Chapter 12. NATURAL SELECTION ON CULTURAL VARIATION

> (a) Experienced weather forecasters, when performing their customary tasks, are excellently calibrated. (b) Everybody else stinks.
>
> Paul Slovic, behavioral decision theorist, 1977

I. Introduction

A. Review of the Sociobiological Hypothesis

The sociobiological hypothesis is an extremely important point of reference. It proposes a solution to the genes-culture problem, namely that cultural transmission is a means to cut the cost of individual learning in spatially and temporarily varying environments. The decision-making forces (reviewed in the inset which follows) can, and presumably to some extent do, act as a "leash" constraining cultural variation to serve the ends of genetic fitness. If this hadn't been so, how could complex capacities for culture have arisen in the hominid lineage? Natural selection is the only known process that can "create" such an adaptation. Notice also that the sociobiological hypothesis gives us a clear picture of how ecological and evolutionary processes are integrated again via the decision-making forces. Even weak decision-making leads to adaptive traits in the long run.

THE FORCES OF CULTURAL EVOLUTION:

- **A. Accidental Variation**
- **B. Cultural Drift**
- **C. Decisionmaking Forces:**
  - **1. Guided Variation:**
  - **2. Bias Forces:**
    - **a. Direct bias**
    - **b. Frequency dependent bias**
    - **c. Indirect bias**
- **D. Natural Selection**

B. Potential Problems

So far, the sociobiology hypothesis does not say anything about the large scale co-operation and the elaborate use of symbols. When one considers these two basic aspects of human behavior, they often fail to look fitness maximizing adaptations at the individual level. Although, as we'll see in the next two chapters, sociobiologists have some arguments about this, it remains a major weakness in their hypotheses.

Complications can arise due to the costs of making decisions. In illustrating the sociobiology hypothesis in the last chapter, we only considered the effects of the most costly decision-making forces, guided variation and direct bias. If individual decision-making is costly, there will be much transmission of culture, causing culture to act as an inheritance system. Recall from the last chapter that when the individual learning part of guided variation is very strong, imitation has virtually no effect. A dependence on tradition is favored when individual learning is costly ***or*** error prone. (Note that these are very similar variables, since we could presumably always decrease the error of learning by raising the costs devoted to sampling and thinking.)

As the tendency to depend on tradition rises due to weak decisions forces, the cultural system will begin to preserve ***heritable cultural variation.*** For cultural variation to be considered heritable, it must depend upon accidents of who you imitated, not on your own decisions. Contrariwise, when the decision-making effects are strong, little behavioral variation depends on who your cultural "parents" were and more depends on how you see the environment. Consider direct bias. If you consulted a large range of models, and carefully evaluated all their alternative behaviors before choosing the best one for you, your behavior would not depend very much on who your models were. As the range of models you consult before making up your mind increases, and as the thoroughness with which you evaluate each one increases, the likelihood that your behavior will reflect the environment you are in rather than the models you happened to consult also increases. In the most extreme imaginable case, you might very carefully determine what sort of environment you are living in, then go to a big library and do very careful research to determine exactly the optimal behavior in that environment. This could be an awful lot of work. On the other hand if you observe only a few models and do not exercise strong bias, your behavior will most likely depend on happenstance; i.e., it will depend on who was available for you to choose as a model. While this isn't terribly analytical, the effort involved is modest. In the latter case, much heritable variation can be preserved. This heritable variation due to light use of costly decision-making strategies does not directly impugne the sociobiology hypothesis, but it does mean that other forces besides guided variation and direct bias play a role in cultural evolution.

Unless you acquire culture only from your biological parents and transmit only to your children, there is a potential conflict between your genetic and cultural fitness. If there is heritable cultural variation, natural selection will act on it, in theory with quite startling results as we'll see a bit later.

> ***Unless you acquire culture only from your biological parents and transmit it only to your children, there is a potential for conflict between your genetic and cultural fitness.***

Thus we cannot rest content with the sociobiological hypothesis, as attractive as it is. Guided variation and direct bias forces will unambiguously yield the simple sociobiological hypothesis when they are strong. But there is plenty of evidence that we humans do not employ strong decision-making techniques before we adopt cultural traits. We are sloppy shoppers in the marketplace of ideas, probably because the cost of making sophisticated decisions about our whole immense cultural repertoire would be overwhelming. We can be good Baconians, but only at considerable cost and over a narrow range of behaviors, as Slovic's epigraph suggests. Slovic's statement is a summary of a large experimental literature on "behavioral decision theory" that appears to justify the weak decision-making hypothesis.

II. Natural Selection on Cultural Variation

A. Natural Selection Versus the Decision-Making Forces

There is no reason why cultural variation should be exempt from natural selection. Selection can be an important force whenever there is heritable variation so long as this variation has important effects on behavior. Any time we use our cultural traits we are liable to affect our life-chances. You have a certain level of commitment to school that you acquired in part from your parents and others and which others may imitate. How earnest you are in school affects your grades which in turn affect your post-university career. In your post-university career, you may have your own children to socialize, and/or you may achieve some role, say by becoming some kind of celebrity, that leads your values to be widely imitated by unrelated children or adults. Aside from the decisions people make about what to imitate, merely what happens to them as a function of their culture also has consequences.

On the argument summarized in the introduction, we must carefully consider the direct effects of natural selection on cultural variation because suspect that information is costly, and therefore significant heritable cultural variation maintained.

B. Natural Selection Versus the Sociobiology Hypothesis

If cultural variation is maintained by horizontal or oblique transmission, it will tend to evolve differently in response to selection than genes, in the extreme like a pathogenic microbe. How important is the transmission of culture from non-parents? Selection effects cause no problem for the sociobiology hypothesis if cultural transmission is symmetric (there is no non-parental transmission, and the two biological parents have equal weights). W. Durham (1979) has suggested that this is true for many basic values and beliefs. The idea here is that for cultural traits whose pattern of transmission is just like genes (i.e., from one's biological parents), culture is sort of like an extra gene as far as selection is concerned. If selection on genes normally favors traits that increase individual survival and reproduction, a cultural trait that is transmitted alongside of genes will respond in just the same way.

The complication for the sociobiology hypothesis comes if there actually is a significant amount of non-parental transmission. Selection on non-parentally transmitted cultural variation *can cause cultural adaptations to differ from genetic adaptations*. This selection can be very strong if the competition for certain social roles is intense (e.g. to be a big-man). We will see that even if the weight of the non-parental role is small, "teacher" type variants can increase even if they reduce genetic fitness.

"Teachers" can be purveyors of ideas that will reduce our genetic fitness! The easiest way to get an intuition for this problem is to adopt Richard Dawkins' model of "selfish" genes and "memes" (his term for units of culture) for a moment. You mustn't get carried away with the anthropomorphism inherent in this terminology—imagining that genes have conscious motives—but Dawkins argues that the gain in making selection more intuitive is worth the risk of being misled by the metaphor. If you've thought through the sex ratio genes on the y chromosome problem from Chapter 9 you already have the idea.

> *Here is how selection on non-parental culture can cause conflicts with genes: Suppose* an idea (meme) arises that causes a person to seek political office, become a teacher, or have ambitions for a similar role that (a) does not result directly in biological reproduction, but which (b) has enhanced opportunities for cultural transmission. Suppose also that achieving this role in a competitive world requires sacrifices, such as gifts to clients, or long, costly years in school. These sacrifices cut the ambitious person's fitness; the same resources we'll assume could be devoted to reproductive activity. If this idea can only spread via parents, it will reduce its carrier's fitness and tend to disappear by natural selection. On the other hand, suppose that being a big-man or teacher

> exposes you to many more young people than the average citizen, at least some of whom are prepared to imitate you. If this non-parental transmission route is important enough, it is intuitive that the "selfish" meme can spread even though it is harmful to the carriers' ordinary reproductive success. Eventually virtually everyone might carry the harmful (to genetic fitness) meme.

Why will selection on genes that affect the degree of attachment to parents not fix this problem by doing away with non-parental transmission? From the point of view of the sociobiology hypothesis, this possibility seems dangerous and absurd. Consider the counter argument: There are problems with a sole reliance on Mom and Dad. One or both might die in the long period of socialization. And even if they are present, the bias forces all work better the more variants the imitator sees. If Pop is a lousy hunter or farmer, it would be nice to pick up better skills from someone else. There are considerable sacrifices implied in a sole reliance on parents especially in a slow, sequential transmission system. Thus, despite the best "efforts" of natural selection to "design" a resistant mind, a selfish meme of the type we are considering here is going to have some room to maneuver.

Once genes have created a cultural system of inheritance, they have made a sort of pact with the devil. Memes will try to slip and slide around the leashes set up by genetic decision rules to favor their own reproductive success at the expense of the genome's. The coevolutionary trajectory may get quite complex as selfish genes and memes get locked in a partly cooperative, partly competitive evolutionary game. It is conceivable that genes could even reverse the leash. Think about what might happen if memes use mate selection to affect genes!

C. A Mathematical Simple Model

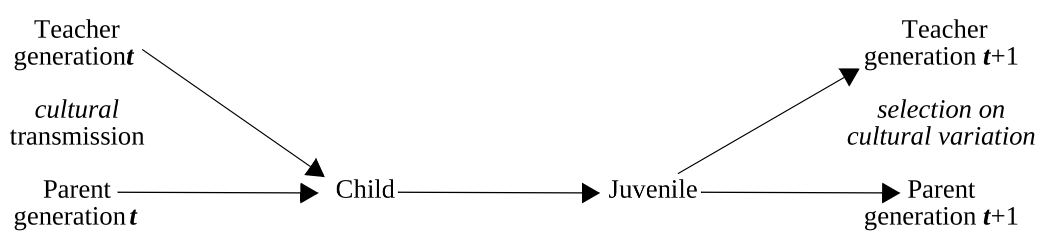
Why complicate things with all that math? As you work through the formal model that is developed in this section, many of you—as many do when exposed to this method of inquiry—will groan, roll your eyes, mutter a few expletives, and wonder "Why on earth do professors have to make things so damn difficult?" The situation we will examine here is perhaps simple enough so that you could reach the same conclusions given by the model without doing the arithmetic. However, there are strong arguments for using mathematical models to test and develop theory. Two of the most important reasons are that mathematical models: (1) hone our notoriously unreliable intuition, and (2) impose an unambiguous structure on arguments that can be readily tested. This last is particularly important because it is easy to make plausible sounding verbal arguments that, underneath, are illogical. (Examples swarm around us during an election year.) Doing the arithmetic becomes absolutely necessary to reach reliable conclusions when things get complicated. Even in the simple example that follows, the math should give you an extra bit of confidence in the argument and help you to see what selection on cultural variation really means.

The selective conflict inherent between inheritance systems with different structures can be demonstrated with a very simple model. We'll keep track of only two cultural variants, ***c*** and ***d***, and only two role models, one parent and one teacher.

We keep it very simple in order to gain insight into the operation of a process, not to make exact predictions. Engineers, economists, physical scientists, and population biologists are all fond of this technique for schooling their intuitions about complex processes. We are big fans of it ourselves. Combining the model analysis with the empirical evidence cited a bit later, we're attempting to convince you that selection is a force in cultural evolution that must be taken seriously. As is common in the more mathematical disciplines, these models are a key part of building hypotheses, in this case an alternative to the sociobiology hypothesis.

Suppose we have the following life cycle:

Figure 12-1. Life cycle with comparison of parent and teacher transmission dynamics.



Now set up submodels of component processes:

Suppose we have rules for the transmission of culture to naive individuals (children) such as are described in Table 12-1.

Explanation: In table 12-1 ***A*** can be interpreted as the weight of influence a parent wields and (1-***A***) is the weight of teachers' influence in the socialization process. As an example of how to interpret this matrix, lets put the first two rows into words:

row 1: If *Parent* has trait ***c*** and *Teacher* has trait ***c***, the probability that child acquires trait ***c*** = 1. (Remember that probabilities range only from 0 to 1.)

row 2: If *Parent* has trait ***c*** and *Teacher* has trait ***d***, the probability that child acquires trait ***c*** = ***A*** and the probability that child acquires trait ***d*** = 1-***A***.

Table 12-1. The probability that naive individuals acquire cultural trait ***c*** or ***d*** as a function of two available models, one parent and one teacher. *A* measures the relative importance of the parent in transmission and 1- *A* the weight of the teacher. Source: Richerson and Boyd 1984:431.

Trait of		**Probability that child acquires trait**	
Parent	Teacher	***c***	***d***
c	***c***	1	0
c	***d***	*A*	1-*A*
d	***c***	1-*A*	*A*
d	***d***	0	1

Now you interpret the last two rows and write in the answer below:

row 3: ____

____.

row 4: ____

____.

We need a model of transmission in population. The transmission rule above for individuals with given pairs of parent types can be combined with data on the frequencies of the two types ***c*** and ***d*** (percentage of parents and teachers with each type) in the population to scale the individual level transmission events up to what we expect to happen in the whole population using the following formula:

"Matings" with:

both parent &parent ***c*** &parent ***d*** &

teacher ***c*** teacher ***d*** teacher ***c***

$$P'_o = P_p P_t[1] \quad + \quad P_p(1-P_t)[A] \quad + \quad (1-P_p)P_t[1-A]$$

which simplifies to:

$$P'_0 = AP_p + (1-A)P_t \qquad (1)$$

Explanation: Where $\boldsymbol{P'_o}$ measures the frequency of c types in children of the next generation, $\boldsymbol{P_p}$ the frequency of c among parents of this generation, and $\boldsymbol{P_t}$ the frequency of

c among teachers of this generation. (Frequencies are just the fraction of each type in the population; multiply by 100 and you have a percentage. In typical evolutionary models, the absolute number of individuals who are of a particular type is unimportant, and it is convenient to keep track of only frequencies[1]. This equation just says that the frequency of ***c*** in the population after transmission is its frequency among parents in the previous generation weighted by their importance in transmission plus the frequency among teachers weighted by their importance in transmission; transmission is a sort of weighted averaging process. (Notice that one does not have to worry about the frequencies of ***d*** explicitly; since frequencies must always add up to 1 (i.e., 100%) and there are only two types, we can always find the frequencies of *d* because they are just 1 minus the frequency of *c*. You can begin to see why we want to keep things simple to demonstrate the bare logic of non-parental selection. Just adding another heritable type would double the number of equations without adding much to our understanding of how selection works in this case[2].

The effect of selection can be modeled like this. Let us suppose that we can measure the effect of ***c*** and ***d*** on becoming a parent or a teacher. Let us suppose that c types like to study hard and hence are likely to get good grades and jobs as teachers. Let us suppose that d types are more interested in the opposite sex. This might well lead to a markedly lower chance of ***c*** types becoming parent ($\boldsymbol{W_c}$) relative to *d* types (W_d), while *c* types have a fairly high chance of becoming teachers (V_c) relative to *d* types ($\boldsymbol{V_d}$). This leads to a pair of equations that describe the natural selection step in the life cycle, as juveniles of different types are sorted differentially into adult roles:

$$P_p = \frac{P_0 W_c}{(1 - P_0)W_d + P_0 W_c} \quad , \quad P_t = \frac{P_0 V_c}{1 - P_0 V_d + P_0 V_c} \qquad (2)$$

Explanation: The terms in the bottom of the fractions just add up the total fitness of both types in getting into each role, and dividing by this number keeps everything in units of frequencies (percentages/100).

Now, a mathematical trick is invoked to keep the equation nice and simple. If one assumes that selection is weak it is OK to assume that:

$$\frac{W_c}{W_d} = 1 + w, \quad \text{and} \quad \frac{V_c}{V_d} = 1 + v \qquad (3)$$

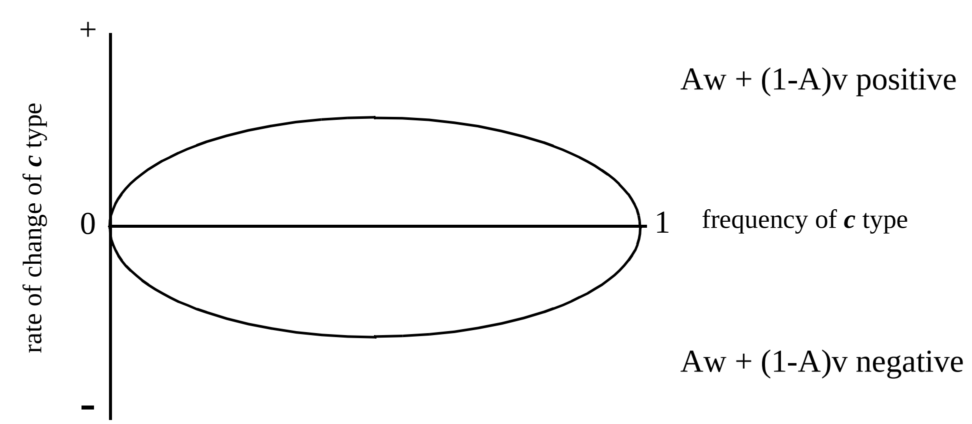
1. See Boyd and Richerson's book, pp. 181-2 to see in detail how this works.
2. The 6th chapter of Boyd and Richerson's book employs a fair amount of gory mathematics to show that the essential point here generalizes to multiple traits and multiple parents. Consult it if you are feeling frisky.

Here *w* can be read as a small disadvantage for *c* in becoming parents, so that it has a negative sign, and ***v*** a small advantage for ***c*** types in becoming teachers[3]. The same qualitative interpretation of the following equation for the whole life cycle is correct even if we do assume selection is strong, but the answer will not be exactly correct. The simplified approximation is:

$$P'_0 = P_0 + P_0(1 - P_0)[A_w + (1 - A)v] \qquad (4)$$

The part of equation 4 after the leftmost plus represents the effect of selection in the model. Notice that if there are no forces (selection in this case), *v* and *w* both = 0, and we just get faithful copying, no evolution. Also notice that $P_o(1 - P_o)$ is 0 if the frequency of ***c*** is equal to 1 or 0, and if this term is 0, selection also has no effect. This must be since in either case there would be no heritable variation for culture to work on, and the $P(1\text{-}P)$ term measures the amount of variation in the population. All ***c*** or all ***d*** types leaves nothing for selection to work on. Assuming neither of these things is true, selection will cause either the teacher-favoring type or the parent-favoring type to increase, eventually until all individuals are ***c*** or ***d***. Which depends on whether the term in brackets is + or -, (recall that we are assuming ***w*** is negative and ***v*** positive to make the model correspond to the teacher-parent conflict case) as follows:

Figure 12-2. Graph of the Aw + (1-A)v effect.



Notice that even if teachers are not too important in cultural transmission (i.e., (1 - *A*) is smaller than *A*), the trait favored by selection on the role that transmits non-parentally can increase if *v* is enough larger than *w*. *Thus, traits that tend to reduce genetic fitness can*

3. See Boyd and Richerson (1985:184-5) for details if you are interested.

spread even when parents are more important than teachers, if *c*-type traits are a big advantage in getting to be a teacher (if teachers are more highly selected than parents).

Strong selection of cultural variation may be common. This would still be pretty academic, except that cultural transmission is by its very nature prone to create situations where there is strong competition to influence others. Just because culture can be acquired by observing others' phenotypes, there is essentially no limit to the number of imitators a person in theory can have. If there happens to be some social role, such as teacher or big-man, that gives a person visibility and influence, such a person is likely to be differentially imitated. Any cultural variant that helps a person attain such a role will spread by imitation (cultural transmission). Those that do care about influencing others are probably more likely to desire such roles and get them, compared to those who are indifferent. Soon desiring such roles will become common, and competition for positions of cultural influence will become strong. Why shouldn't the desire to perpetuate your ideas (to have cultural offspring) be as strong as your desire to have actual offspring? The little model we have analyzed gives us some insight into what circumstances should favor one urge relative to the other. Figure 12-3 illustrates one of the less desirable consequences of our tendency to copy this type of cultural information.

The informal selfish meme argument gave the same basic insight as this little model. As we said at the beginning of this section, mathematical models provide a method for injecting more rigor into theoretical arguments; they hone notoriously unreliable intuition, and provide a formal structure that is much easier to test than verbal arguments alone. Doing the arithmetic becomes absolutely necessary to reach reliable conclusions when things get complicated. Even in our simple example, the math should give you an extra bit of confidence in the argument, and help you to see what selection on cultural variation really means. For those of you who are already familiar with such techniques, this model will give you a glimpse of how many of the less formal arguments in this course can be made more rigorous. If you are non-mathematical, we hope to have given you some insight into the way the numerate think about problems.

III. The Costly Information Hypothesis

A. The Simplest Alternative to the Sociobiological Hypotheses

The case that we have been building here is that the interaction of cultural and genetic evolutionary processes is liable to be somewhat more complex than the sociobiological hypothesis envisions. The cultural system cannot be too strongly leashed lest its advantages of flexibility and speed of adaptation be sacrificed and/or enormous decision-making costs imposed. But if it is not strongly leashed, it will become evolutionarily active in its own right—selfish memes will start to filter into the population's culture as variants arise that take advantage of the loose leash. Let us summarize the idea as a set of deductive propositions.

B. Basic Deductive Argument

We'll call the basic bit-of-cultural-realism alternative to sociobiology hypothesis the costly information hypothesis. Based on the parent-teacher model and supporting empirical facts it seems plausible that:

> 1. A fair amount of cultural variation is transmitted non-parentally via oblique and horizontal transmission.
>
> 2. Selection will act on this variation to favor traits that are effective in non-parental transmission even at the expense of vertical transmission.
>
> 3. Therefore, the adaptation that results from cultural transmission will be more or less significantly "distorted" away from traits that enhance genetic fitness.

C. Meeting the Sociobiologists' Argument From Natural Origins

Defenders of the sociobiology hypothesis are very skeptical. They argue that since culture arose as an adaptation under the influence of natural selection, that selection would never permit culture to "slip the leash" in the way envisioned in the costly information hypothesis. The argument so far depends on the empirical assertion that heritable cultural variation is transmitted non-parentally. We'll see in a bit that the empirical claim is plausible, but we can carry the deductive argument a step deeper as well.

Why is it probable that selection on genetic capacities for culture will favor weak decision-making and non-parental transmission, thus setting up the selfish meme effect?

> 1. There is an advantage to non-parental transmission. The various bias forces all tend to work better as there is more variation for a naive individual to observe. Imitating individuals besides your parents is often an advantage.
>
> 2. Information is very costly to acquire for many traits (e.g. the best way to farm). This means that using the direct decision-making forces (guided variation and direct bias) is often likely to be very costly, especially if people try to make very accurate decisions.
>
> 3. Selection on genes may favor inexpensive rules of thumb:
>
> a. weak bias and guided variation—try out or observe a few alternatives and mostly guess which one is best.
> b. depend upon vertical transmission—your parents can't have done disastrously in terms of their own genetic fitness—after all, they had you.
> c. use really crude rules like conformist transmission (positive frequency dependent transmission) or indirect bias. See the next two chapters.

4. As a result, selection on genes will tolerate a fair amount of genetically maladaptive cultural traits resulting from selection acting on non-parentally transmitted culture. Averaged over many traits, many individuals, and a long time, a given genetic capacity for culture must provide an increase in reproductive fitness, but not necessarily for any particular trait in any particular society. The systematic maladaptations introduced by selection on culture will be tolerated because the cost of reducing them still further by using better decision rules will be greater still.

Decision rules of high enough quality to eliminate the selective conflict between genes and culture are too costly to be worthwhile.

From the gene's point of view, the evolutionary problem is essentially as stated in the following inset box. Can you see from this argument how the existence of a second system of inheritance with somewhat different properties from genes is almost inevitably a double-edged sword? Without some properties different from genes, culture is of no use. But once it becomes different enough for its special features to be useful, it is different enough to cause complications.

THE EVOLUTIONARY PROBLEM FACED BY GENES:

Ordinary individual learning is expensive and prone to random errors. Cultural transmission is cheaper, but prone to systematic errors as selection acts on heritable cultural variation. To whatever extent the higher costs and large random errors that result from individual decisions are important, selection on genes for mental capacities and decision rules affecting culture will not favor completely eliminating cultural traits that diverge from those that enhance genetic fitness. Tolerating some cultural goofiness is likely just to be part of the price of depending on the information-cost-shortcutting properties of culture.

IV. Empirical Evidence

Is there any empirical evidence (1) that decision-making forces can be weak, and (2) that selection on cultural variation can cause genetically maladaptive traits to increase? See Boyd and Richerson (1985: Ch 3 & 6) for more citations.

A. Macro Evidence of Traits that Demonstrate Conflict Between Genes & Culture

In many agrarian societies, substantial numbers of people enter celibate priesthoods. These are elite "teacher-type" roles, with limited opportunities for reproductive success. How could institutions such as celibate priesthoods be sustained unless some mechanism like that illustrated by the parent-teacher model is in operation?

You all face a conflict between going to college, getting a good job, spending money on prestige items, and having as many children as you can. Aren't most middle class people reducing the number of children they have in order to respond to the dictates of memes that demand professional performance, and high consumption of material goods? The poor have more children than we do, perhaps because they are less influenced by the "success" memes? It seems pretty obvious that modern middle class people sacrifice reproductive success to compete for prestigious careers, much along the lines of our little models in this chapter. (See the section on the demographic transition in today's reading. We'll return to this evidence in Chapter 17.)

Lots of demographic practices don't make sense from the sociobiological perspective. You may have recently read that Chinese attempts to limit families to one child have run into the problem that the Chinese feel that at least one child must be a male. This has a disastrous tendency to distort the sex ratio, as people dispose of female infants in various ways. It is fairly common for sex ratio to be biased by female infanticide in societies with a strong masculine emphasis. However, natural selection favors an emphasis on the rare sex. The Chinese sex ratio problem should be self-correcting under the sociobiological hypothesis. In extreme cases, like among the warlike Yanomamo Indians of Southern Venezuela, a quite significant fraction of wives are captured from other societies.Wife capture is motivated by the high female infanticide rate in the Yanomamo. Genetically, the Yanomamo are perhaps being swamped by such forced migrants. Sustained one-way migration will eventually dilute away the genes of the receiving population, but culturally the system is quite viable because males are socialized to be aggressive enough to maintain the female-infanticide/wife-capture system. If you thought about the problem of sex ratio distortion presented in Chapter 10, you can see the similarity here.

B. Micro Evidence—Indicates that the Mechanism Could Function

There is a fair amount of evidence that cultural variation exists and that some of it is transmitted horizontally and obliquely. Parent-offspring resemblances for traits like religious preference and political party preference are quite high. People do convert from one religion to another, but many more adopt the same affiliations as parents. For example, in a study of Catholics and non-Catholics in Wisconsin, Janssen and Hauser (1981), about

11.8% of the sample were converts, but both groups lost nearly as many people as the gained. There was a slight net conversion of Catholics from non-Catholic, but it was considerably smaller than the growth of the Catholic group due to natural increase. At the same time, it is clear that kids learn from peers, and organizations like schools and work have demonstrable effects on attitudes and values. Catholic fertility in the US has fallen to near national norms in recent years, despite Catholic pronatalism. Presumably, non-Catholic education, achievement, and consumption norms have influenced Catholics, despite Church teaching. Relative to our parent-teacher model, it is as if *A* is considerably larger than 1-*A*, but 1-*A* is still appreciable.

The behavioral decision theory literature is consistent with the idea that decision-making forces are weak. There is pretty strong empirical evidence that people are relatively poor decision makers, particularly on statistical problems:

a. People often ignore statistical aspects of the problem in favor of other cues.

b. People often form strong beliefs on the basis of a very small sample, and resist any further information, e.g. when buying a car, you may consult your friends rather than *Consumer Reports* to form a reliability estimate.

c. People tend to think that causes should resemble consequences; we have already met these in the “doctrine of signs” and “the argument from design.”

An example given by the pioneering behavioral decision theorists Kahneman and Tversky (Science, 174:1124, 1974) from their research works like this: People are given a stereotyped description of a person. Some subjects might be given the description of a shy, meticulous person, others of an outgoing verbal type. Then they are asked to judge how likely this person is to be a lawyer or a librarian, given that the description is of a person drawn from a group composed of 30 lawyers and 70 librarians. Different subjects are asked the same questions using the same description while the proportion of lawyers and librarians in the sample is varied, say 70/30 instead of 30/70. Almost everyone judges the descriptions on the basis of the stereotypes of lawyers and librarians. They pay almost no attention to the kind of population from which the sample was drawn. Yet a little reflection will convince you that some lawyers are shy and meticulous, and some librarians outgoing and verbal. People should alter their guesses substantially as the relative number of librarians and lawyers in the sample changes from say 30% to 70% lawyers. They don’t. For a more extensive discussion see R. Nisbett and L. Ross (1978) *Human Inference*. Since so many real life decisions involve statistical matters, the decision making forces are often likely to be weak. Nisbett and Ross argue that people often make poor judgments by using poor decision rules because the poor rules they use are often not too misleading, and the statistically appropriate rules require costly sampling and analysis.

Selection on culture should not always conflict with what selection on genes would favor. To meet the natural origins problem, we need culture to be fitness enhancing on average, and selection directly on culture may often assist decisionmaking forces in this direction. There is fairly strong selection against various bad habits in modern society. Abuse of strong drugs, for example, leads to increased mortality (e.g., fatal traffic accidents) and depressed fecundity (heroin addicts, alcoholics, and others who are liable to be institutionalized form families and have children at a lower than normal rate). Selection is probably an important factor counterbalancing the biases in favor of using pleasurable but harmful substances. On the other hand, belonging to a conservative pro-natalist religious faith such as the Mormons may lower your risk of substance abuse and increase your fertility. Religious belief tends to have a strong element of vertical transmission (from biological parents to offspring). Thus selection seems to favor some religions over others; conservative Protestant denominations are currently increasing relative to liberal denominations and secular people due in substantial part to population growth, as was the case in Janssen and Hauser's sample.

VI. Conclusion

We've argued here that it is plausible to imagine that selection on cultural variation is likely to be a reasonably important evolutionary force, at least not one we can neglect at this stage of knowledge. Some important cultural traits are *copied* pretty faithfully—as the model from last chapter suggested they should be when individual decision-making is costly or inaccurate. There is heritable cultural variation upon which natural selection can work. We have also briefly reviewed the evidence from psychology that people use cheap, relatively error-prone decision-making rules, as if they knew that using better ones would be costly in terms of time and effort. Again, if this is so, the decision-making forces cannot quickly get human behavior to the state determined by the rules of decision-making (to the fitness genetic optimum if the sociobiologists are right about what causes the rules to evolve). This indicates that selection on cultural variation has some scope in which to work.

We also saw that when non-parental models (like college professors or priests) are active in teaching the young, the traits that are selected for can differ from those that enhance fitness. The urge to, say, compete for a high status job that may make you active in a teacher-like role can cause you to neglect your genetic fitness. ***You are endangering your genetic fitness right now by wasting an hour of time during your valuable prime reproductive years reading these notes!***

The conclusion of the last chapter was that culture should be useful across a broad *spectrum of variable environments*. The model of guided variation described there suggested that a cultural system of inheritance would generally be an advantage in variable environments. This left us with the puzzle of why culture is not more common among other organisms. Now we have a possible answer. It is not easy to capture the advantages of a cultural system without allowing it to become "evolutionarily active." Once culture starts responding to selection, conflicts between genetic and cultural fitness may arise and impose additional costs from the point of view of selection acting on genes. Speaking metaphorically, culture may be a difficult system for genes to manage. Thus, tolerating some cultural goofiness may be the price of the adaptive properties of culture.

We have applied the term ***costly information hypothesis*** *to the proposal that the conflictive evolutionary activity of culture is appreciably important*. In the following 2 chapters we will explore some further consequences of the costly culture hypothesis.

V. Bibliographic Notes

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