

Tylor vs. Westermarck: Explaining the Incest Taboo

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In the late 19th century arguments explaining incest avoidance were framed separately by Edward Tylor and Edward Westermarck. Tylor offered an environmental theory asserting that people have to marry outside of their own kin and communities or die out from the detrimental effects of isolation. Westermarck turned to Darwin's theory to explain that harmful inbreeding had been selected against in the human genome. By the late 20th and early 21st centuries explanations of human behaviors have become increasingly encompassed by natural selection theory. The debate concerning the productiveness of evolutionary biology for explaining complex human behaviors is highly contentious and continues unabated. Although human evolutionists repeatedly say that environment is important for understanding human behavior they often do not develop this part of the equation. Behind the prestige of evolutionary biology selection models of human behavior have passed into popular science and the public psyche. Often heard today from a wide range of highly visible media sources is an assortment of topics on human behaviors which are framed by Darwinian assumptions. Contemplations about incest and inbreeding avoidance fall into this category and are presented by Darwinian social science as the best case example demonstrating evolutionary suppositions about human behavior. In the article that follows these issues are framed and examined. The argument is offered that evolutionary approaches are not always the most compelling and that convincing environmental explanations are overlooked.

Keywords: Explanations of Human Behavior; Environmentalism; Natural Selection; Incest and Inbreeding Avoidance; Tylor's Thesis; Westermarck's Thesis

Introduction

A keen interest in the incest taboo spans the history of human studies and bridges such disciplines as cultural anthropology, sociology, evolutionary biology and psychology. Given the diversity of academic interests it is not surprising that explanations of the incest taboo have taken very different directions. In the late nineteenth century, at almost the same time, Edward Tylor (1888), an English anthropologist, and Edward Westermarck (1891), a Finnish sociologist, proposed alternative and opposing hypotheses for explaining the incest taboo. These divergent premises laid the foundation in the literature for distinctive approaches in understanding incest rules.

Tylor looked to the sociocultural environment to understand what he identified as "the rules of exogamy"¹. He proposed that these marital and sex rules, which required persons to have relationships outside their consanguineal community, tied different kinship groups and communities together in mutual aid for survival.

Exogamy, enabling a growing tribe to keep itself compact by constant unions between its spreading clans, enables it to overmatch any number of small intermarrying groups, isolated and helpless. Again and again in the world's history, savage tribes must have had plainly before their

minds the simple practical alternative between marrying out and being killed out (Tylor, 1888).

Referred to as "alliance theory", Tylor's hypothesis has been developed and expanded by a variety of scholars in anthropological and sociological studies. Alliance theory has become one of the most widely excepted explanations of the incest taboo's position in the intricate web of marriage and sex rules in human societies. Although modern alliance theory is commonly credited to Tylor, it nonetheless has a deep historical accounting. For example, Plutarch, a Greek philosopher and priest (AD 46-120?) and his Roman contemporary, Tacitus (AD 56-120) both anticipated alliance theory in their respective writings on the incest taboo. Somewhat later this same idea appears in the writings of Augustine (AD 354-430) and Aquinas (AD 1225-1274) (Honigmann, 1976). More modern presentations of alliance theory can be found in White (1948), Murdock (1949), Parsons (1954), Cohen (1978) and Leavitt (1989).

In contrast, Westermarck, noting the universal aversion to sex among persons raised in intimate proximity, proposed that incest prevention was a product of natural selection. Recognizing further that inbreeding had a deleterious effect on the offspring of closely related mating pairs, Westermarck hypothesized that nature would select outbreeders for a successful evolutionary outcome.

Generally speaking, there is a remarkable absence of erotic feelings between persons living very closely together from childhood. Nay more, in this, as in many other cases, sexual indifference is combined with the positive feeling of aversion when the act is thought of. This I take to be

¹The terms "exogamy" and "incest taboo" were often used interchangeably in early discussions and only became distinct as the scholarship matured over the twentieth century. In general, exogamy refers to marriage and incest refers to sex but in practice the rules of exogamy and incest rules are highly correlated in terms of the persons excluded from marital and sexual relationships.

the fundamental cause of the exogamous prohibitions. Persons who have been living closely together from childhood are as a rule near relatives. Hence their aversion to sexual relations with one another displays itself in custom and law as a prohibition of intercourse between near kin... We may assume that in this aversion, as in other cases, natural selection has operated, and by eliminating destructive tendencies and preserving useful variations has molded the sexual instinct so as to meet the requirements of the species (Westermarck, 1922).

This thesis of genetic inheritance, strongly criticized in the social sciences, did not become widely accepted until Edward O. Wilson's reintroduction of such suppositions in his 1975 publication, *Sociobiology*. With this publication, Darwin's natural selection theory was again employed to develop an inheritance model of complex social behaviors in animals (including humans), incorporating specifically an aversion hypothesis of incest and inbreeding.

In the following discussion the development of Tylor's alliance theory will be considered followed by a lengthier and critical review of the development of Westermarck's natural selection hypothesis. In general, the argument is forwarded that the incest taboo is understood in relation to human environmental and sociocultural demands, not an inheritance product of natural selection.

Alliance Theory

Tylor's insight concerning exogamy and the incest taboo is as simple as it is compelling. He argued that groups of people must construct lines of cooperation to aggregate outside of their immediate kinship organization and community or risk survival. In modern parlance, Tylor's "savage" societies would be recognized as nomadic hunters and gathers and simple agricultural peoples. Such societies, organized around family groups and kinship lineages, enhance their survival and well-being if they abide rules which require their members to make associations outside of their immediate kin communities. While other kinds of cooperative alliances can occur to the same ends, marriage and sexual prohibitions are especially affective in compelling individuals to connect with outside persons and communities.

Alliances forged by marriage and sexual relations are regularly confirmed by the birth of children, obligating affinal communities to each other even when marriages fail. And beyond this the importance of marriage alliances are witnessed in the related practices of levirate (where a man marries a dead brother's wife) or sororate (where a man marries the sister of his deceased wife) which maintain alliances even after the death of a spouse. In many societies the exchange of children in adoption is practiced to tie different families together in mutual aid. Bride-price and dowry are additional practices that enhance family alliances through the exchange of gifts. In these and other related cultural practices the incest taboo and rules of exogamy are revealed as being part of an important and larger set of rules designed to enhance the web of cooperation among communities.

Through this alliance system, commitments of a political, military and economic nature are formed. During times of stress and hardship these coalitions will provide critical aid. It would seem apparent that groups with firm rules compelling such

associations would fare much better, especially over the long-run, than groups that remained unattached, self-reliant and inwardly directed.

In particular, Cohen (1978) expands alliance theory beyond "savage" cultures to include the full spectrum of human societies—from the socially and technologically simplest to the most complex. He hypothesized that the extension of the incest taboo (how far the incest taboo reached to include distant relatives) varied with the complexity of the society, with the least complex societies having the greatest extension and coverage. As societies become more complex, the incest taboo contracts so that a very limited taboo is found in advanced agrarian and industrial societies, covering only the immediate family (nuclear family members, aunts and uncles, grandparents and sometimes first cousins). Leavitt's (1989) cross-cultural test of this relationship provided strong support for Cohen's hypothesis².

Cohen argues that in less complex societies kinship alliances are driven by the need for trade in scarce and essential resources. No society has all of the material goods required to survive, thus necessitating trade with people outside of their community and region. Encounters with strangers make trade an uncertain and even dangerous activity. With incest rules that compel people to find mates beyond their most distant relatives, lines of trade are secured and forthcoming. Mapping such trade alliances reveals a complex network of trade routes moving a wide variety of resources to even very distant places.

Continuing, Cohen asserts that as modern societies develop specialized political and economic institutions that establish formal trade ties, and with better transportation and communication technology, the need for complex family alliances recedes. In complex societies the incest taboo contracts to include only the nearest family members. Cohen proposes that this is evidence that the incest taboo will disappear completely, though he is not suggesting that immediate family incest would become common as a result. Rather, he proposes that modern mobility and social organization makes incestuous mating less likely.

While recognizing the alliance model presented above, Parsons (1954) offers a version of this theory specific to the immediate family, explaining the continuation of the incest taboo in developed societies. He argues that "eroticism" (including especially non-genital physical intimacy) is a necessary tool in the healthy socialization of children. By giving and withholding erotic stimulation the family can use affection to reward or punish the child in the socialization process. But since intimate affection often bonds people in long-term relationships, a mechanism is required, says Parsons, which both regulates and ultimately separates children from parents. Rules prohibiting incestuous behaviors mark the boundary on the extent of affection that socializing adults can use with attached children. By denying dependent children complete erotic satisfaction, the incest taboo helps to project children out into the greater society to seek intimacy and sexual partners. This movement of the child out of the family often culminates in marriage, which ties the family into the larger cooperating societal network. This expulsion of the young from the nuclear family into the greater society is healthy for the nuclear family, the child and the so-

²Leavitt's data supported Cohen's hypothesis that the incest taboo extension is negatively related to social complexity with the exception that many hunting and gathering societies with bilateral kinship organizations have relatively attenuated incest taboos.

ciety.

The Westermarck Hypothesis

As noted above, Edward Westermarck hypothesizes that natural selection has provided an incest avoidance mechanism to avert the deleterious effects of inbreeding. Specifically, Westermarck proposes that this inheritable mechanism operates by generating sexual disinterest in those individuals raised together. Since no such genes have been identified, support for Westermarck's hypothesis has typically come indirectly from four bodies of scholarly literature. This includes observations that the incest taboo is universal; that inbreeding is deleterious to offspring; that inbreeding avoidance occurs in many other species; and that evidence of such a mechanism has been demonstrated in Shepher's (1983) kibbutzim study and Wolf's (2005) research on Chinese minor marriage.

Leavitt (1990, 2005) critically examined this support literature and questions the evidence offered by evolutionary scholars. Although some of that discussion will be covered below, the focus will be on those central theoretical issues surrounding the Westermarck hypothesis. Specifically, explored is the notion that a naturally selected incest/inbreeding³ avoidance mechanism would be compelled by the conditions forwarded by evolutionary scholars.

The Deleterious Effect of Inbreeding

At the core of Westermarck's natural selection hypothesis is the long held scientific and cultural belief that inbreeding and incestuous matings have a deleterious effect on subsequent offspring. The science behind this perception is assembled on a number of straightforward and simple facts. As taught in elementary biology, genes are normally either dominant or recessive. A dominant gene on the loci of a chromosome will normally manifest itself in the individual's genotype and will more often be beneficial or neutral. Recessive genes, which are more often harmful, will manifest themselves only when paired on loci with an identical recessive. Since individuals who share a close ancestor(s) are more likely to inherit the same detrimental recessive genes, closely related mates will more likely produce progeny that carry a double measure of the unsafe recessive. A number of studies on the deleterious effects of inbreeding have been published and support this commonly accepted fact (see Leavitt, 1990, 2005).

In addition to the deleterious effects of inbreeding, evolutionists commonly assume that individuals in a population are competing with one another to produce the most progeny in order to perpetuate the breeders' genes in future generations. If

³As the author has acknowledged at length in other publications (author's name removed, 1990, 2005), incest and inbreeding are not precisely or necessarily the same thing. Incest does not always include all cases of inbreeding or visa-a-versa.

⁴"Inbreeding" and "outbreeding" are relative terms that are often used in exactly (see Leavitt, 2005). In common parlance inbreeding refers to mating with known relatives, usually cousins as any closer inbreeding is typically considered incestuous. "Outbreeding" refers to mating outside of this immediate relative circle. More technically, however, inbreeding refers to mates who share any common ancestors, thus all matings are to some degree inbred. In small populations, especially those that are to some degree isolated, inbreeding occurs even when rules of exogamy disallow matings with close relatives simply because the small population size restricts the choice of mates. For most of human existence (as with most other animal species) humans lived in small, relatively isolated and thus inbred communities.

these assumptions are correct, then it is supposed that "outbreeders" will reproduce more successfully than "inbreeders"⁴. It is hypothesized that over time this evolutionary process will be reflected in a population that is almost exclusively composed of outbreeders. The success of outbreeders is explained by the fact that they are believed to have acquired through mutation an inheritable mechanism that makes them sexually adverse to those to whom they are closely raised. Most often, it is asserted, these close associates are siblings, parents or other close relatives.

Accurately, however, the deleterious thesis is true only in limited circumstances, which through time has been unusual for most animal species. Shields (1982a, 1982b, 1983, 1987, 1988, 1993), who has written extensively on the inbreeding issue, discredits the notion that inbreeding is harmful. Shields (1982a) concludes that "[t]here is an alternative view of much of that evidence and additional evidence that is cited less often that flatly contradicts the view that inbreeding (or even incest) per se is maladaptive."

All breeding populations have a genetic load that reflects an average number of harmful recessives per individual in the population. Large and outbreeding populations, as typically found in modern complex societies, carry relatively large genetic loads but avoid the production of significant numbers of genetically diseased offspring because of their outbreeding pattern. Outbreeding occurs because individuals following exogamous rules either consciously select mates who have no known common ancestry and/or because these societies are highly mobile resulting in individuals selecting mates outside of their community of origin.

As has been true for most animal species through time, breeding commonly occurs in small relatively isolated philopatric populations⁵. Only in the past few hundred years have humans begun to live in large, relatively outbreeding and mobile aggregates. Philopatric populations disperse their offspring within a known and nearby environment. In most circumstance, to disperse more widely increases morality because of ignorance concerning resources and predators. As a result, even when incest rules are quite extended individuals are going to reproduce with genetically similar mates.

As noted, inbreeding will more readily expose the genetic load. Such exposure will pair harmful recessive more quickly in individuals who are then frequently miscarried, still-born or die before they reproduce. In this manner harmful recessive are "washed-out" of the breeding population and the genetic load is reduced resulting in fewer genetically harmed progeny (Livingstone, 1969; Bengtsson, 1978; Shields, 1982a). As long as a breeding population maintains a consistent pattern of inbreeding overtime, deleterious effects will be minimized. Outbreeding populations that switch to inbreeding will initially expose more harmful recessive traits, but in the grand scheme of things this is not a typical breeding pattern and its limited appearance cannot account for a naturally selected aversion mechanism. As Shields (1982a) reveals, most of the research literature demonstrating the ill effects of inbreeding comes from studies of domestic outbreeding or laboratory populations that have abruptly been switched to inbreeding.

⁵Philopatry refers to the widespread tendency of animal species to disperse locally; that is, to remain close to their place of birth and to select mates in that locality who share a common genetic heritage (Shields, 1982a).

Close Inbreeding and Human Isolates

Cousin marriage is common in human societies as a regular and even preferred practice (see Leavitt, 2005; Stephens, 1963). Societies practicing cousin marriage typically have small breeding populations that have been inbred for long periods of time yet demonstrate little inbreeding depression. Even more telling is human isolates that are characteristically small and completely or virtually cut-off from other human populations. Such populations are secluded either because of geographical isolation and/or through religious restrictions (see Leavitt, 2005). As a result of their isolation, these communities become exceedingly inbred even when they are diligent in their exogamous practices (Messenger, 1971).

One of the most studied human isolates is the Samaritan community currently residing in Israel (Jamieson, 1982; Bonne-Tamir, 1980; Talmon, 1977). The Samaritans are a small endogamous religious group that broke completely from the larger Jewish society about BC 200. The Samaritans have declined in size from several hundred thousand during the late Roman period to about 700 people today. Their historical and rather dramatic decline in population during the past millennium and a half has been due primarily to forced conversions to Islam, but also because of plagues, physical and economic repression. The Samaritan population reached its smallest number of 146 people at the end of World War II.

Because of their religious beliefs and cloistered way of life, the Samaritans have seldom married outside of their own community, resulting in a substantially inbred population. This inbred condition is further amplified by their customs of marrying within extended family lineages and by their preference for cousin marriage. About 85 percent of all Samaritan marriages are to first or second cousins. Not only does the Samaritans situation challenge the notion that close inbreeding is detrimental, but it also disputes Westermarck's hypothesis that children raised together trigger an inherent mechanism of sexual apathy. As described by Talmon (1977),

The Samaritans live in virtual seclusion... restricted to a special quarter of Nablus that was a small scale replica of a typical medieval European Jewish ghetto... Its isolation guarded the community against alien inroads and strengthened internal cohesion. The physical concentration of the entire group within a comparatively small area enabled its members to maintain their social and religious identity for century after century even though their number was small.

Under these circumstances it seems likely that a particular cohort of children, being small in number, is raised close together from birth.

Incest in the Immediate Family

Confronted with the considerable evidence that inbreeding in human communities is not harmful, many evolutionary social scientists have changed their Westermarckian claims to include only the immediate (grandparents, aunts and uncles, and first cousins) and nuclear families. Testing this claim is problematic because with a strong incest taboo in the society we would not expect to find many cases of incest. How cultural rules can be convincingly detached from genetic factors to determine which is actually operating is unclear, though the kibbutzim and Chinese minor marriage studies examined in the next section have

been engaged in this attempt.

Even if there was no incest taboo, and even if immediate and nuclear family members were inclined to have sexual relations, a number of difficulties arise that make any sustained pattern of family incest difficult and in many cases impossible. As Slater (1959) and Case (1969) had argued, a number of demographic factors make an intergenerational pattern of family incest unlikely. For example, age differences between generations, spacing of siblings, and the difference in gender numbers and order among siblings would moderate the number of incest cases. Father-daughter or mother-son incest would be unlikely to continue into the second generation because of age differences and would certainly not continue into the third generation.

Most telling are those incest cases that directly challenge Westermarck's hypothesis. Certainly there are numerous cases of incest, though evolutionists dismiss these as rare individual instances, often cases of pathological child abuse. Since good data on the frequency of adult-partnered incest are absent, this part of the discussion will go unresolved until further research is done. More notable are cases of socially institutionalized incest practices. These cases cannot be dismissed as individually exceptional because they are instances of sociocultural practice. Best known are the cases of royal incest such as those found among the Inca, Hawaiian and Egyptian societies (see Goggin & Sturtevant, 1964). Again, evolutionists dismiss these occurrences as rare and exceptional, though Goggin and Sturtevant found 34 cases in the Human Relations Area Files.

A revealing circumstance is that of the Roman Egyptians who for at least three well documented centuries practiced brother-sister incest and marriage. This was not a practice of royalty but of common people. As Middleton (1962) observed,

During the period of Roman rule in Egypt there is, for the first time, an abundance of papyrus documents and records which give evidence that commoners often practiced brother-sister marriage. These documents are of several kinds: personal letters, marriage contracts, other types of contracts, petitions and documents addressed to the administrative authorities, and census documents carrying genealogical information. Unlike some of the earlier types of evidence which may be subject to differing interpretations, these documents of a technical character have an "indisputable precision" (also see Hopkins, 1980).

The instances of incestuous marriages were not rare but common and culturally condoned. In one thoroughly documented location, Scheidel (2005) reported that "... 37 percent of the marriages are between full siblings. Owing to the limited availability of suitable sibling-spouses in any particular family and a strong preference for younger wives, the observed incidence approaches the feasible maximum." Scheidel concluded that these sibling marriages represent a cultural custom not just a tolerated alternative.

Brother-sister marriages were not arranged or forced by parents, nor were they ceremonial in nature. Rather Egyptian siblings freely entered socially sanctioned marriages that were affectionately motivated.

[W]hat is important for our present argument is that brother-sister marriages were obviously fertile, not formal, and were declared openly, not only in family matters but also in business [records]; for example, the sale of a crop... in a lawsuit... in a petition to an official... the par-

ticipators made it clear that a husband was also a brother and that a wife was also a sister... I come to the tentative conclusion that Egyptian brothers and sisters married each other because they themselves wanted to (Hopkins, 1980).

Other culturally institutionalized cases of immediate family incest are expectedly unusual as reflected in the literature. Schroeder (1915) described incest among the Mormons, Slotkin (1947) offered a similar example with historical Iran and Evans-Pritchard (1974) reported customary incest between brothers and sisters among the Azande.

The Shepherd and Wolf Marriage Studies

Shepher's (1983) study of the Israeli kibbutzim and Wolf's (1995) examination of the Chinese minor marriage form have been repeatedly forwarded by the evolutionary community as representing unambiguous examples of Westermarck's avoidance mechanism operating in children raised in intimate circumstances. In these instances the children involved are not siblings, thus presumably not subject to the influences of the incest taboo. These cases are said to represent clear occurrences where Westermarck's mechanism has operated.

The easiest of these studies to dismiss is Shepher's conclusion that children raised together in kibbutzim peer-groups never marry (Leavitt, 2005). These children, who take up residence in a nursery when only a few weeks old, are raised by professionals in an intimate environment until they finish high school. Sharing sleeping and bathroom areas, and raised in a sexually tolerant atmosphere, these children, according to Shepher, never marry or have sex with one another thus supporting Westermarck's hypothesis. To arrive at this conclusion Shepher went through mathematical and definitional contortions and made many errors. In a re-analysis of Shepher's data, Hartung (1985) not only found that some peer-group members married, but did so at a rate higher than would be expected by chance. These marriages occurred even though there are many social and structural barrier, some deliberate, that discourage peer mates from marrying (Talmon, 1964).

Wolf (2005) has for many years studied a Chinese marriage form referred to as "minor marriage". In this situation a married couple adopts an infant or very young girl and raises her to be their son's wife. Being raised as brother and sister, Wolf found that these marriages are less successful than "major marriages" (arranged marriage), the form most common and socially desirable. The lack of success in minor marriage compared to the major form is attributed by Wolf to Westermarck's mechanism.

Without invoking genetic inheritance, it is much easier to understand the higher failure rate of minor marriage by simply accepting Wolf's account of the persuasive and destructive cultural context that surrounded this minor marriage form. The marriage records employed by Wolf were taken from a time in Taiwan history when the island community was westernizing and minor marriage was becoming more unpopular. In addition, major marriages were culturally more desirable and came with prestigious public ritual and economic advantages that were missed if a couple was joined in the minor form. Minor marriage was openly ridiculed and the butt of jokes. The minor marriage bride is described as a cultural symbol of misery customarily being raised in a household that treated her as a servant and which often abused her. That this marriage form was

less successful does not need inherited mechanisms to understand. Indeed, we might wonder why under these social conditions more minor marriage did not fail.

Inbreeding Vigor and Inclusive Fitness

The common appearance of inbreeding in human societies, and in the animal kingdom more generally (Shields, 1982a), suggests that inbreeding is often an adaptive strategy. In other words, it is not just that inbreeding is usually harmless but that it provides a distinct advantage over outbreeding under common circumstances. The breakup of successful gene combinations through outbreeding in a population that overtime has adapted to a particular environment is referred to as outbreeding depression. In the extreme case we find hybrids, individuals who come from genetically dissimilar parents or even parents of different species. Outbred and hybrid individuals will not be well adapted to either parental environment and thus are commonly selected against in nature.

Inbreeding populations preserve successful genomes and more rapidly adapt to the residential environment. Because parents in a particular breeding population and environment represent successful genotypes/phenotypes, the offspring's best chances for survival are to duplicate the parental genome as closely as possible rather than chance that a new mix of genes will be equally or more adaptive.

Even though evolutionary scholars have routinely argued that inbreeding should be avoided in nature, their own theoretical concept of inclusive fitness (or kin selection) suggests otherwise (see Leavitt, 2005). The idea of inclusive fitness proposes that individuals will act altruistically only toward genetically related individuals and in proportion to the strength of that genetic relationship. Altruism, it is supposed by evolutionists, is a nature induced method whereby individuals can perpetuate their genes in the competition of life with the aid of related individuals. If the supposition is true that individuals compete to leave the most genes in later generations, inbreeding individuals will have a greater chance of gene survival than outbreeding competitors because they will be more closely related to those around them. This means they will gain more aid and leave more genes than outbreeders. Perfect outbreeders will discount their genome by 50% each generation and thus will not only quickly destroy their adapted genotype but discount the aid they will receive from others.

Discussion: The Ecology of Mating Patterns

The above reasoning does not conclude with the notion that "more inbreeding is better." Rather, observing the wide range of breeding patterns in different populations through time and space would suggest that different environments produce different optimal breeding strategies. In general, the breeding continuum is ultimately an inbreeding continuum since all members of a species are related. Examining modern human "outbreeding" populations Patterson (1978) observes that "[e]ven today, when international travel and social mobility are relatively easy, an individual is most likely to marry a close neighbor, if not the girl or boy next door." In other words, most populations being to a degree philopatric are inbreeding to some extent.

The great variation in human breeding patterns strongly suggests that there is no Darwinian induced Westermarckian me-

chanism at work. A thorough understanding of the ecology of human mating patterns yet eludes us, in part because we are often looking in the wrong places. Nonetheless, some general patterns can be observed. For example, it seems reasonable to assume that the closeness of inbreeding in a population generally declines with greater social complexity, the increasing size of the breeding populations, and with geographical and social mobility. On the other hand, we can observe inbreeding induced by social class, religion, ethnicity and race in the sense that these groupings tend to be exclusive.

A more exacting ecology of breeding patterns is offered by Caldecott (1984, 1986a, 1986b) in his study of macaque monkeys. Dividing macaques species into two groups, Caldecott (1986a) found that the availability of food in the environment is related to the degree of inbreeding. Where food is scarce in the environment females compete with males for limited food resources. Consequently, the female foraging group will keep the male population at a distance by encouraging males to compete with one another for breeding females. The result is that females will share sex and food with only one dominant male. The female competition with males is further reduced because rivalry among males leads to a high male mortality. The remaining males will seek mates outside of their foraging group of origin thus encouraging outbreeding.

Where food is abundant in the macaque environment males are not compelled by females to compete for mates and they remain part of the foraging group in more or less equal numbers with females. During estrous, females in these groups mate promiscuously engaging most, if not all of the adult males in the group. Because there is no competition among males for mates, males do not leave the group, which results in an inbred population. Keeping males in the foraging group also provides greater protection against predators and increases what Caldecott (1986a, 1986b) calls "paternalism"—because all the males of the group are highly related to all other members of the troop, adult males spend a great deal of their time caring for the young.

Darwinian evolutionists who deal with complex social and cultural behaviors commonly underestimate the influence that the environment has on explaining behavior. We are so accustomed to thinking of ourselves as free agents that it seldom occurs to us that much of our behavior is often unconsciously molded by the context within which we live. It did not occur to Paleolithic hunters and gatherers, as they made the slow change to agriculture, that the changing environment was dictating a new way of life that would engulf most humans (Harris, 1977). Though nearly universal, we would not imagine that agriculture is an expression of genes.

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