percent of the variance among females and 72 percent of the variance among males, and there were no shared environmental influences. In the older cohort (born between 1922 and 1952) genetic influences accounted for 32 percent of the variance for females and none of the variance among males, and there was a significant shared environmental component for both sexes. These data indicate that the erosion of traditional Western controls on sexuality have had far more effect on those who are genetically inclined toward precocious sexuality.

Given the general importance of perceptions of the effects of reproductive decisions on social status discussed previously, one could interpret the results as consistent with the hypothesis that individuals on the low end

of the IQ distribution do not perceive that adopting a low-fertility, high-investment pattern of child rearing will result in upward social mobility for themselves and their children. Such individuals may (correctly or incorrectly) believe that adoption of a low-fertility, high-investment strategy will not in fact raise the social status of themselves or their offspring. Like the Eastern European Jews in the 19th century, contemporary lower class populations may believe that there are no opportunities for upward social mobility and therefore engage in a low-investment/high-fertility life history strategy.

In this regard it is relevant that Herrnstein and Murray (1994) summarize their own and others' data indicating that since the early 1960's in the United States, IQ has been linked with upward social mobility independent of economic deprivation during childhood and independent of ethnicity. Therefore if indeed high-fertility/low-investment parenting among lower status people occurs because of a perception of lack of opportunities for upward social mobility, this perception is in fact false.

Secondly, low-IQ individuals who engage in low-investment parenting under contemporary conditions may be low on the personality trait of Conscientiousness and therefore less able to defer gratification, engage in sustained work, use birth control consistently, persevere in long term goals, etc. This is the interpretation of Richard Lynn (1996). Lynn provides evidence for an inverse association between Conscientiousness and social class and fertility in contemporary populations, and shows that downward social mobility is linked to low levels of Conscientiousness. He also provides evidence that the trait of Conscientiousness is heritable, with correlations between identical twins reared apart suggesting a heritability in the 0.6 range.

BETWEEN-GROUP COMPETITION FOR RESOURCES

An evolutionary perspective might very well lead to a sense of doom and gloom regarding the long term prospects of human population regulation. The total human population of approximately 6 billion continues to increase, and there is little question that some countries are overpopulated. Moreover, the present size of the human population must be seen in theoretical terms as a windfall effect resulting from the exploitation of fossil fuels in the last 200 years. It is by no means certain that humans will be able to sustain even this level of energy extraction indefinitely, much less the higher levels of energy required by increasing human populations and by demands for higher standards of living.

The long-term prospect therefore is that there will be increasing com-

petition for resources among human groups and increasing attempts of poorer populations to migrate to wealthier areas. Given that such a scenario is at least plausible, what insight might an evolutionist have on the possible outcomes of such a situation?

(1) There is little reason to suppose that humans have been designed by natural selection to be “noble savages” living in a balanced and harmonious relationship to nature (Low, 1996). At a theoretical level, the noble savage paradigm assumes altruism because people are presumed willing to sacrifice their individual material short-term advantage for the long-term betterment of the group. This is theoretically problematic and empirically unfounded. Research is more compatible with the proposal that human-environment interactions are characterized by individualistic striving for control of resources rather than by altruistic self-restraint for the long-term good of the group. Low provides evidence for human-caused extinctions since the Quaternary caused by over-hunting or other human activities.

(2) There are individual and group differences in fertility even in the presence of similar ecological contexts. I have noted evidence that there are racial/ethnic differences in life history strategy. These differences imply that in the absence of external controls there will be a tendency for different racial/ethnic groups to have different levels of fertility, even in response to the same environmental context. In evolutionary terms this implies different fitness for the genes of different groups. For example, within the U. S., in 1995, Whites aged 15–44 had 59.2 births per 1000 women, Blacks had 70.6 births per 1000 women, and Hispanic women had 79.6 births per 1000 women (*Current Population Reports*, 1997). As indicated below, the consequences of differential birth rates in multi-ethnic societies have often been politically explosive, since they imply that in the absence of other forces, low-investment/high-fertility reproductive styles will outcompete high-investment/low fertility reproductive styles in the long run.

(3) Since ethnic/racial groups are a common form of human demarcation with at least some biological underpinning, even in Western societies where assimilation has historically been the rule, it is expected that conflicts over resources will fairly often be conflicts between ethnic groups. In the United States there was a prolonged battle between immigration restrictionists bent on maintaining the ethnic status quo versus others intent on changing the ethnic status quo (MacDonald, 1998a, b). An often-expressed argument of the restrictionists was that immigration should maintain the ethnic status quo, an argument that favored those already with a majority but opposed by other groups, mainly Jewish-Americans, who saw their interests as better served by an ethnically fractionated society in which no one ethnic group would be able to control the society.

From an evolutionary perspective, such conflicts of interest between ethnic groups essentially involve conflicts of interest over the future genetic constitution of the population. For example, Macunovich (this issue) notes that emigration from a high-fertility society to a low-fertility society results in an overall decline in births because the entrance of immigrants into the low-fertility country causes the natives to have a lowered fertility because of the increased RCS; and in the long run at least, emigrants tend to adopt a lower pattern of fertility in their new country. In any case, when the immigrants and the native population differ substantially in their genetic makeup, this constitutes natural selection against the genes of the native population.

Given that 90% of recent immigrants to the U.S. are non-European, this implies selection differentials against European peoples. Using the logic in Macunovich's Table 4 which assumes an approximate equivalence between number of immigrants and number of births foregone by U.S. women because of RCS effects, and assuming a legal immigration rate of approximately 800,000 per year and a net illegal immigration rate of approximately 275,000 (Krikorian, 1999), U. S. women are foregoing over one million births per year as a result of immigration. (This does not include the suppressive effects on the native birth rate of the children of the immigrants in the next generation. It is thus a very conservative estimate.) Since European-derived peoples presently constitute around 75% of the U.S. population, Macunovich's model implies that there are approximately 750,000 fewer births per year among the European-derived peoples of the U.S. than there would be in the absence of immigration. Due to the greater genetic overlap between recent immigrants and established U.S. citizens from immigrant-sending countries such as Mexico, the selection differential is much less in the case of present U.S. women who derive from immigrant-sending areas.

It is interesting in this regard that during the debates over immigration in the 1920's, opponents of relatively unrestricted immigration sometimes noted that immigrants had high birth rates and that immigration has a tendency to depress birth rates among the native population (e.g., Madison Grant, 1924). These views are thus corroborated by contemporary research (see also Berry, 1996). Those making such arguments were rather explicitly declaring that immigration of other groups opposes their genetic interests. In modern theoretical terms, natives advocating immigration of other groups are behaving altruistically: Since there are substantial genetic differences between human groups, the principle of relatively unrestricted immigration, at least under the conditions obtaining in late twentieth-century Western societies, clearly involves altruism by some individuals and estab-

lished groups. Natives are renouncing additional offspring in favor of offspring of people from different racial/ethnic groups.

It is unclear whether such an altruistic course of action is sustainable in the long run, and indeed, I suggest that such altruism will not continue if there are obvious signs that the status and political power of European-derived groups is decreasing while the power of other groups increases. The prediction, both on theoretical grounds and on the basis of psychological research (see MacDonald, 1998a, b), is that as other groups become increasingly powerful and salient in a multicultural society, there will be increasing tensions between the groups.

Recently Bookman (1997) and Parsons (1998) have shown that demographic competition is common among human groups. For example, the present conflict in Yugoslavia is influenced by the Albanian demographic explosion, unique in Europe. From 733,000 in 1948, the Albanian population in Kosovo grew to 1,730,000 in 1981 (Djordjevic, 1992). The Serbian population in Kosovo dropped from approximately 40% early in the century, to 27.9 percent in 1953, to 14.9 percent in 1981, and to 10 percent in 1987. Moreover, the rate of population increase in Kosovo was over three times the rate of population increase in Serbia; for example, in the period from 1971–1981, the Kosovar population increased 27.4% compared to 8.4% for the population of Serbia (Ramet, 1992, p. 141). The decline of the Serbian presence in Kosovo, partially due to economic factors drawing Serbs to urban centers in Serbia, was also caused by the pressure, physical as well as psychological from what had become an overwhelming Albanian majority.

Demography may be destiny, but from an evolutionary perspective it is not surprising that the destiny of groups with a high reproductive rate to rule the areas where their numbers come to eclipse other groups may be hotly contested by the groups being eclipsed. In theoretical terms this may often be a conflict between r-strategists, relatively speaking, and K-strategists. By definition, r-strategists, in this case the Albanians, out-reproduce K-strategists, but K-strategists may use other means of competition, including warfare, "ethnic cleansing" via expulsion, and genocide.

Three recent articles in *Population and Environment* illustrate other aspects of the general problem of population, environment, and ethnic conflict. Two of these articles (Boyle, 1999; Kelly, 1999) center around the concerns of some elements of the native population of the Isle of Man to retain their culture and their demographic predominance while other elements of the population, especially the non-Manx business interests, favor a larger population size and increased levels of immigration because they

stimulate economic activity. Ethnic conflict and population as an instrument of government policy are also important features of Courbage's (1999) paper on fertility issues in the Arab world. For example, Syria adopted an aggressively pro-natalist policy in the hopes of countering territorial losses to its neighbors, and Palestinians inside Israel and in the Occupied Territories have developed some of the highest fertility rates in the world at least partly as a response to competition with Israel (see also Gilbar, 1997).

(4) Group processes may function to regulate individual reproductive behavior. As indicated above, an evolutionist fully expects that there will be contexts in which humans voluntarily curtail reproduction, particularly if reproduction conflicts with other evolved motive dispositions such as seeking social status. Nevertheless, groups (and societies) are able to control the behavior of individuals via social controls so that individuals may be coerced to act in a manner that conflicts with tendencies that might be expected on the basis of our evolved psychology. At a moderate level there are controls on immigration or on wages that influence RCS effects (see Macunovich, this issue), while at the extreme we have the example of fertility control in China in which family size is limited to one or two children.

At a theoretical level, social controls on reproductive behavior may be viewed as influenced by evolved motivational systems and perceived conflicts of interest over the construction of culture. Nevertheless these social controls are underdetermined with respect to evolutionary theory, human nature/nurture (i.e., the characteristics of humans), or external ecological variables (MacDonald, 1995b). In their theory of how to conceptualize historical phenomena within an evolutionary framework, the evolutionary theorists Richard Boyd and Peter Richerson (1992) emphasize the importance of happenstance, indeterminacy, and slight variations in initiating conditions in producing qualitatively different historical outcomes. At an intuitive level, slight variations in military capability may tilt the outcome of a battle to one side or the other and the outcome of the battle may have very important historical consequences (e.g., deciding whether Christianity or Islam would be the religion of Europe, or whether Germany would win World War II). Nevertheless, there is no general theory by which we could predict such a result; but in retrospect we can describe why one side or the other won.

An historically important case is the establishment and maintenance of monogamy in Western Europe (MacDonald, 1995b). Although evolutionary theory predicts that high-status, wealthy males will attempt to be poly-

gynous, these interests conflict with the interests of other sectors of society, such as lower-status males, women, and a wealthy, powerful institution, the Catholic Church.

As in the case of fertility restriction in China, social control of reproduction in the form of monogamy may have profound consequences. There some reason to suppose that monogamy was a necessary condition for the peculiarly European "low-pressure" demographic profile described by Wrigley and Schofield (1981). This demographic profile results from late marriage and celibacy of large percentages of females during times of economic scarcity. The theoretical connection with monogamy is that monogamous marriage results in a situation where the poor of both sexes are unable to mate, whereas in polygynous systems an excess of poor females merely lowers the price of concubines for wealthy males. Thus, e.g., Wrigley and Schofield (1983) find that at the end of the 17th century approximately 23% of individuals of both sexes remained unmarried between ages 40–44, but that, as a result of altered economic opportunities, this percentage dropped at the beginning of the 18th century to 9%, and there was a corresponding decline in age of marriage. Like monogamy, this pattern was unique among the stratified societies of Eurasia (Hajnal 1965; 1983; Laslett 1983; MacFarlane 1986; Wall 1983; Wrigley & Schofield, 1981). For example, in China with a polygynous system, virtually all females married and married before age 24 while substantial percentages of males remained bachelors and the males who did marry married at considerably later ages than women (Lee & Feng, 1999). However, as is typical of polygynous marriage systems, fertility within marriage was lower in China than in prototypical European societies, thus dampening overall differences in fertility.

In turn, the low pressure demographic profile of Western Europe may have had economic consequences. Increased nuptiality and a lowering of the age of marriage had a tendency to lag behind favorable economic changes, especially in England, so that there was a tendency for capital accumulation during good times rather than a constant pressure of population on food supply:

The fact that the rolling adjustment between economic and demographic fluctuations took place in such a leisurely fashion, tending to produce large if gradual swings in real wages, represented an opportunity to break clear from the low-level income trap which is sometimes supposed to have inhibited all pre-industrial nations. A long period of rising real wages, by changing the structure of demand, will tend to give a disproportional

tionately strong boost to demand for commodities other than the basic necessities of life, and so to sectors of the economy whose growth is especially important if an industrial revolution is to occur. (Wrigley & Schofield 1981, p. 439; see also Hajnal, 1965; MacFarlane, 1986)

In any case, these findings indicate the importance of considering complex processes of social control and their interaction with individual differences in life history strategies in attempting to understand historical changes in life history strategies. Similar considerations would apply to thinking about group processes that regulate migration between societies. Immigration policies and actual immigration are complex outcomes of competing individual and group interests. For example, it has often been observed that immigration policies in Western countries have not been voted in by popular majorities but rather by elites bent on satisfying their own ethnic or economic interests. I suppose that the actual pathways to policy are indeterminate, but nevertheless *ex post facto* analysis may reveal the ethnic and economic interests served by liberal immigration policies, as, for example, the role of Jewish organizations in influencing U.S. immigration policies (MacDonald 1998, a,b).

CONCLUSION

I conclude simply by noting that evolutionary perspectives address many of the central issues related to population and the environment. While drawing on the wealth of data gathered by other social scientists, evolutionists differ in grounding their explanations in human nature and in the interactions between human nature and the environment. By grounding their explanations and theories in human nature, evolutionists can account for the emotional intensity of issues related to population and the environment. For example, it was noted above that economic models and empirical data show that that emigration from a high-fertility society to a low-fertility society results in an overall decline in births for the world as a whole while lowering the birth rate of the immigrant receiving country. One might argue that high levels of immigration from countries with high birth rates to countries with low birth rates would therefore benefit the whole human population even if it obviously clashes with individual interests of the great majority of the receiving country.

Thus stated, the problem is a classic problem in theoretical biology, i.e., the problem of the group versus the individual, and there is a con-

sensus that organisms did not evolve to benefit the group. While one may argue that there is a moral imperative to benefit the group (whatever that might mean), it is highly unlikely that human psychological adaptations are geared toward benefiting the group. From an evolutionary perspective it is not at all surprising that native populations have typically opposed immigration of large numbers of people unlike themselves. Modeling exercises that fail to take account of evolved psychological mechanisms will thus fail to account for real world behavior. In much the same way that human reasoning in real life situations typically fails to approximate formal optimality models of rational thought, the default hypothesis must be that human reasoning about issues related to fertility and migration is deeply influenced by our evolved psychology.

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