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An Evolutionary View of Family Conflict and Cooperation

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What can evolutionary theory tell us?

What can we expect our evolutionary history to tell us about human reproductive and family life? Each of us is a descendant of an unbroken line of males and females who survived to adulthood and somehow managed to mate and produce at least one offspring who also survived to adulthood, mated, and so on.

For most economists, the hypothesis that human preferences are designed to maximize reproductive success even over some long horizon seems so unlikely as to receive no consideration at all. Indeed the axiomatic foundations of economists' consumer theory would give little offense to the most devout of creationists. If pressed on this question, scientifically inclined economists tend to take the view that we humans are different from the rest of the animal

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kingdom in that our preferences have been hijacked by the pleasure centers of our minds. Thus we have arrived at “utility functions” that value production of children as one of many consumer goods rather than as a reason for existence. Therefore they would argue, there is little of interest to be learned from our evolutionary history.

Exhibit A for this viewpoint is the “demographic transition”. What possible evolutionary explanation can there be for the low birth rates found among prosperous people in wealthy modern countries. The evidence that modern Western families are not behaving in such a way as to maximize their number of children, or even number of grandchildren seems simply overwhelming.

There is compelling evidence that humans care about things other than the production of offspring. But when we think about it, the preferences that over the long haul result in the most surviving descendants are not likely to be preferences focussed entirely on having children, or even grandchildren. The problem of how to produce the largest possible number of descendants is an extremely difficult problem in intertemporal allocation and strategic interaction with others. Moreover, the data that an individual is able to gather by life experience is small compared to the cumulative information that has been experienced by our genome over the course of evolutionary history. Larry Samuelson and Jeroen Swinkels [18] express this viewpoint as follows.

Much as a computer program uses its processing power to maximize a heuristic, Nature has designed us, through the trial and error of evolution to use our cognition in maximizing a utility function. If Nature trusted our cognition equally in all situations, she could achieve her optimum with a classical utility function. However she does not. For example, she has “learned” through

the course of evolution that we often have valuable information about when a method of hunting . . . is productive. But she has also “learned” that her knowledge of nutrition as gathered is sufficiently good as to make her more skeptical of . . . information we may think relevant to the choice of what or how much to consume once food is available. . . .Nature might be quite respectful of an agent’s information about appropriate courtship behavior, but less easily convinced that a readily available sexual opportunity should be forgone.”

It is obvious that a preference for getting pregnant whenever possible would not serve a female’s long term reproductive interests, since this strategy is unlikely to maximize the number of healthy children who themselves survive to reproduce. In principle, we could imagine that evolution might produce females whose utility functions depended only on their expected long term reproductive success. For such a utility function to be successful, it would have to be accompanied by a good understanding of the way that optimal birth intervals depend on observed environmental variables along with the ability to measure the relevant environmental variables and to calculate the implied optimum strategy.

But this may be too much to ask. Finding optimal birth spacings in every circumstance is an enormously complex problem and one for which the information directly available from personal experience is likely to be less useful than the cumulative experience of the generations. Instead of giving her preferences that focus entirely on ultimate reproductive success, nature may do better by endowing her with preferences that include desires for good food and for rest and relaxation as direct objectives. As Alan Rogers suggests, [17] an appropriately calibrated preference for these amenities would impel

her to acquire the strength needed to take care of her children and the health to bear strong infants. A preference for accumulating durable goods and social contacts that would help get her family through hard times would also serve her well.

Males would face tradeoffs between spending their efforts trying to get females pregnant and acquiring resources that attract women help to sustain their children. Thus it is plausible that natural selection would endow humans of both sexes with preferences that value consumption goods and material wealth as well as children. The hypothesis that I propose for consideration is that, although nature has given us preferences that proximally rather than directly to reproductive ends, these preferences are calibrated by nature in such a way that they approximately maximize expected reproduction in the long run. I do not expect this hypothesis to be entirely vindicated. But it may be close enough to correct so as to give us an understanding of human preferences that would be otherwise hard to come by.

The evolutionary hypothesis seems to do quite well in explaining some fundamental characteristics of human behavior that are hard to explain in any other way. In previous papers, I have discussed the predictions that evolutionary theory makes about cooperation and conflict between siblings [3] [4]. In another paper, my son Carl (who is an evolutionary biologist) and I have discussed the biology and economics of conflict between parents and children [5]. Alan Rogers has proposed an interesting evolutionary explanation why humans and other animals discount the future relative to the present and [16] future generations relative to their own. Robert Trivers' book, *Social Evolution* [19] explores a variety of implications of the evolutionary hypothesis with original and thought-provoking examples ranging widely over the animal kingdom. Today I will spend most of my time on the

question of what evolutionary theory might tell us to expect about conflict and cooperation between husbands and wives.

Measuring reproductive success

A reasonable first cut at measuring reproductive success is the *expected number of offspring who survive to adulthood*. But some qualifications should be considered. What if children with fewer siblings are healthier and more prosperous and thus have more children themselves? What if parents with grown children divert their energies from having babies of their own to helping raise grandchildren? In principle, the number of grandchildren who reach adulthood would be a better measure of reproductive success. If there are tradeoffs between number of grandchildren and number of great-grandchildren, then long run evolutionary success would favor actions that maximize the number of great-grandchildren, and so on.

For many purposes, measuring direct reproductive success by the number of grandchildren who survive to adulthood may be an adequate approximation. But there are important exceptions. In other work, I have argued that with some patterns of property rights, such as primogeniture, not all grandchildren or even great-grandchildren count equally toward one's long term reproductive success. In this case, I show how one can solve a dynamic optimization problem that assigns appropriate value functions to each possible type of descendant. Individuals then seek to maximize a weighted sum of the numbers of their offspring of each type, where the weights are given by the value functions which can be solved for.

The chances that our ancestors in the direct line survived to reproduce successfully typically depended not only on the behavior of their own parents

and grandparents, but on the amount of help they got from brothers and sisters and uncles and aunts as well as surviving grandparents. If behavior toward one's near relatives is inherited, what does our evolutionary history imply about the amount of concern that humans can be expected to show toward their relatives?

In 1964, the great evolutionary biologist, William D. Hamilton [12] proposed a systematic answer to this question—an answer that has come to be known as *Hamilton's Rule*. Biologists define the “coefficient of relatedness” between two animals of the same species to be the probability that a rare “gene” found in one of these animals will also appear in the other. For sexual diploids if mating is between unrelated individuals, the coefficient of relatedness between two full siblings is $1/2$, that between half-siblings is $1/4$, that between an individual and a full sibling's child is $1/4$, that between full cousins is $1/8$, that between parent and offspring is $1/2$, that between grandparent and grandchild is $1/4$, and so on. Hamilton proposes that natural selection would produce individuals who try to maximize *inclusive fitness* where inclusive fitness is defined to be a weighted sum of one's own reproductive success and that of one's siblings, half-siblings, and cousins of various types, where the weights are coefficients of relatedness.¹ (Of course some care has to be taken to avoid double-counting of say, one's children's fitness and that of one's grandchildren.)

Hamilton stated his rule as follow:

The social behaviour of a species evolves in such a way that in each behaviour-evoking situation the individual will seem to value

¹More recent theoretical work [7] [11] [3] has shown that Hamilton's rule is strictly correct only where the benefits and costs from interaction between relatives take a linear form.

his neighbor's fitness against his own according to the coefficient of relatedness appropriate to the situation.

Hamilton's rule implies that when faced with the option of sacrificing c units of its own reproductive success in order to increase the success of a relative whose coefficient of relatedness is k , by b units, the decision maker should make the sacrifice if it passes the benefit-cost test $kb > c$.

Conflict and Cooperation between Parents

Let us explore the implications of the hypothesis of inclusive fitness maximization for relations between the sexes. To parents who seek to maximize inclusive fitness, the health and well-being of a child whom they have together conceived is what economists call a *public good*. The child's welfare is "jointly consumed" by the two parents, much like the shared heat of a common fire. Contributions that one parent makes to the child's welfare also benefit the other.

Economists make much of the "free-rider problem" with public goods. The problem is that selfish individuals when deciding how much to contribute to the shared public good do not properly account for the fact that their own contribution benefits the others. Let us pursue the common fire analogy a bit further. Consider two selfish foragers who subsist on berries and who share the warmth of a single fire. Alice is relatively good at picking berries and Bob is relatively good at collecting wood. Without some kind of explicit cooperation, an equilibrium outcome would occur where Bob gathers some wood and spends the rest of his time picking and eating berries. Alice gathers no wood, but picks berries and eats them. Bob gathers just enough wood so that the extra warmth generated gained by an extra hour's wood-gathering

would give him less benefit than the berries that he could pick or eat in that hour. Since Alice is better at berry-picking relative to wood-gathering than Bob, she will not want to sacrifice berry-picking to gather any wood in addition to that collected by Bob. This outcome, however, is not efficient, since Bob's decision of when to stop gathering wood does not account for the fact that Alice will also benefit from a warmer fire. Both could gain if Alice and Bob agreed to a deal in which Bob gathers some more wood than he would choose on his own account and Alice rewards him with some berries. Such an agreement may be possible if the relationship between Alice and Bob is durable, but even then it requires that a bargain be reached. If neither knows the other's true willingness to pay, then in general there is no assurance that they will reach an efficient bargain.

Things would be quite different if all that Alice and Bob really cared about was building as large and lasting a fire as possible. They would of course still want to consume berries in order to give themselves strength to gather firewood. In this case, Alice and Bob would have no disagreements about how to allocate resources. Although berries eaten by one can not be eaten by the other, these berries are valued only in the way that a factory values inputs into the production of the output it desires. It might well be that the efficient way to produce the biggest fire is for Bob to spend all of his time gathering firewood and for Alice to give him berries to sustain his strength. No bargaining will be needed to sustain this outcome. There is no conflict of interest and no need to higggle over the "price" of Bob's services. Since their interests coincide, Alice will want to choose to allocate her efforts between picking berries for herself, picking berries for Bob, and gathering firewood in exactly the same way that Bob would have her do it if Bob could dictate her activity.

Can a similar story apply to a man and woman bound in a lifelong monogamous relationship? Suppose, for example, that evolution has shaped the preferences of each parent to be concerned only with the number of his or her surviving grandchildren? Parents would value their own consumption and well-being only as instruments toward that end. They would desire goods and leisure for themselves, but only for the reason that these increase their own, health, strength, and longevity, so that they can better produce and care for their children and grandchildren. In this case, there is no free-rider problem. Because they are fully monogamous, they share exactly the same line of descendants. Because they care only about their private consumptions as instruments for producing grandchildren, their interests about the allocation of private goods and public goods in the household are coincide exactly. With such harmony of reproductive interest, we could expect natural selection to favor the development of affection and caring between spouses. This is perhaps the one case where the biblical injunction, "love thy neighbor as thyself" might be consistent with the evolved nature of humans.

Having started with an idealized model of harmonious marriage based on identity of interest, let us consider the elements of discord that enter the picture as we add more elements of reality. Even where mating is monogamous and lifelong, the genetic interests of inclusive-fitness maximizing husbands and wives do not exactly coincide. A major source of dissonance, often noted in popular culture, is "the inlaw problem". Evolutionary theory suggests that individuals will value the fertility of their siblings at half the value they place on their own fertility. Thus neither the husband nor the wife will be wholeheartedly devoted to the well-being of their own line of descendants, but each will sometimes be willing to divert resources to needy siblings and other relatives. Since the relatives of the wife are typically not closely related

to the husband and vice versa, we can expect even the most monogamous couples to disagree about when to help the inlaws.

Through most of our evolutionary history, the death rates of men and women in their prime reproductive years were high. Thus there was a significant chance that one partner would die and that the surviving partner would remarry and have children with another partner. This effect would drive another wedge between the reproductive interests of husbands and wives.

And, I don't suppose that this would have occurred to anyone in this audience, but what about adultery? Consider a society in which all marriages were thoroughly monogamous and where husbands and wives wholeheartedly pursued their joint reproductive interest. What a great reproductive opportunity this would present for a philandering male. If he can impregnate someone else's wife her mate's knowledge, then at a very small cost to himself he passes his genes to a child who will be well cared for by the woman and her cuckolded husband. The situation is nicely posed in a paper by anthropologists, Kristen Hawkes, Alan Rogers, and Eric Charnov in a paper called "The male's dilemma: Increased offspring production is more paternity to steal." [13]. These authors suggest that in equilibrium we can expect to see males spending some time philandering, some time guarding their mates from philanders, and some time providing resources for their mates' children.

But sometimes it may be in the biological interest of a woman to cooperate in cuckolding her husband. It may be that the interloper is able to give the additional resources for her children beyond those provided by her husband. Evolutionary psychologists have proposed another possibility (see for example Helen E. Fisher's provocative *Anatomy of Love: A Natural History of Mating, Marriage, and Why We Stray*)[10]; that women are evolved to

seek both “good genes” and a “good provider” for their children, but that it is only the unusually lucky woman who finds both in the same man. Thus many women have to settle for marrying a man who is less healthy or less attractive, or less prestigious than they would like. Such a woman if given the chance, can expect to increase her long term reproductive success by getting good genes from a secret coupling with a more attractive male, while obtaining child support from her puny husband.

Sometimes, too, a philandering male may impregnate a woman against a married woman against her will. Even though she may have resisted, a woman may conceal the rape from her husband in hopes that that he will be more willing to help her care for the child if he believes it is his own.

For widows or divorced women who remarry, the conflict of reproductive interests with their new mates is especially transparent. The new husband has no genetic interest in his wife’s earlier children and thus there is direct conflict of interest over the amount of time and energy she devotes to them. Fortunately, human males are not as resolute about this matter as male lions or chimpanzees, who when encountering a nursing mother whom they have not bred are likely to kill the infant in order to bring the mother into oestrus so that they can breed her. But some of these inclinations seem to persist in our species. Evolutionary psychologists, Martin Daly and Margo Wilson’s [9] present convincing statistical evidence that child abuse by stepfathers is far more frequent than by biological fathers or by mothers.^{2j}

Evolutionary psychologists have attempted to draw inferences about the evolutionary history of human mating patterns by comparative study across

²There are also a number of studies by economists showing that children raised by stepfathers are much more likely to end up in trouble with the law and other problem behaviors. [8], [2]

primate species of correlations between physical characteristics and mating patterns. The idea that one could learn something about our inherited psychology from measurable characteristics of our anatomy is intriguing, though it seems to me that the evidence that has been collected is spotty. Whether or not this approach is useful, you may find it thought-provoking, or perhaps amusing. Among mammals in general and particularly among primates, there tends to be a positive correlation between the size ratio of males to females and the degree of polygyny practiced in mating. The standard explanation is that in highly polygynous species, the only males who are able to mate are the strongest fighters. Thus males achieve a size larger than would be optimal. Among the primates, gorillas and orangutans are highly polygynous, with most females belonging to harems attached to a single male. In contrast, gibbons are thoroughly monogamous. Chimpanzees and bonobos on the other hand are highly promiscuous. Typically every male in the group gets to mate with an ovulating female.³ Sexual dimorphism in size is most pronounced among the polygynous gorillas and orangutans where the males are about twice as large as the females. In contrast male and female gibbons are almost exactly the same size and chimpanzee males are only about 6% larger than females. The size difference between male and female humans is greater than that of chimpanzees, but much less than that of gorillas or orangutans. This has been construed as an indication that that our species through most of its history has been moderately polygynous.

A second correlation that has been observed among mammal species leads

³This serves the females reproductive interests by giving each of the males in her group a probabilistic stake in her infant. If a chimpanzee meets a mother and her infant from another group, and if he hasn't copulated with the mother before the infant was born, he is likely to kill the infant.

to the “testicle test”. It is claimed that the more promiscuous the species, the larger the males’ testes. The apparent reason for this is that in highly promiscuous species, where ovulating females typically copulate with many males, the male that is able to deliver the most sperm has a competitive advantage over the others. Gorillas, while polygynous are not at all promiscuous. Female gorillas reportedly do not engage in extracurricular sex. Male gorillas have small testicles, smaller in absolute size than those of humans. In contrast, for the promiscuous chimpanzees and bonobos, sperm competition is intense and the males have very large testicles, 5 to 10 times as large relative to their body size as those of gorillas.

This exercise in comparative anatomy suggests that humans fall somewhere between gorillas and chimpanzees, both with respect to polygyny and with respect to promiscuity. This view is in accord with anthropologists’ observations of modern hunter-gatherers. It seems to me that it may be futile to seek a single evolutionary background for human mating behavior. While each of the other primate species seems to have a fairly narrow characteristic mating pattern, we see great variation in human institutions. Polygyny, monogamy, polyandry, all with varying degrees of promiscuity have been observed as stable institutions in human populations. Even within single societies, there are wide variations in mating behavior across individuals. It is plausible that this variable pattern has characterized our species for a long time and that we have developed ways of adapting our behavior to optimize reproductive success in a variety of institutional surroundings.

Conflict over Number of Children

One of the problems for which social scientists might hope to get some guidance from evolutionary biology is in trying to understand the determinants

of human reproduction rates. Thus it will be interesting to explore the conflicts and commonality of genetic self-interest between husband and wife as regards the spacing of births and the number of children that they conceive. A first thought on the matter might be: Natural selection is likely to result in men wanting more children than their wives. After all, there is little doubt that the wife almost always bears a larger share of the cost of producing a child. She alone must bear the physical burden of pregnancy, and of lactation. Typically she must also assume a much greater share of the labor of child care than her husband. And over most of our evolutionary history, women assumed a high risk of death with each childbirth. Thus it is plausible that husbands, who bear smaller costs, but pass the same number of genes to their children will want more children than their wives do.

But wait a minute. Remember the foragers, Alice and Bob. Bob was relatively good at wood gathering and did all or most of the work on the fire. But if the fundamental objective of both is to maximize the size of the fire, then Alice and Bob would be in perfect agreement about how to allocate their time between berry-picking and fire-tending and hence about how big the fire should be. In a perfectly monogamous marriage where both partners are focussed on reproductive success, there will be the same unanimity of interest with respect to questions of birth-spacing and number of children. If the only children that either spouse will ever have are children they have together, then the reproductive benefit to the husband from prolonging the interval between births is the same as those to the wife. If the wife dies in childbirth, not only will all of her potential future fertility be lost, but so will all of his. If adding a new child to the family reduces the amount of food and attention given to her other children, these are also his children. Thus he has exactly the same incentives for reproductive restraint that she has.

Matters are less harmonious if there is uncertainty about the paternity of previous and future children. At the time when a new conception is considered, a woman who already has some children must weigh the expected long term success of another child against the loss in reproductive success to her previously born children as she redirects resources from them to the new child and as she risks her life in childbirth. While the mother has the same genetic stake in her previous children as she would have in the new one, her husband would discount the costs to these children by the probability that these previous children are not his. Moreover, if he is not certain that his wife's future children will be his own, he would place a lower weight on the risk to her life in childbirth on this account.

These considerations suggest that our species might have evolved in such a way that on average, husbands want to get their wives pregnant more often than the wives would choose if it were up to them. If this is the case, then there are some interesting consequences. If the choice of birth spacing becomes a tug-of-war between husbands and wives with the outcome the result of opposing tugs, then we might expect each sex to evolve preferences that exaggerate the difference in true genetic interests. Men would desire more children and women fewer children than their own genetic interest dictates because in the conflict between husband and wife, outcomes are pulled away from the preferred outcome of each in the direction of his or her partner's preferred outcome.

Gary Becker [1] and his followers have attempted to explain the demographic transition from very high birth rates to very low birth rates in Europe and more recently in much of Asia as rational responses of well-informed decision makers to changes in incomes and relative prices. The argument is that while the time cost of producing goods has fallen, the time cost of producing

children has not changed very much. Thus as the relative cost of children has increased, the number of children demanded has decreased. This argument would be more convincing if real income had not changed over the time spanning the demographic transition. But, in fact, income has increased enormously. In order for the substitution effect on the demand for children to overwhelm the income effect so as to reduce the number of children demanded, either children would have to be an "inferior good" with income reducing demand for them, or demand for children would have to be highly price elastic and the income elasticity would have to be close to zero. The hypothesis that the income elasticity of demand for children is small or even negative would be consistent with cross-sectional and time series data on human reproduction in developed countries over the last few decades. But it is very difficult to see how evolution could have selected for such behavior, unless indeed our minds have hi-jacked our preferences and replaced biological fitness by personal comfort as a human objective.

The divergence between men's and women's reproductive interests suggests an alternative to Becker's rational choice explanation. If reproductive outcomes are not the choice of a single rational agent, but rather the result of a tug-of-war between two divergent preferences, then that changes in birth rates could arise when one side or the other gains increased leverage in this tug-of-war. The balance of forces in times and places with exceptionally high birth rates, such as 19th and early 20th century Europe, may have given males the upper hand in household decisions. In more recent times, the economic and social power of women has increased significantly. Consumer studies [6] [15] [14] indicate that increases in female incomes have increased women's bargaining power within the household. Perhaps then what we are seeing is not so much the effect of a change in relative prices on the demands

of a single rational consumer, but instead a shift in influence from consumers with one set of preferences to consumers with another.

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